DETERMINANTS OF PRODUCERS' CHOICE OF WINE GRAPE CULTIVARS IN THE SOUTH AFRICAN WINE INDUSTRY

JOSEPHINE KAVITI MUSANGO

Thesis presented in partial fulfillment of the requirements for the degree of Master of Agricultural Management at the University of Stellenbosch

Supervisor: Dr. JP Lombard

Co-supevisor: TS Mkhabela

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DECLARATION

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.

Signature: …………………………… Date: ……………………………

SUMMARY

The wine industry is one of the oldest commercial activities in South Africa. The South African wine grape industry annually produces more than a million tonnes of grapes, making the country the ninth largest producer in the world. The total area under wine grape production is divided into eight regions for administrative purposes. These boundaries are a legacy of the era of controlled marketing and there is continued meaningfulness of having various classifications such as 'wine of origin' scheme.

The purpose of this study is to identify the factors that determine the producers' choice of wine grape cultivars in the wine regions in South Africa. Time series data for the period 1990-2003 were used to estimate the parameters of linear regression models. Two equations for each wine grape cultivar in each region were postulated and estimated using Ordinary Least Squares as applied with Eviews. Further, a stepwise regression as applied in STATISTICA was used to eliminate the parameters that were not statistically significant at five percent significant level.

In identifying the factors that determine the choice of wine grape cultivars in the regions, the results showed that each wine grape cultivar in each region has its own factors influencing the producers' choice of that specific wine grape cultivar. Same wine grape cultivars in different regions similarly have its own factors determining the producers' choice. The implication of this is that there are differences in terms of the requirements and types of crops and wine grape cultivars grown in each region. However, the most important result that emerged with regular frequency is that, the factors determining the producers' choice of a specific wine grape cultivar for each region is price of other wine grape cultivars and competitive products in that wine region. The price of specific wine grape cultivars only had an influence on few wine grape cultivars. The implication is that the producers in South Africa appears to consider the prices of other wine grape cultivars and competitive products before making a choice of whether to plant or uproot a specific wine grape cultivar more than the price of the specific wine grape cultivar. This supports the theory that farm prices play a key role in allocating resources and in rewarding efficient producers.

OPSOMMING

Die wynbedryf is een van die oudste kommersiële aktiwiteite in Suid-Afrika. Die Suid-Afrikaanse wyndruifbedryf produseer jaarliks meer as een miljoen ton druiwe, wat die land die negende grootste produsent in die wêreld maak. Die totale oppervlakte waarop wyndruiwe verbou word, is vir adminitratiewe doeleindes in agt wynstreke verdeel. Hierdie indeling dateer nog uit die dae van beheerde landboubemarking en dit maak al meer sin om van verskillende indeling- en klassifikasieskemas soos die "wyn van oorsprong" gebruik te maak.

Die doel van hierdie ondersoek is om die faktore in die verskillende wynstreke te identifiseer wat produsente se keuse van wyndruifkultivars bepaal. Tydreeksdata vir die periode 1990 tot 2003 is gebruik om die parameters van lineêre regressiemodelle te beraam. Twee vergelykings vir elke kultivar in elke wynstreek is gepostuleer en deur middel van die metode van gewone kleinste kwadrate met behulp van EVIEWS beraam. Voorts is die stapsgewyse prosedure van STATISTICA gebruik om die parameters wat nie by ‘n vyf persent betekenispeil aanvaar kon word nie, te elimineer.

Met die identifisering van die faktore wat die keuse van wyndruifkultivars in elke streek bepaal, het die resultate getoon dat elke kultivar in elke streek eie spesifieke faktore het wat die produsent se keuse van daardie spesifieke kultivar beïnvloed. Soortgelyk het dieselfde kultivars in verskillende streke ook eie spesifieke faktore wat die produsente se keuse bepaal. Die implikasie hiervan is dat daar verskille is in terme van die vereistes van en die tipe gewasse en wyndruifkultivars wat in elke streek verbou word. Die belangrikste resultaat wat regdeur na vore gekom het, is dat die faktore wat die produsent se keuse van ‘n spesifieke kultivar vir elke streek bepaal het, die prys van ander wyndruifkultivars en die prys van mededingende produkte in daardie streek is. Die prys van ‘n spesifieke wyndruifkultivar het net by sommige wyndruifkultivars ‘n invloed getoon. Die implikasie is dat wyndruif- produsente in Suid-Afrika blykbaar eerder die prys van ander wyndruifkultivars en mededingende produkte oorweeg as die prys van die spesifieke kultivar by die keuse om ‘n spesifieke kultivar aan te plant of uit te trek. Dit ondersteun die teorie dat die plaasprys ‘n sleutelrol speel by die allokasie van hulpbronne en die vergoeding aan doeltreffende produsente.

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LIST OF ABBREVIATIONS

ANPCAB	Area Newly Planted with Cabernet
ANPCHA	Area Newly Planted with Chardonnay
ANPCHE	Area Newly Planted with Chenin Blanc
ANPCIN	Area Newly Planted with Cinsaut
ANPCOL	Area Newly Planted with Colombar
ANPHAN	Area Newly Planted with Hanepoot
ANPMER	Area Newly Planted with Merlot
ANPPIN	Area Newly Planted with Pinotage
ANPSAU	Area Newly Planted with Sauvignon Blanc
ANPSHI	Area Newly Planted with Shiraz
AUCAB	Area Uprooted with Cabernet
AUCHA	Area Uprooted with Chardonnay
AUCHE	Area Uprooted with Chenin Blanc
AUCIN	Area Uprooted with Cinsaut
AUCOL	Area Uprooted with Colombar
AUHAN	Area Uprooted with Hanepoot
AUMER	Area Uprooted with Merlot
AUPIN	Area Uprooted with Pinotage
AUSAU	Area Uprooted with Sauvignon Blanc
AUSHI	Area Uprooted with Shiraz
APCHA	Area Planted with Chardonnay
APCHE	Area Planted with Chenin Blanc
APCIN	Area Planted with Cinsaut
APCOL	Area Planted with Colombar
APHAN	Area Planted with Hanepoot
APMER	Area Planted with Merlot
APSHI	Area Planted with Shiraz
GDP	Gross Domestic Product
KWV	Ko-operatiewe Wijnbouers Vereening Van Zuid-Africa
SAWID	South African Wine Industry Directory
SAWIS	South African Wine Industry Information and Systems

SAWSEA	South African Wines and Spirits Export Association
WOSA	Wines of South Africa

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

The South African wine industry is located primarily in the Western Cape and wine grapes are the third most important crop in the province, contributing 30 percent of the income from horticultural production (Galli, 1998).

The wine industry is a major player in the South African economy in terms of its contribution to gross domestic product (GDP) and employment. The industry's contribution to the country's GDP is R16.3 billion out of a total nominal GDP of well over R1.2 trillion. It also plays a cardinal role in South African subsistence especially regarding the contribution that is being made to the economic subsistence of lower income groups, in particular on wine farms. It forms the backbone of the economy in many Western Cape districts. The industry provides direct and indirect employment opportunities for some 257 000 people in various sectors ranging from primary agriculture to cellars, manufacturing, wholesale and retail, as well as tourism (WOSA, 2004a).

The wine industry is also linked to the rest of the economy in various ways: directly through producers' purchase of goods such as fertilizers, herbicides and pesticides, and services such as research and advisory services, and also as they sell their wine grapes to wine makers. The indirect link is through the purchase of consumer goods and services by producers and farm workers. Agri-tourism could be considered as both direct and indirect and this refers to tourists' visits to wine producing areas and their consumption of wine at the wineries, hotels and restaurants (Vink, 2003).

Historically, the industry was based on co-operative production with a minimum price and surplus removal scheme sometimes resulting in poor quality and inefficient production methods. The Ko-operative Wijnbouers Vereening Van Zuid-Africa (KWV) was set up to co-ordinate the production and selling of wine and wine based products. However, some producers wished to expand plantings of wine grape cultivars and began complaining about the constraints to doing so imposed by the KWV's production quotas. In response production quotas were suspended in 1992 and the task of regulating production was passed on to the co-operatives. The result was the more careful pricing of the wine grape cultivars and grapes of quality

(Williams *et al*, 1998:73). This was followed by eventual 'privatization' of KWV and some other co-operatives.

Wine grape producers have been uprooting certain wine grape cultivars and replacing them with different wine grape cultivars each year since the late 1980s. The local wine industry as a whole is also strengthening its focus on six varieties and is primarily replanting, on a large scale, Cabernet Sauvignon, Pinotage, Merlot, Shiraz, Chardonnay and Sauvignon Blanc. The industry rapidly increased its plantings of red wine grape cultivars, which in 2000 and 2001 constituted over 80 percent of all new plantings. This fell to 65 percent in 2002 and to 51 percent in 2003. At the same time, lesser white wine grape cultivars are being uprooted and replanted to other wine grape cultivars. Over 2 800 hectares of white wine grape vineyards were uprooted in 2003, representing 73 percent of all vines uprooted that year (WOSA, 2004a).

Since the wine industry is crucial to the South African agricultural sector and the economy, a study on the determinants of choice of wine grape cultivars is imperative. Wine grape producers are the backbone of the wine industry and their activity in the farm such as uprooting and new planting of vines affects the wine industry and the South African economy as a whole. Thus it is imperative to identify, analyse and understand the factors underpinning producers' preference of wine grape cultivars in each region.

1.2 STATEMENT OF THE PROBLEM

In 1993, an international panel of wine experts ventured predictions about the wine world in the year 2000. They predicted that, Hungary, Chile and South Africa would produce some of the best wines in the world by 2000 (Krige, 2003). However, the panel was less outspoken about wine grape cultivars.

Judging from the local new plantings of vines there were a few prophets among the experts. By the late 90s there was a significant planting revival in the industry, but the frantic establishment of new vines in new areas declined by 2000.There was more uprooting than plantings for the first time in 2000. Between December 2001 and November 2002, Sauvignon Blanc took the lead among the white plantings while Shiraz occupied the second place among the red plantings. Cabernet Sauvignon was still king, however, with more than 1 000 hectares having been prepared for this cultivar. An interesting and obvious trend is now the decreased planting of red wine grape cultivars in absolute terms . This is an interesting phenomenon which calls for investigation. The purpose of this study is to analyze and identify the most important factors affecting the choice of wine grape cultivars in the wine regions in South Africa. Thus, the main question addressed here is: What are the factors that affect the area newly planted and area uprooted hence leading to producers' choice of wine grape cultivar(s) in the South African wine regions? This question will therefore help in identifying the factors that are the result of the changes in composition of the different wine grape cultivars in each wine region. This information would therefore be useful in policy making in the wine industry.

1.3 AIMS OF THE STUDY

The purpose of this study is to analyze and identify the most important factors affecting the producers' choice of wine grape cultivars in the wine regions in South Africa.

The aims of this research therefore are:

- To describe the structure of the South African wine industry
- To investigate the change in area under wine grape cultivars through area uprooted and area newly planted
- To analyze and interpret the effect of various factors on area newly planted and area uprooted
- To identify from the analysis the factors influencing producers' choice of wine grape cultivars in the wine regions

1.4 DELIMITATIONS

The study did not consider wine cultivars grown in less than four regions since these are considered to be less important.

The study was limited to analysis of ten wine grape cultivars based on the area planted. These cultivars are: Cabernet Sauvignon, Chardonnay, Chenin Blanc, Cinsaut Noir, Colombar, Hanepoot, Merlot, Pinotage, Sauvignon Blanc and Shiraz.

1.5 DEFINITION OF TERMS

Researchers define terms so that readers can understand the context in which the words are being used or their unusual or unrestricted meaning (Creswell, 1994:106). Key concepts concerning this study will now be disclosed to enable the reader to interpret the essence thereof.

1.5.1 Cultivar

There are various definitions of cultivar but the one used here is adapted from Wile (1978:112). Hence a cultivar is a race or variety of vine that has been created or selected intentionally and maintained through cultivation.[1]

1.5.2 Grapes

An edible berry growing in pendent clusters or bunches on the grapevine. The berries are smooth-skinned, have a juicy pulp, and are cultivated in great quantities for table use and for making wine and raisins. [2]

1.5.3 Area uprooted

This term will be used to refer to the area of specific wine grape cultivars that have been removed from the land in a specific year.

1.5.4 Area newly planted

This term will be used to refer to the area of new plantings of specific wine grape cultivars in a specific year.

1.5.5 Area planted

This term will be used to refer to the current or existing area (in various regions) under specific wine grape cultivars before uprootment and area newly planted for each year have been taken into consideration.

1.5.6 Co-operative/Company

According to Wikipedia (www.wikipedia.org), a co-operative (also co-op) comprises a legal entity owned and democratically controlled by its members, with no passive shareholders. Unlike a union, a co-operative may assign different numbers of votes to different members; typically a co-operative is governed proportionally according to each member's level of economic interest in the co-operative. However, many co-operatives maintain a strict "one member, one vote" policy to avoid the concentration of control by an elite.

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[1] Also refer to (i) De Jongh S J (1976). Encyclopaedia of South African Wine. Cape and Transvaal Printers, Parrow, Cape. p. 39 and (ii) Jancis R (1999). The Oxford companion of wine. Oxford University Press. p. 219

[2] Ibid. (i) p. 56 and (ii) p. 325 for further explanation.

On the other hand, a company refers to an organisation that operates on a large scale and generally has a large number of employees. By legal status, a company is classified either as a public or private company. A company is typically multi-functional, operates with several business activities, and has proper audited accounts for taxation and regulatory purposes. It can also operate as an enterprise and have several branches in different locations.

However, for the purpose of this study, the term co-operative will be used to mean either a co-operative or a company. This is because recently, within the South Africa wine industry, some co-operatives have amalgamated or converted into companies and others are in the process of conversion.

1.6 ASSUMPTIONS

This study is based on the following assumptions:

- The contribution of the wine industry to the South African and specifically Western Cape economy will continue to be a relatively important one.
- The average prices offered by co-operatives are representative of the market going prices.
- All producers have a rational view of planting

1.7 SIGNIFICANCE OF THE STUDY

Before selecting which wine grape cultivar to plant, a producer should consider various factors. Several studies have been conducted on these factors but most of them focus on the aspects of nature (climate, soil and location). This study will analyze the factors that effect uprooting and new plantings and hence the choice of wine grape cultivars other than the aspects of nature. The results of this study hence will be of value to the wine co-operatives and to policy makers in the wine industry in understanding the factors that affects the producers' choice of wine grape cultivars in each region.

1.8 LAYOUT OF THE THESIS

This thesis consists of six chapters. Chapter 1 provided the background to the study, statement of the problem, the aims and rationale of the study. Concepts used to introduce the topic were defined. Chapter 2 provides a survey of the available literature and research conducted on the theoretical framework of price and how it is useful as an element of making choice, factors affecting wine grape production and cultivar selection. The focus of the chapter is on identifying the factors that determine wine grape production and cultivar selection as per the literature. Chapter 3 mainly deals with a discussion on the research design, methods and techniques used. Chapter 4 discusses the structure of the South African wine industry and specifically describes the wine producing regions, the current production, the co-operatives price forming mechanism, market conditions, supply and value chain and lastly the analysis of area newly planted and uprooted. Chapter 5 provides results from the questionnaire on the price forming mechanism and analyses the data that were obtained from using Ordinary Least Squares (OLS) as applied by means of EVIEWS[3]. Chapter 6 provides the conclusions that were made from the research findings, recommendations and suggestions for further research

[3] EVIEWS is a Quantitative Micro Software (QMS) for statistical analysis, time series estimation and forecasting, cross sectional and panel data analysis, large scale model simulation, presentation graphics and simple data management. For more information refer to www.eviews.com

CHAPTER TWO

LITERATURE REVIEW ON PRICING THEORY AND THE FACTORS THAT INFLUENCE WINE GRAPE PRODUCTION AND CULTIVAR SELECTION

2.1 INTRODUCTION

This chapter reviews the literature on pricing theory and the influence of price on the choice of wine grape cultivars, and the factors that influence wine grape production and cultivar selection. The focal point of addressing these issues is to identify the factors that determine wine grape production and cultivar selection as per the literature therefore providing an insight on some of the variables to take into account in the analysis.

There are two factors which play the most important role in determining the character and quality of a wine which are, nature (climate, soil and location) and the human hand (cultivar choice, viticultural practices and winemaking techniques). Of these two, nature is considered to have a greater influence (WOSA, 2004c). In certain areas vines grow better and within the South African wine-producing areas there are differences in soil, climate and location which cause wines to vary from region to region. Notwithstanding the importance of nature in viticulture, the human hand is still vitally important. Jackson (2001) similarly describes two factors that determine the quality of wine. However, to him these factors are primary and secondary factors which are summarized in Figure 2.1.

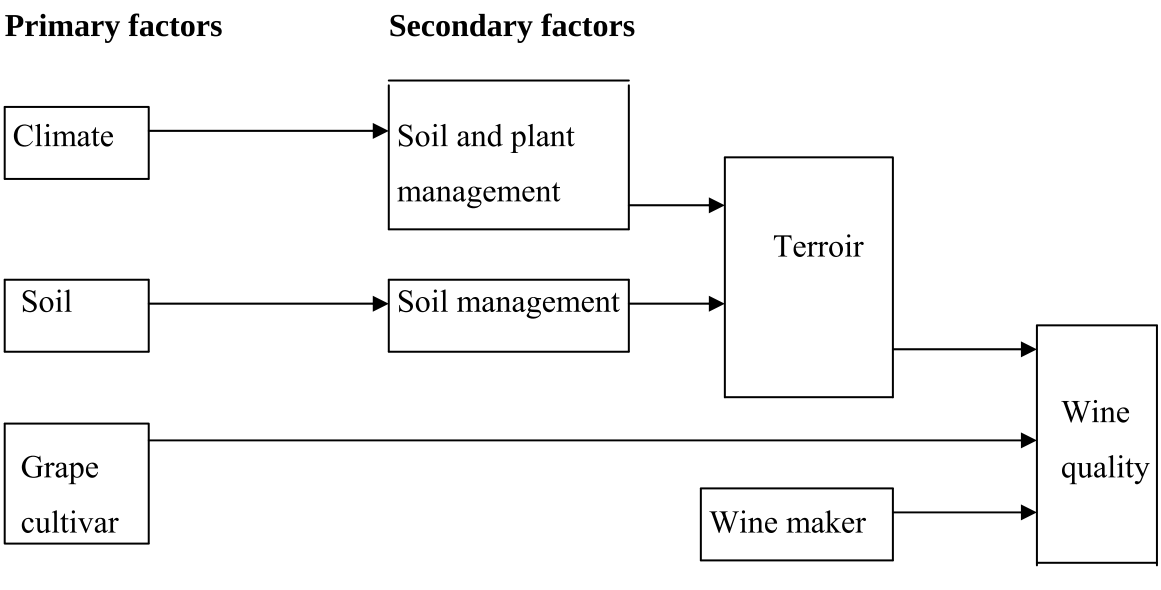

Figure 2.1: Factors contributing to wine quality
Adapted from Jackson, 2001

According to Johnson *et al* (2003), a successful vineyard operation should include appropriate site selection, cultivar selection and cultural practices to produce sufficient yields of wine grapes of acceptable quality to fulfil the local and regional market demands. Loubser (1998) notes that there are more than 12 million vines removed and replanted annually in South Africa which represents an area of approximately 4 300 hectares. Although some of these plantings occur on new land, most are done on sites on which grapevines were previously grown. Therefore, this implies that cultivar selection and cultural practices plays a significant role in South African vineyard operation. Factors influencing the cultivar choice need to be investigated since according to Jackson's (2001) argument grape cultivar is among the primary factors.

The producers in each region are faced with a number of wine grape cultivars to choose from. According to economic theory, price influences choice. Price determination and price discovery are two important concepts in pricing. Price determination deals with the pricing theory and the manner in which economic forces influence prices while price discovery is the process by which buyers and sellers arrive at specific prices and other terms of trade (Tomek & Robinson, 1981:213). In this regard, the influence of price on the choice of wine grape cultivars also requires further investigation. The next section therefore provides an overview of the pricing theory, pricing methods and its behaviour, the role of prices and studies on price as a determinant of replanting and uprootment.

2.2 OVERVIEW OF PRICING THEORY

Price theory has its long history of research in price formation. Cournot's famous work dates back to 1838, and milestones such as the contributions by Launhardt (1885), Hotelling (1929), Chamberlin (1933) and Robinson (1933). Krelle's monograph (1976) provides the most recent comprehensive overview.

The first quantitative (empirical) approaches to pricing originated from econometric analysis (Simon, 1989). However, this was primarily directed at advertising. Efforts have been made to integrate economic price theory and marketing (Rao 1984; Nagle 1987), but still there remained a lack of theory. The theoretical basis for price studies is usually some variant of a competitive model of price determination (Tomek & Robinson, 1977). Kohls and Uhl (1990:148) describes price determination as the process by which the broad forces of supply and demand establish a general, market-clearing, equilibrium price for a commodity. One theoretical view is that prices and quantities are determined sequentially, and this model may be empirically relevant when sufficient time is allowed (Tomek & Robinson, 1977). An alternative view is that prices and quantities are determined sequentially but this mode may be empirically relevant when time lags between changes in variables are long or when the time unit over which variables are observed is short. An important issue in the price analysis literature of the 1940's and 1950's was the question of when and under what circumstances it is appropriate to use single-equation methods (based on the assumption of recursive relationships) to estimate supply and demand functions.

The sequential nature of price determination in agriculture was recognised in the pre-war period and was incorporated in what has become known as the cobweb model. Bean (1929) stressed the lagged relationship between price changes and supply response of farm products. Thus, early studies supported the hypothesis that current production is a function of lagged prices and current production is, in turn, an important determinant of current price (Tomek & Robinson, 1977). Similarly, according to the theory of rational expectations, the price of agricultural products depends on how many acres farmers plant which in turn depends on the price that farmers expect to realize when they harvest and sell their crops (Muth, 1961). In this study, the current area newly planted and area uprooted will be treated as a function of lagged prices.

The pre-war literature provided a basis for the use of both simultaneous and recursive models in agricultural price analysis. In the post-war period Wold (1964) among others emphasised the importance of the recursive concept. If the values of the endogenous variables in a model are determined sequentially and if certain assumptions about the disturbances of the equations are met, then the structural equations are identified and ordinary least squares applied singly to each equation provides consistent estimates of the parameters. These conclusions justify the use of single equations for some research problems [4](Tomek & Robinson, 1977).

Larson (1964) takes the view that the cobweb is not an appropriate model of price behaviour. He proposes a 'harmonic motion' model in which supply responses is a *rate of change* in planned production through time (t):

$$dX_t \; / \; dt \; = kp_t$$

where:

X = planned production

---

[4] Much of the empirical price analysis is still based on estimating separate demand and supply equations; if such models are recursive models (perhaps with other equations not specified), then each equation is an identifiable structural equation which can be estimated with least squares.

k = a constant

p = price

In this model, since the rate of change rather than the total level depends on price, the maximum in planned production is achieved only after a one-period lag following the price maximum. A second lag occurs between the maximum in planned production and actual production. Hence, this model produces a cycle twice the length of the one implied by the cobweb.

The harmonic model does recognize the 'pipeline effects' (inertia) in the production process for livestock and livestock products, but it does not seem applicable to crops with periodic production (Tomek & Robinson, 1977). Also, the model assumes a fixed period in the cycle, but in fact producers have some discretion in modifying production plans. However, McClements (1970) provides a critical examination of studies which have rejected the cobweb theorem in favour of a harmonic model.

In an empirical analysis of farmers' response to changes in price, Ferris (1998) points out that the analyst should focus on dependent variables other than production. This is because production includes effects beyond the farmers' control such as weather and pests. He suggests that planted area and not production would be appropriate since planted area reflects farmers' response to expected prices. Using Ferris (1998) argument this study has used the area newly planted and area uprooted as the dependent variables in analysing the producers' response to the choice of wine grape cultivars.

2.2.1 Pricing methods and price behaviour

Alternative mechanisms for discovering or establishing farm prices have been suggested by various authors (Rogers 1970:1-11; Tomek & Robinson, 1981:213-228; Kohls & Uhl, 1990:148-152). Kohls and Uhl (1990:148) define price discovery as the process by which buyers and sellers arrive at a specific price for a given lot of produce in a given location. These alternative mechanisms include price negotiations between individuals, group bargaining (co-operatives or producer organisations), organized marketplaces (including auctions), administered prices (including governmental regulation) and formula prices (Tomek & Robinson, 1981:214). The establishment of a price is sometimes viewed as having two components: the discovery of a base or reference price and the discovery of prices for specific lots of the product relative to the base (Tomek & Robinson, 1977). Studies have been conducted both with regard to the mechanisms of establishing base prices and for specific prices.

Pricing institutions unquestionably do influence price behaviour. Some provide greater stability than others. Criticisms of pricing mechanisms usually center on one or more of the following: price levels are biased; price fluctuations are too large; or prices fluctuate too frequently. Any of these may lead to misallocation of resources (Tomek & Robinson, 1977).

One obvious problem of price analysis is to separate the influences of economic factors from the influences of institutional factors. The latter effects are difficult to isolate since two different pricing mechanisms for a particular commodity cannot be observed under precisely the same economic conditions. In this study, the co-operative price forming mechanisms in South Africa is investigated. Issues such as whether the co-operative is registered in the Wine of Origin scheme, or whether it is registered as a company or co-operative is taken into account in order to visualize how these institutional factors influence pricing and hence the choice of wine grape cultivars.

2.2.2 Role of prices

Prices play a central role in economic theory in guiding production and consumption (Tomek & Robinson, 1981). A more fundamental question raised by agricultural economists is whether price is becoming less important as a coordinating mechanism for economic activities and whether existing prices are satisfactory for this purpose (Breimyer, 1962; Collins, 1959). This view has been challenged by others (e.g. Gray, 1964). Prices, especially relative prices, influence human behaviour. Farmers have repeatedly demonstrated that they will produce more in response to favourable relative prices.

Collins (1959) argues that the shift from price to administrative coordination has occurred, in part, because the latter system leads to a more stable volume moving through the system and a more homogeneous quality. Gray (1964) agrees with Collins in one aspect, namely that administration and engineering coordination have supplanted price at some intersections of economic activity. But Gray (1964) asks whether the importance of price is enhanced or diminished by this shift. He concludes that the change-inducing role of price is enhanced.

According to Friedman (1976:10), prices do three things in an economy: (i) they transmit information, (ii) they provide an incentive to users of resources to be guided by this information and (iii) they provide an incentive to owners of resources to follow this information. However, though price plays this important role of communicating information, the mode of communicating the information about prices needs to be investigated since this determines the magnitude of response.

On the same note, Anderson (2002) argues that the new role of price has major implications on the way farmers and growers manage their operations. According to him there are four roles of price. First, price provides income; price times quantity sold results in the total income from a commodity. Secondly, price determines quantity supplied and consumed; as prices increase, more is supplied and less consumed and vice versa. Thirdly, price serves as a signal and especially through price incentives (premiums) and disincentives (discounts) it communicates information to provide more or less of a product and finally, price transfers ownership.

Some authors argue that customs and traditions of institutions such as farmers' co-operatives play a greater role in influencing decisions. However, Kohls and Uhl (1990) point out that though customs and tradition can influence decisions, they appear to be a poor choice for guiding decisions in a dynamic economy. Price therefore becomes the alternative to guide decisions. Price signals and the profit motive are better explanations of changing production patterns in the South African wine industry, an aspect which needs further investigation.

2.2.3 Price as a determinant of replanting and uprootment

There is very little literature on this subject, especially in the South African context. Stanford (2003) in his study in Australia explained that wine grape prices are the primary driver of vine plantings and softer wine grape prices since 1999 had dampened new plantings. He noted that, over time, plantings in the spring of each year correlated strongly with prices achieved in the harvest leading into planting. However, no econometric analysis was done in explaining this relationship between wine grape price and plantings.

According to Vink *et al* (2004) the main reason for the shifts in the composition of production in the South African wine industry can be found in the changing relative prices in the industry reflecting changes in demand in the domestic and export markets and previous planting decisions. They noted that when planting decisions must be made several years ahead of the prices at which the crop will be sold, farmers are always likely, with the encouragement from merchants, to "plant after the price" rather than get ahead of uncertain markets. However, there was no analysis of how prices affect the plantings.

2.3 FACTORS INFLUENCING WINE GRAPE PRODUCTION

Several factors may influence wine grape production and they have been discussed by Jackson (2001), Jackson (2000), Bonnardot *et al* (2002), Winkler *et al* (1994), Coombe (1987), Jackson and Spurling (1992), Gallet (2002), Pool (2000) and Nonecke (2002). Although these factors differ from country to country and region to region within a country, their common denominator is the aspects of nature.

2.3.1 Climate

This is one of the most important factors influencing the production of wine grapes. It is defined as the sum total or average pattern of the weather pattern of a specific region/district (Jackson 2001:6). Jackson (2000) emphasised that it is impossible to separate climate from viticulture. Various indices combining climatic components, mainly temperature (minimum, maximum or mean), rainfall, humidity and shine duration etc, may be used to describe the viticultural potential of a macro-region (Bonnardot *et al*, 2002). Climate is described in viticulture on three levels, namely macroclimate, mesoclimate and microclimate (Carey, 2001:13). Macroclimate is the climate of a region, extending over possibly hundreds of kilometres (Bonnardot *et al*, 2002). However, not all parts of that region have identical climate (Jackson, 2001). Where variations occur, the areas are subdivided into mesoclimate which describes climate within smaller areas, extending less than a kilometre to many hectometres (e.g. vineyards or districts) (Saayman, 1981). The final level is microclimate which is the climate immediately within or surrounding plant canopy and differences occur within few meters/centimetres (Saayman, 1981). These climatic scales are shown in Figure 2.2.

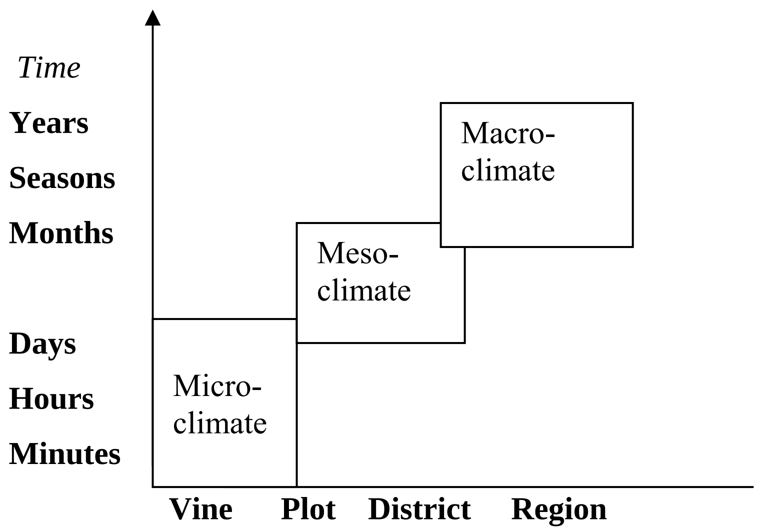

Figure 2.2: Climatic scales related to area and time

Source: Saayman, 2004

Climate monitoring is necessary in wine grape production. Strydom *et al* (2004) pointed out that climate monitoring helps the viticulturist to estimate the potential of a region and to select the correct wine grape cultivars for a specific situation. These have value in their own right, as a better understanding of climate will enable the viticulturist to choose cultivars that produce outstanding and unique wines, improve sustainability of viticultural practices and produce wines to meet consumer preferences. The climatic parameters and their effects on wine grape production are described in the next sub-sections.

2.3.1.1 Temperature

Temperature has generally been accepted as the parameter having the greatest effect on the functioning of the grapevine, and specifically on reactions that occur during maturation and thus final berry composition. Literature concerning temperature as a factor influencing wine grape production has been studied and discussed in depth by a number of authors *inter alia* Winkler *et al* (1974), Barney *et al* (No date), Coombe (1987), Gladstones (1992) and Jackson (2001).

An investigation of the factors affecting wine quality in geographic regions in California where the principal climatic factors of the areas were correlated with the analytical data and quality scores of the matured wines of the areas showed that the only factor of climate that proved to be of predominant importance was temperature (Winkler *et al*, 1974:61). The other factors may have effects, but these are much more limited than the effect of heat summation.

According to Jackson (2001:10) the importance of temperature in wine grape production is related to minimum temperature for growth, cold damage and heat damage. Archer and Toombs (2000) noted that the minimum temperature required for a vine to be physiologically active varies from cultivar to cultivar and is also related to the specific area in which a vine is grown. This indicates why cultivar selection is important and why cultivar selection differs from region to region.

2.3.1.2 Radiation and sunshine hours

The radiation and sunshine hours influences wine grape production. Jackson and Spurling (1992) noted that the amount of radiation received by the vine in combination with the number of sunshine hours experienced in a specific region influence the rate of growth of the vine. Unlimited sunshine hours are desirable for viticulture. However, in practice the issue is less simple (Gladstones, 1992). Very sunny climates mostly have marked temperature variability. A reasonable conclusion is that sunshine hours are positively related to both vineyard and quality over a fairly wide range, but only if temperature variability and relative humidity remain favourable.

According to Wooldridge and Beukes (2005), information concerning insolation and its variability across landscape facilitates decisions regarding demarcation and cultivar selection. At any given latitude, season and time of day, insolation varies across the landscape, mainly as a function of slope angle and aspect (slope direction relative to geographic north). Since wine style is affected by average temperature variability (Gladstones & Smart, 1994), as well as by the direct, photosynthetic effects of insolation itself, Wooldridge and Beukes concluded that radiant solar energy was clearly an important factor in vineyard and wine production.

2.3.1.3 Rainfall

Rainfall is another element in climate since water is needed for the development of the grapevine. Gallet (2000:212) pointed out that at least 250-350 mm of rain is considered necessary during the vegetative and ripening periods. However, the vine can subsist under even drier conditions. According to Spiegel (1970), 4mm of water is needed to produce 1hL of wine, or $44m^3$ for 1hL/ha. Below this minimum level of rainfall irrigation becomes necessary.

The number of rain days and the intensity of rain during rainy periods and throughout the year must also be taken into account (Gallet, 2000:212). Chaptal (1931) showed that rain at an intensity of 1mm per hour is completely absorbed by clear, flat or slightly sloped soil. According to Chaptal (1931), rainfall has its maximum effect when its length in hours is equivalent to its height in mm (i.e. at 1 mm/hr). At greater than 1 mm/hr, the proportion of water retained in soils decreases, and run-off begins to dominate.

2.3.1.4 Altitude and latitude

Grapevines cannot be planted at all latitudes since the average and extreme temperatures encountered at some latitudes are unfavourable for vines (Gallet 2000:222). Similarly, different localities at the same altitude and latitude differ greatly in climates. There is little literature to suggest that altitude in its own right has ever been reckoned a significant factor for vine performance. Nevertheless, theoretical reasons can be advanced for thinking that it may be so (Gladstones, 1992). Perold (1927:8) noted that the temperature of the air drops $0.625^{o}C$ for a rise of 87.6-109.2 metres hence a locality at a high altitude may sometimes be more suitable for viticulture than one at a low altitude that is further from the equator. Though this temperature lapse rate varies with region and season, in South Africa it can be accepted as being approximately 0.3^{o}C for every 100 metres above sea level (Le Roux, 1974). However, Dumas *et al* (1997) and Gladstones (1992) pointed out that this effect can be alleviated by an increase in radiation, warmer soil surfaces, poor ventilation and movement of cold and warm air.

2.3.1.5 Wind

Wind is another important part of climate and according to Gallet (2000:218), it has both positive and negative effects. Strong winds in spring and early summer can injure new growth and young bunches, as well as reducing fruit set. Moderate winds of higher than 3-4m/s^{-1} can result in closure of stomata in the leaves resulting in inhibition of photosynthesis (Hamilton, 1989). Air circulation, however, prevents high relative humidity and excessively high temperatures from developing in vine canopies (Gallet, 2000:218).

2.3.2 Soils

Under normal conditions, soil is an essential element in grape growing. Though grapevines can be grown in its absence (Gallet, 2000:235) its importance to wine grape production is well recognised. Different authors have different views only on its relationship with quality. Archer and Toombs (2000) pointed out that soil is the most important factor that must be taken into account when considering vineyard cultivation. Although the climate of a certain area really decides whether it is suitable for viticulture, the chemical and physical properties of soil are of utmost importance for success in viticulture. Perold (1927) similarly emphasised that soil and climate must guide in the choice of cultivar a farmer wants to grow.

Grapes are adapted to a wide range of soils and a wine grape producer finds a decided preference for certain soil types in nearly every grape growing district. Winkler *et al* (1974) notes that when all soils used for growing the various kinds of grapes in many different grape-producing regions of the world are compared, they range from gravely sands to heavy clays, from shallow to very deep and from low to high fertility. Saayman (1981) however maintains that soils are difficult to deal with because of their wide range.

2.3.3 Vineyard layout

Vineyard layout affects the growth, performance and quality potential of a vineyard over a long period. In theory, the size, shape and position of a vineyard block is normally chosen to form an economic unit consisting of a single scion cultivar, situated on a uniform soil type, therefore requiring mostly uniform vineyard practices (Boehm & Coombe, 1999). In practice however, the latter is not always attainable. This is why vineyard soil variability is managed in South Africa before planting through adaptation of long-term practices such as rootstock choice, trellis height, within row spacing, and through the adaptation of soil preparation implements and methods.

The vineyard layout can alter the influence of orientation (Gallet, 2000:226). Gallet (2000) suggested that the best situation is to have the slope of the vineyard perpendicular to the direction of solar radiation. A study on the effect of altitude, elevation, slope and orientation of a vineyard on productivity using a statistical model showed that the orientation of a vineyard is responsible for 61 percent of the variation in productivity (Rapcha *et al*, 2004). However, these results may differ from region to region. According to Winkler *et al* (1974:59) these local variations are very important, not only in their general influence on the cost and returns of the wine industry, but also because they affect the choice of cultivars, the training and pruning, the cultural practices and the quality of the product.

Row direction similarly is an important aspect determining grape performance. Grapevines are generally planted in straight rows running in a North-South (NS) direction for maximum sunlight interception (Bordelon, No date 2). However, sites on sloping land may require contour planning or straight rows across the slope regardless of compass direction. Van Schalkwyk (No date) pointed out that little is known about the effect of row direction on vine performance worldwide. A study by Fidelibus *et al*, (No date) showed that grapevines were more fruitful when planted in NS rows than in rows oriented EW. Grapevines in NS rows had more clusters on canes than did vines in EW rows, but vines in either row orientation produced a similar number of clusters on renewal shoots. However they found that row direction had no effect on berry size, soluble solids, or yield.

2.4 FACTORS INFLUENCING CULTIVAR SELECTION

Selection of cultivars is an important decision for a wine grape producer. According to the Ministry of Agriculture, Columbia (1994) identification of wine grape cultivars appropriate to a particular vineyard enterprise requires integration of knowledge dealing with consumer needs, economic factors, site limitations and cultivar characteristics. Selection of adapted wine grape cultivars significantly reduces the chemical, labour and resource inputs into the vineyard operation compared to non-adapted cultivars. Johnson *et al* (2003) acknowledges wine grape cultivar selection as being important due to recent increases in acreage planted to wine grapes and wine demand for high quality fruit in both local and regional markets. Bordelon (No date 1) similarly pointed out that selection of the proper cultivar is a major step towards successful wine grape production. However, he pointed that because of the different types of wine grape cultivars available, the choice of which wine grape cultivar to grow can be a difficult decision.

In South Africa, there are various practical guidelines available via research and extension to assist the wine grape producer in decisions on optimal the choice of wine grape cultivar for a specific region (Department of Agriculture, KWV & Cape Wine and Spirit Institute, 1984 & 1991). However, these guidelines are not recommendations or prescriptions for each individual farm since the producer can still do his/her planning to specific circumstances on the specific farm, given the decision making environment (Lombard, 1999:62). Further work on the factors influencing the producer's choice of available wine grape cultivars needs investigation. This study investigates the factors influencing the choice of wine grape cultivars in the South African wine regions. The factors determining cultivar selection from the literature sources are discussed in the next sections.

2.4.1 Cultivar and site suitability

According to De Wet and Le Roux (1995), site selection and cultivar choice go hand in hand. Each cultivar has its own time of budding, ripening, temperature requirements and it is therefore evident that the properties of the site such as soil fertility, mean day and night temperature, slope, and aspect must be compatible with the requirements for optimum production and quality of the cultivar. The same applies to the rootstock on which the cultivar should be grafted.

Cowhams (2003) stressed that no single cultivar and rootstock can meet the different challenges of every site. Each cultivar and rootstock has its own particular characteristics, strengths and weaknesses. He pointed out that the selection of the most appropriate cultivar and rootstock for a given situation requires a thorough understanding of a particular site in which the vines are to be planted, as well as knowing the likely product end use specification. Yield and quality outcomes can be influenced by cultivar choice and rootstock which therefore can assist the producer in delivering wine grapes of particular quality specifications.

2.4.2 Climatic adaptation

Climatic adaptation is the most important consideration in selecting cultivars to plant (Nonnecke, 2002). A factor influencing the selection of cultivars includes the fluctuation in temperatures within regions. This is because the classification of grapevine hardiness is based upon the temperature range at which injury begins to occur. Although Johnson *et al* (2003) argue that local climate is the predominant influence in cultivar selection, Archer and Toombs (2000) pointed out that the chemical and physical properties of soil are important factors influence the choice of a specific cultivar in a certain region.

2.4.3 Season for ripening

According to Nonnecke (2002), the season of ripening is the second most important consideration in selecting climatically adapted cultivars. Grape cultivars need a growing season that is long enough to properly mature the crop, and allow the vines to harden before going into winter (Nonnecke, 2002). Further, Barney *et al* (no date) noted that maturation and ripening of grapes depend on the amount of heat available to the plants during the growing season. The amount of heat required differs between cultivars and this will determine the selection of cultivar in different regions. Pool (2000) provides the length of the growing season and how it determines the grape cultivar choice as shown in Table 2.1.

Table 2.1: Length of growing season and cultivar choice

Frost-free days	Suitability for grapes
< 150	Unacceptable
150 to 160	**Marginal**: Only early season maturing cultivars
160 to 170	**Satisfactory**: Early and most mid-season maturing cultivars
170 to 180	**Good:** Early, mid-season and some late season cultivars
>180	**Excellent**: Most cultivars

Source: Pool, 2000

In general a frost free period of 165-180 days is required to mature grape fruit and wood. The period must be long enough to allow for harvest of the fruit and time for the wood to acclimate for the winter. The frost season (April to October) in South Africa, is longest over the eastern and southern plateau areas bordering on the Escarpment and it decreases to the north, while the

Western Cape is virtually frost-free. Popenoe *et al* (1990) however argue that the length of the growing season is not as important as the growing degree days in determining cultivar adaptability, as some areas with long seasons are not warm enough to mature grapes well.

2.4.4 Growing degree days

This involves the heat summation above the physiological minimum of 10^{o}C during the growing period of the grapevine (Winkler *et al*, 1974). By convention growing degree days are tallied between April 1 and October 31 in the northern hemisphere, using the temperature provided by Winkler *et al* as the base temperature (Pool, 2000). In the southern hemisphere on the other hand the growing degree days are tallied between September 1 and March 30.

Le Roux (1974) applied the heat summation technique of Amerine and Winkler (1944) to the South Western Cape. The growing season was taken as September 1 to March 30. The few available weather stations in 1944 meant that the indirect methods had to be used in order to determine the boundaries of the regions. Le Roux (1974) and De Villiers (1996) proposed the following classification shown in Table 2.2.

Table 2.2: Classifications of regions and suitable cultivars for South Western Cape

Region	Degree days	Suitable cultivar
I	< 1 389	Quality red and white wine cultivars
II	1 389 to1 666	Good quality red and white table wine cultivars
III	1 667 to 1 943	Red and white table wine cultivars and port
IV	1 944 to 2 220	Dessert wine, sherry and standard quality table wine grape cultivars
V	> 2 200	Dessert wine and brandy cultivars

Source: Adapted from De Villiers, 1996

However, Le Roux (1974) concluded that not all classifications made were representative of the wine grape cultivars expected from those areas. He recommended that the weather station network should be increased and the plots monitored in order to determine the real applicability of the model. Further research on the weather stations and its applications on viticulture showed that the minimum level of growing season heat accumulation for a vineyard site is 1 093 growing degree days (Bonnardot *et al*, 2002). Therefore, the closer the macro-climate of a region approaches this threshold value, the more significant the mesoclimate characteristics of the vineyards become. Though a table with cultivar preferences was provided by De Villiers (1996), Lombard (1999:61) notes that there is still a dramatic difference between the cultivars planted (reality) and what is conceptualized (and 'prescribed' by terrain). He suggests that the pricing could be one of the factors that contribute to this situation. Therefore a study including price as a variables determining the choice of cultivars becomes necessary.

2.4.5 Pest and disease resistance or tolerance

Most studies on cultivar selection support the view that disease and pest resistance is a factor which should be considered in choosing a cultivar. The common diseases are black rot, downy mildew, powdery mildew and *botrytis* bunch rot, while the common insects and pests are phylloxera and nematodes (Winkler *et al*, 1974). Most studies on this factor however, focus on phylloxera and nematodes since they have long term effects on cultivars. In South Africa, just as in Europe, the only practical control measure for phylloxera has been to graft onto phylloxera resistant American rootstock, hence resistance to phylloxera determines the choice of rootstock. Shaffer *et al* (2004) recommends that producers should consider cultivar nematode resistance when soil tests indicate high population densities of plant parasitic nematodes. However, he points out that there is a common misconception that a cultivar resistant to one type of nematode is resistant to all types of nematode.

2.4.6 Vine improvement and availability of plant material

According to the literature, vine improvement and availability of plant material determines the producers' choice of cultivar. Kriel (1999) describes plant improvement as an ongoing process with continuous phasing in of improved technology. Throughout the world biotechnology is playing an increasingly important role in plant improvements (Botha, 1999) and it offers immense possibilities in the form of transformed clones for specific wine objectives (Kriel, 1999). To ensure long-term economic survival it is of the utmost importance for each producer to use only the highest-quality plant material. However, plants deteriorate, mainly as a result of genetic degeneration and accumulation of harmful pathogens. To counter this effect, scientists have developed various processes to genetically improve plant material, as well as phytosanitary processes to eliminate the harmful pathogens (Lombard, 1999:68). The available plant material during the planting period or years of normal replacement also determines the producers' choice of cultivar.

2.4.7 Berry use

Berry use also dictates the choice of cultivar. Himelmeric and Dozier (1996) argue that an overriding consideration in the selection of cultivars is whether they have self-fertile flowers or self- sterile pistillate flowers. Self-fertile, perfect-flowered cultivars that have both male and female parts do not require pollonizers. Pistillate cultivars have only female flower parts and must be adjacent to pollen producing lines. Though their study was only on two cultivars, they recommended that pistillate cultivars should be planted one row of a self-fertile pollen-producing cultivar between two rows of pistillate cultivars. Grapes have various uses such as wine production, jelly and juice, raisins and for the fresh market. In making a choice for a cultivar these uses should be considered.

2.4.8 Trends in the wine market

According to De Wet and Le Roux (1995), trends in the wine market are an important consideration to choice of cultivar. Establishment of a vineyard is a long term investment while trends in the market may vary in the medium term. According to Wine Business Communications (2005) wineries and producers need information to respond to market changes. However, obtaining useful data can be challenging because of the unique nature of the industry and the structure of sales and distribution.

Nonnecke (2002) suggests some factors to consider on a marketing strategy which are important in guiding the wine grape producers in cultivar selection. These factors are depicted in Table 2.3.

Table 2.3: Cultivar selection for wine - considerations on marketing strategy

Sell to a winery:	Establish a winery:
• What adapted cultivars do wineries want? -Proven cultivar -New cultivar • How much are they willing to take? • Is a long-term contract negotiable?	• What do customers want in a wine? • What adapted cultivars make quality wine? • What type/styles of wine do they want to make • How much risk are they willing to take? -Cultivar adaptation -New cultivars

Source: Nonnecke, 2002

Though the marketing strategy provides a checklist to determine which wine grape cultivar to plant, it has a limited use in the South African context since most producers sell their wine grapes through co-operatives. Further study is required to provide a checklist on the cultivar choice in guiding producers who sell their wine grapes through co-operatives.

A survey by Visser *et al* (1998) on the impact of market changes on the business strategy of the South African co-operative wineries indicated that more than 19 percent of the farmers had not changed their cultivar composition in any way since 1993 and more than 35 percent only farmed with standard (not premium) varieties. They recommended that since it is the responsibility of co-operatives to guide members through the process of cultivar selection, that they should supply the members with clear planting guidelines. However, they noted that co-operative information systems appeared to be inadequate to support strategic decision making.

2.4.9 Regional considerations

Each wine growing region in the world has a range of grape growing challenges and issues which in part form the basis for cultivar selection. Cowhams (2003) proposed that producers should consider the main factors that apply to cultivar selection in a particular region. However in certain circumstances the vineyard is not typical of the region and hence he recommends that it is best for producers to identify the specific viticultural and site requirement of their vineyard and choose on that basis.

2.5 SUMMARY

Climate is an important factor influencing wine grape production. A number of climatic indices have been formulated to describe the potential of a region for viticulture. However, many of these indices are based on temperature. Soil also has an effect on wine grape production, although there are a number of contributing factors that are the effect of the soil type such as soil colour, soil pH, temperature and chemical composition.

There is no doubt as to the important effect of climatic adaptation and vine characteristics on cultivar selection. It takes several decades of trial and error to sort through the available grape cultivars (McGrew *et al*, 1993). Assuming that South African wine grape producers know which cultivars to grow in each wine region, it is important, therefore, to include information pertaining to factors other than nature as a determinant of cultivar choice in order to get a clearer picture.

Wine grape prices can guide the viticulturist in adjusting his/her production activities. This study attempts to contribute to the existing information on the choice of wine grape cultivars by analysing and identifying the factors that determine the choice of wine grape cultivars using Ordinary Least Squares as applied by means of EVIEWS.

Chapter 3 deals with the research methods, designs and techniques that were used to collect information on the price forming mechanism of co-operatives and the methods and procedures used to analyse statistical data obtained from SAWIS on the factors affecting the quantity of area newly planted and area uprooted in the wine regions.

CHAPTER THREE

RESEARCH METHODS, DESIGN AND TECHNIQUES

3.1 DATA COLLECTION.

In this study, the data used was secondary data, mainly collected and compiled by South African Wine Industry Information and Systems (SAWIS). The study also partly included primary data that were collected by means of a questionnaire completed by wine co-operatives in the various regions. These regions are explained in Chapter 4. The following criteria were applied for admissibility of data obtained from SAWIS:

- Data for the period 1990-2003 were used
- Only data involving the ten wine grape cultivars[5] were used

The reasons for encompassing the above limits and the wine regions were:

- All the data for the eight regions[6] were available from SAWIS
- A number of studies have been carried out for the eight regions and there is, therefore, already existing data to compare results with
- Data for the period used in this study were available for the cultivars in the respective wine regions

The criterion used to select the ten wine grape cultivars was that only those cultivars grown in four or more of any of the eight wine regions were chosen. If a cultivar is grown in less than four wine regions, it was eliminated. This is the reason why Sultana was excluded in this study, though it ranks first in the area planted in the Orange River region.

3.2 RESEARCH METHODS

Research involves application of a variety of standardized methods and techniques in the pursuit of valid knowledge. Precisely because scientists aim to generate truthful knowledge, they are committed to the use of objective methods and procedures that increase the likelihood of attaining validity (Mouton, 1995:35). The research methods and techniques employed in this study are discussed in the next sections.

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[5] Refer to Section 1.4 for the list of the ten wine grape cultivars
[6] The eight wine regions are explained in detail in Section 4.1

3.2.1 Literature survey

An extensive literature survey was done to obtain the relevant information on the eight wine regions, their geographic location, structure of production, export orientation of the industry, supply and value chain of the wine industry, changes in wine grape cultivar patterns, area planted and age distribution. The sources consulted included articles published in journals and books, conference papers, postgraduate students' thesis and articles on the internet. This will be discussed in Chapter 4.

3.2.2 Questionnaire

According to Leedy (1997:191) data sometimes lie buried deep within the minds or within the attitudes, feelings or reaction of men and women. As with oil beneath the sea, the first problem is to devise a tool to probe below the surface. A commonplace instrument for observing data beyond physical reach of the observer is a questionnaire and its advantage is that it can be sent to people thousands of kilometers away.

In order to partly obtain information on the price forming mechanisms of co-operatives, a questionnaire was devised and answered by wine co-operatives. The first part of the questionnaire covers the co-operative/company details and the second part is on the price forming mechanism. In the following section, what was intended to be achieved in each question of the questionnaire is established. (Refer to the questionnaire in Appendix 1).

a) Co-operative/company details

Question 1, 2 and 3: To determine the region in which the co-operative is located

Question 4: Assessing whether the co-operatives are registered either as a company or a co-operative, since this can contribute to findings on pricing

Question 5: Whether a co-operative is registered with the 'Wine of Origin' system can also play a role in pricing

Question 6: This question was to determine whether the co-operative is a single player in price formation or whether it is influenced by the other co-operatives with which it has merged

b) Price forming mechanism

Question 7: To assess the type of wine grape cultivars and quantity/tonnage delivered by co-operatives and compare prices of different co-operatives within the same region

Question 8: To assess the composition of the total quantity/tonnage received and processed by co-operatives

Question 9: To assess whether delivery of wine grapes to co-operatives from other regions affects it's pricing

Question 10: To determine the factors considered by each co-operative in forming its price

Question 11: To assess the time of communicating the wine grape prices and the type of price (preliminary or final)

Question 12: To assess the mode of communicating the prices. This was to determine the degree of influence on the choice of different wine grape cultivars

3.2.2.1 Population

According to Mouton (1996:134), the term population is a collection of objects, events or individuals having some common characteristics that the researcher is interested in studying. Leedy (1997:211) argues that there is little point in sampling for a smaller population (N <100). For this study, the population consisted of all wine co-operatives in South Africa. It was decided not to make use of sampling since the location of the co-operatives could not be ascertained from the list[7]. Secondly, since as mentioned in Chapter 1 that some co-operatives were in the process of converting/merging into companies, it was also difficult to determine this from the list of names.

3.2.2.2 Procedures and practical considerations

The list of all wine co-operatives and their telephone numbers was obtained from SAWIS. This list consisted of 72 co-operatives. After completing the questionnaire, all the co-operatives were

[7] This is a list of names of co-operatives obtained from SAWIS.

contacted by telephone and their email address or fax number was obtained. Although the intention was to interview the whole population, some co-operatives were not willing to complete the questionnaire and others considered the information required as confidential. Forty co-operatives gave their email addresses and six gave their fax numbers. The questionnaire was send to the co-operatives who provided their email address and fax numbers respectively. They were given a due date by which the questionnaire had to be returned through email or fax. A follow-up was made for those co-operatives who had not returned their questionnaire within the specified period. The results will be discussed in Chapter 5.

3.2.3 Statistics on the study regions

Documentary sources with information relevant for the study included data on area planted, area newly planted, area uprooted, prices for each wine grape cultivar and competitive products in each wine region. The data for area planted, area newly planted and area uprooted were in hectares (ha) while the prices were in rand per ton (R/ton). These data were for 14 years from 1990 to 2003 based on SAWIS annual reports. The data were mainly used to determine the factors affecting the area newly planted and area uprooted, hence identifying the factors determining producers' choice of wine grape cultivars in each wine region. The procedures prior to the analysis of this data are explained in Section 3.3.

3.3 PROCEDURES PRIOR TO DATA ANALYSIS

The data obtained from SAWIS had to be prepared and organized for analysis as described in the following sub-sections.

3.3.1 Identification of variables

According to production theory, various factors determine changes in farm produce (supply). However, most empirical farm supply analysis focuses on dependent variables other than production. The reason is that production includes effects beyond the farmers' control - influences such as weather and to some extent, pests. Dependent variables that indicate the farmers' intentions should therefore be carefully selected. On annual crops, area planted and not production would be appropriate (Ferris, 1998). Area planted reflects farmers' response to expected prices and hence a general formula can be developed as follows:

Area planted = *f* (expected prices, other independent variables)

Wine grape cultivars are long-term crops and variables such as area newly planted and area uprooted would best reflect the wine grape producers' intentions, especially in the investigation of their choice of wine grape cultivars. Area newly planted and area uprooted with wine grape cultivars can reflect wine grape producers response to changes in various factors. These factors may include changes in price of a specific wine grape cultivar, price of other wine grape cultivars, prices on competitive products, input prices, technological change, institutional constraints such as government programs, area planted of a specific wine grape cultivar and other variables discussed in Chapter 2 such as climatic adaptation, season of ripening, growing degrees days etc. The effect of these variables can be captured in the following single general model of a specific area newly planted and specific area uprooted shown below:

$ANP_s = f\,(P_s, P_o, P_c, P_i, T, AP_{s,} O_n)$

$AU_s = f\,(P_s, P_o, P_c, P_i, T, AP_s)$

where:

ANP_s = Area newly planted of a specific wine grape cultivar

AU_s = Area uprooted of a specific wine grape cultivar

P_s = Price of a specific wine grape cultivar

P_o = Price of other wine grape cultivars

P_c = Price of competitive products

P_i = Price of inputs

T = Technology

AP_s= Area planted with a specific wine grape cultivar

O_n = Other variables such as climatic adaptation, season for ripening, growing degree days etc as described in Chapter 2.

Ferris (1998:87) point out that econometricians are limited in terms of the number of independent variables they can incorporate in ordinary least square supply equations. However, he provides some guidelines for formulating supply equations and more specifically the independent variables, which are as shown in Appendix 2. Given these guidelines, the variables that were used in the study are as discussed below:

(a) Dependent variables

Two dependent variables were selected, namely, area newly planted and area uprooted which were analyzed separately and abbreviated as follows:

ANP_{st} = Area newly planted for a specific cultivar at time t

AU_{st} = Area uprooted for a specific cultivar at time t

(b) Independent variables

Guided by the theory of farm production (supply) the independent variables used included prices for a specific wine grape cultivar, prices of other wine grape cultivars, prices of competitive products, prices of inputs, technology, and area planted for each specific wine grape cultivar. Factors affecting cultivar selection as identified in Chapter 2 will be included in this study in the sense that the analysis for each wine grape cultivar will be on a regional basis. Although these factors are reflected in the analysis, each region covers a large area and changes in terrior should be carefully considered because there are small changes due within a farm (Carey, 2004).

The first question that arises concerns the arguments which may be made for including absolute prices rather than real prices. Cuddy (1982) argues that farmers are interested in real earnings when input costs have been met. Some measure of expected real earnings is however, the best independent variable to use. This study however uses price as independent variable rather than the expected real earnings due to unavailability of data. Using the nominal output price does not make economic sense especially when inflation is high. Farmers would be interested in the actual purchasing power of their money and as a result would respond to changes in real output prices rather than changes in nominal prices. Though inflation in South Africa is not high, it is necessary to accommodate the changes in inflation over the years. The approach of using real price would therefore seem to be more appropriate in the South African wine industry. However, one of the most important factors relating to the price specification is in choosing the relevant deflator (Mamingi, 1997). The output price may be deflated by the consumer price index, the producer price index, or an index of the prices of competitive crops (Askari & Cummings, 1977). The most appropriate deflator that has been used for wine grape prices is the viticultural products index[8].

The second question which arises is that of competitive products to use for wine grapes and thus the appropriate price variables to include. Fruit products were considered as the best competitive products. However, the appropriate type of fruit differs from region to region. The export prices for these fruit products and the appropriate deflator, which was considered to be

[8] This index is obtained from Abstracts of Agricultural Statistics 2005, South Africa. www.nda.agric.za/publications/publications.asp?category=statistical+information

fruit products index[9], were used. The third question concerns which inputs would be considered, and hence the suitable price variable. As single input could not suitably be considered, the price index of all farming requisites[10] was used as a proxy for the price of inputs. The price ratios such as P_s/P_i, P_o/P_i and P_s/P_c where P_s is the price of a specific wine grape cultivar, P_i is the price of inputs, P_o is the price of other wine grape cultivars and P_c is the price of competitive products could possibly be used. This has the advantage of reducing the number of variables used.

The dependence of area newly planted and area uprooted (dependent variables) on the prices of wine grapes, competitive products and inputs (independent variables) is not instantaneous and the response is likely to come after a lapse of time. These variables can be formulated as values in the previous period, distributed lags, futures or rational expectations (Ferris, 1998). However, the question that arises concerns the length of the lag to be used. Since the area newly planted and area uprooted in any year is to some extent the result of decisions taken in previous years, the prices of the wine grapes, competitive products and inputs were lagged. Similarly, the existing vineyard composition may influence the producers' choice of the area newly planted or uprooted with a specific wine grape cultivar. This arises because the producers' would want to ensure a balanced and diverse production strategy. Lagged Area planted with a specific wine grape cultivar is therefore, used as an independent variable.

Finally, the question arises of an appropriate variable to take account of technological change. According to Askari and Cummings (1977), the inclusion of a time frame variable instead of specific variables is justified if there is lack of available data or if there is a danger of multicollinearity among variables. In this case, a time trend variable would act as a proxy for improvements in technology and other farming methods over time. However, Mamingi (1997) warns that omitted variables should only be captured by the use of a time trend variable as a last resort, since the whole point of the model is to determine the impact of specific variables.

The list of variables used as independent variables are as follows:

$AP_{s\ t-n}$ = Lagged total area planted with a specific wine grape cultivar
$RPAPP_{t-n}$ = Lagged real price of apples
$RPAPR_{t-n}$ = Lagged real price of apricot

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[9] Ibid
[10] Ibid

$RPCAB_{t-n}$	= Lagged real price of Cabernet Sauvignon
$RPCHA_{t-n}$	= Lagged real price of Chardonnay
$RPCHE_{t-n}$	= Lagged real price of Chenin Blanc
$RPCIN_{t-n}$	= Lagged real price of Cinsaut
$RPCOL_{t-n}$	= Lagged real price of Colombar
$RPHAN_{t-n}$	= Lagged real price of Hanepoot
$PIFR_{t-n}$	= Lagged price index of farming requisites used as proxy for the price of inputs
$RPMER_{t-n}$	= Lagged real price of Merlot
$RPPEC_{t-n}$	= Lagged real price of peaches
$RPPER_{t-n}$	= Lagged real price of pears
$RPPIN_{t-n}$	= Lagged real price of Pinotage
$RPPLU_{t-n}$	= Lagged real price of plums
$RPSAU_{t-n}$	= Lagged real price of Sauvignon Blanc
$RPSHI_{t-n}$	= Lagged real price of Shiraz
$RPTGR_{t-n}$	= Lagged real price of table grapes
TIME	= Simple time frame (t = 0 for 1990 to t = 13 for 2003)
TIME2	= Quadratic time trend (t = 0 for 1990 to t = 169 for 2003)

3.3.2 Determination of equations

Gujarati (2003:517) argues that in practice researchers are never sure that the model adopted for empirical testing is 'the truth, the whole truth and nothing but the truth'. They develop a model that they believe captures the essence of the subject under study and then subject the model to empirical testing.

Two linear equations for each wine grape cultivar in each region were formulated in this study and the above variables were included in the equations. However, the number of independent variables contained in each equation differed from region to region due to differences in the type and number of wine grape cultivars grown and competitive crops in the regions. The equations were subjected to empirical testing to ensure that they are of the correct functional form using the Durbin-Watson *d* statistic. Since the data are in time series, the variables were further subjected to stationary tests, autocorrelation, and multicollinearity tests. The data were found to be non-stationary and efforts to make them stationary by taking the first or second difference were in vain, because of the presence of outliers. To counter this, a dummy variable was used for each region in the period where it showed an abrupt change in area newly planted and area uprooted. Though the time period for the dummy variable for the regions differed slightly, the reason for the dummy variable was identified to be among one of the following:

- Opening of South Africa to the international market in 1994
- Changing of KWV from a co-operative to a company in 1997
- Weakening of the South African Rand in 2000/01

The two equations for each region are as follows:

(a) Little Karoo

$$ANP_{st} = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPAPR_{t-n} + \beta_3 RPCHA_{t-n} + \beta_4 RPCHE_{t-n} + \beta_5 RPCOL_{t-n} + \beta_6 RPHAN_{t-n} + \beta_7 PIFR_{t-n} + \beta_8 RPPEC_{t-n} + \beta_9 RPPLU_{t-n} + \beta_{10} D1 + \beta_{11} TIME + \beta_{12} TIME2 + e \quad (1)$$

$$AU_{st} = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPAPR_{t-n} + \beta_3 RPCHA_{t-n} + \beta_4 RPCHE_{t-n} + \beta_5 RPCOL_{t-n} + \beta_6 RPHAN_{t-n} + \beta_7 PIFR_{t-n} + \beta_8 RPPEC_{t-n} + \beta_9 RPPLU_{t-n} + \beta_{10} D2 + \beta_{11} TIME + \beta_{12} TIME2 + e \quad (2)$$

where:

D1 = 1 for the period between 1997-2000, and 0 otherwise

D2 = 1 for the period between 1998-2001, and 0 otherwise

(b) Malmesbury

$$ANP_{st} = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPAPP_{t-n} + \beta_3 RPAPR_{t-n} + \beta_4 RPCAB_{t-n} + \beta_5 RPCHA_{t-n} + \beta_6 RPCHEt_{-n} + B_7 RPCIN_{t-n} + \beta_8 RPCOL_{t-n} + \beta_9 PIFR_{t-n} + \beta_{10} RPMER_{t-n} + \beta_{11} RPPEC_{t-n} + \beta_{12} RPPER_{t-n} + \beta_{13} RPPLU_{t-n} + \beta_{14} RPPIN_{t-n} + \beta_{15} RPSAU_{t-n} + \beta_{16} RPSHI_{t-n} + \beta_{17} D3 + \beta_{18} TIME + \beta_{19} TIME2 + e \quad (3)$$

$$AU_{st} = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPAPP_{t-n} + \beta_3 RPAPR_{t-n} + \beta_4 RPCAB_{t-n} + \beta_5 RPCHA_{t-n} + \beta_6 RPCHEt_{-n} + B_7 RPCIN_{t-n} + \beta_8 RPCOL_{t-n} + \beta_9 PIFR_{t-n} + \beta_{10} RPMER_{t-n} + \beta_{11} RPPEC_{t-n} + \beta_{12} RPPER_{t-n} + \beta_{13} RPPLU_{t-n} + \beta_{14} RPPIN_{t-n} + \beta_{15} RPSAU_{t-n} + \beta_{16} RPSHI_{t-n} + \beta_{17} D4 + \beta_{18} TIME + \beta_{19} TIME2 + e \quad (4)$$

where:

D3 = 1 for the period between 1999-2002, and 0 otherwise

D4 = 1 for the period between 1998-2000, and 0 otherwise

(c) Olifants River

$$ANP_{st} = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPCHA_{t-n} + \beta_3 RPCHE_{t-n} + \beta_4 RPCOL_{t-n} + \beta_5 RPHAN_{t-n} + \beta_6 PIFR_{t-n} + \beta_7 RPMER_{t-n} + \beta_8 RPPIN_{t-n} + \beta_9 RPSAU_{t-n} + \beta_{10} RPSHI_{t-n} + \beta_{11} D5 + \beta_{12} TIME + \beta_{13} TIME2 + e \quad (5)$$

$$AU_{st} = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPCHA_{t-n} + \beta_3 RPCHE_{t-n} + \beta_4 RPCOL_{t-n} + \beta_5 RPHAN_{t-n} + \beta_6 PIFR_{t-n} + \beta_7 RPMER_{t-n} + \beta_8 RPPIN_{t-n} + \beta_9 RPSAU_{t-n} + \beta_{10} RPSHI_{t-n} + \beta_{11} D6 + \beta_{12} TIME + \beta_{13} TIME2 + e \quad (6)$$

where:

D5 = 1 for the period between 1998-2001, and 0 otherwise

D6 = 1 for the period between 1997-2001, and 0 otherwise

(d) Orange River

$$ANP_{st} = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPCHE_{t-n} + \beta_3 RPCOL_{t-n} + \beta_4 RPHAN_{t-n} + \beta_5 PIFR_{t-n} + \beta_6 RPTGR_{t-n} + \beta_7 D7 + \beta_8 TIME + \beta_9 TIME2 + e \quad (7)$$

$$AU_{st} = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPCHE_{t-n} + \beta_3 RPCOL_{t-n} + \beta_4 RPHAN_{t-n} + \beta_5 PIFR_{t-n} + \beta_6 RPTGR_{t-n} + \beta_7 D8 + \beta_8 TIME + \beta_9 TIME2 + e \quad (8)$$

where:

D7 = 1 for the period between 1998-2000, and 0 otherwise

D8 = 1 for the period between 2000-2001, and 0 otherwise

(e) Paarl

$$ANP_{st} = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPAPR_{t-n} + \beta_3 RPCAB_{t-n} + \beta_4 RPCHA_{t-n} + \beta_5 RPCHE_{t-n} + \beta_6 RPCIN_{t-n} + \beta_7 RPCOL_{t-n} + \beta_8 PIFR_{t-n} + \beta_9 RPMER_{t-n} + \beta_{10} RPPEC_{t-n} + \beta_{11} RPPLU_{t-n} + \beta_{12} RPPIN_{t-n} + \beta_{13} RPSAU_{t-n} + \beta_{14} RPSHI_{t-n} + \beta_{15} D9 + \beta_{16} TIME + \beta_{17} TIME2 + e \quad (9)$$

$$AU_t = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPAPR_{t-n} + \beta_3 RPCAB_{t-n} + \beta_4 RPCHA_{t-n} + \beta_5 RPCHE_{t-n} + \beta_6 RPCIN_{t-n} + \beta_7 RPCOL_{t-n} + \beta_8 PIFR_{t-n} + \beta_9 RPMER_{t-n} + \beta_{10} RPPEC_{t-n} + \beta_{11} RPPLU_{t-n} + \beta_{12} RPPIN_{t-n} + \beta_{13} RPSAU_{t-n} + \beta_{14} RPSHI_{t-n} + \beta_{15} D10 + \beta_{16} TIME + \beta_{17} TIME2 + e \quad (10)$$

where:

D9 = 1 for the period between 1999-2001, and 0 otherwise

D10 = 1 for the period between 1998-2000, and 0 otherwise

(f) Robertson

$$ANP_{st} = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPAPR_{t-n} + \beta_3 RPCAB_{t-n} + \beta_4 RPCHA_{t-n} + \beta_5 RPCHE_{t-n} + \beta_6 RPCOL_{t-n} + \beta_7 PIFR_{t-n} + \beta_8 RPPEC_{t-n} + \beta_9 RPPLU_{t-n} + \beta_{10} RPSAU_{t-n} + \beta_{11} RPSHI_{t-n} + \beta_{12} D11 + \beta_{13} TIME + \beta_{14} TIME2 + e \quad (11)$$

$$AU_{st} = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPAPR_{t-n} + \beta_3 RPCAB_{t-n} + \beta_4 RPCHA_{t-n} + \beta_5 RPCHE_{t-n} + \beta_6 RPCOL_{t-n} + \beta_7 PIFR_{t-n} + \beta_8 RPPEC_{t-n} + \beta_9 RPPLU_{t-n} + \beta_{10} RPSAU_{t-n} + \beta_{11} RPSHI_{t-n} + \beta_{12} D12 + \beta_{13} TIME + \beta_{14} TIME2 + e \quad (12)$$

where:

D11 = 1 for the period between 1998-2001, and 0 otherwise

D12 = 1 for the period between 2000-2001, and 0 otherwise

(g) Stellenbosch

$$ANP_{st} = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPAPP_{t-n} + \beta_3 RPAPR_{t-n} + \beta_4 RPCAB_{t-n} + \beta_5 RPCHA_{t-n} + \beta_6 RPCHE_{t-n} + \beta_7 RPCIN_{t-n} + \beta_8 PIFR_{t-n} + \beta_9 RPMER_{t-n} + \beta_{10} RPPEC_{t-n} + \beta_{11} RPPER_{t-n} + \beta_{12} RPPLU_{t-n} + \beta_{13} RPPIN_{t-n} + \beta_{14} RPSAU_{t-n} + \beta_{15} RPSHI_{t-n} + \beta_{16} D13 + \beta_{17} TIME + \beta_{18} TIME2 + e \quad (13)$$

$$AU_{st} = = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPAPP_{t-n} + \beta_3 RPAPR_{t-n} + \beta_4 RPCAB_{t-n} + \beta_5 RPCHA_{t-n} + \beta_6 RPCHE_{t-n} + \beta_7 RPCIN_{t-n} + \beta_8 PIFR_{t-n} + \beta_9 RPMER_{t-n} + \beta_{10} RPPEC_{t-n} + \beta_{11} RPPER_{t-n} + \beta_{12} RPPLU_{t-n} + \beta_{13} RPPIN_{t-n} + \beta_{14} RPSAU_{t-n} + \beta_{15} RPSHI_{t-n} + \beta_{16} D14 + \beta_{17} TIME + \beta_{18} TIME2 + e \quad (14)$$

where:

D13 = 1 for the period between 2000-2003, and 0 otherwise

D14 = 1 for the period between 1998-2000, and 0 otherwise

(h) Worcester

$$ANP_{st} = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPAPP_{t-n} + \beta_3 RPAPR_{t-n} + \beta_4 RPCHA_{t-n} + \beta_5 RPCHE_{t-n} + \beta_6 RPCIN_{t-n} + \beta_7 RPCOL_{t-n} + \beta_8 RPHAN_{t-n} + \beta_9 PIFR_{t-n} + \beta_{10} RPMER_{t-n} + \beta_{11} RPPEC_{t-n} + \beta_{12} RPPER_{t-n} + \beta_{13} RPPLU_{t-n} + \beta_{14} RPPIN_{t-n} + \beta_{15} RPSHI_{t-n} + \beta_{16} D15 + \beta_{17} TIME + \beta_{18} TIME2 + e \quad (15)$$

$$AU_{st} = \beta_0 + \beta_1 AP_{t-n} + \beta_2 RPAPP_{t-n} + \beta_3 RPAPR_{t-n} + \beta_4 RPCHA_{t-n} + \beta_5 RPCHE_{t-n} + \beta_6 RPCIN_{t-n} + \beta_7 RPCOL_{t-n} + \beta_8 RPHAN_{t-n} + \beta_9 PIFR_{t-n} + \beta_{10} RPMER_{t-n} + \beta_{11} RPPEC_{t-n} + \beta_{12} RPPER_{t-n} + \beta_{13} RPPLU_{t-n} + \beta_{14} RPPIN_{t-n} + \beta_{15} RPSHI_{t-n} + \beta_{16} D16 + \beta_{17} TIME + \beta_{18} TIME2 + e \quad (16)$$

where:

D15 = 1 for the period between 1998-2001, and 0 otherwise

D16 = 1 for the period between 1998-2000, and 0 otherwise

ANP_{st}[11] = Area newly planted for a specific wine grape cultivar at time t

AU_{st}[12] = Area uprooted for a specific wine grape cultivar at time t

AP_{t-n}, $RPAPP_{t-n}$, $RPAPR_{t-n}$, $RPCAB_{t-n}$, $RPCHA_{t-n}$, $RPCHE_{t-n}$, $RPCIN_{t-n}$, $RPCOL_{t-n}$, $RPHAN_{t-n}$, $PIFR_{t-n}$, $RPMER_{t-n}$, $RPPEC_{t-n}$, $RPPER_{t-n}$, $RPPLU_{t-n}$, $RPPIN_{t-n}$, $RPSAU_{t-n}$, $RPSHI_{t-n}$, $RPTGR_{t-n}$, TIME and TIME2 are as defined in Section 3.3.1 (b) and

e = Stochastic error term

3.3.3 Data processing

According to Mouton (1996:67), data collection produces new information or data about the world that requires further 'processing'. Data processing involves at least two types of operations, namely data reduction, during which quantitative and qualitative data are summarized, and data analysis. Data analysis would include quantitative or statistical analysis and qualitative analysis, which includes processes such as thematical and content analysis.

For this study, the Ordinary Least Squares (OLS) regression technique as applied by means of EVIEWS and STATISTICA were used for the data analysis. The data obtained from SAWIS were processed to impart the following:

- To describe what has been discovered on the factors affecting the area newly planted and area uprooted for each wine grape cultivar in each region, hence determining the factors influencing the producers' choice of these wine grape cultivars in each region
- To draw conclusions regarding the accuracy and significance of the findings obtained

[11] In defining the area newly planted with a specific wine grape cultivar in each region as a dependent variable, the initials ANP followed by the first three letters of the cultivar name were used. For instance, in the case of Cabernet Sauvignon and Chardonnay cultivars in each region, the dependent variable is defined as ANPCAB and ANPCHA respectively.

[12] Similar approach of defining the area uprooted for a specific wine grape cultivar is used. The initials AU followed by the three letters of the name of the cultivars were used. For instance the dependent variables for each wine region for Chenin Blanc and Cinsaut is given as AUCHE and AUCIN respectively

3.4 SUMMARY

In this chapter research designs, methods and techniques that were used to collect data were discussed. The literature survey and the questionnaire were discussed in detail mainly to explain the process of collecting and obtaining data.

Procedures prior to analysis were explained. It was noted that for statistical analysis, identification of variables and determination of the equations had to be established and the equations had to be subjected to various tests.

Chapter 4 discusses the structure of the South African wine industry and describes the wine producing regions, the current production, the price forming mechanism of co-operatives, market conditions, the supply and value chain, and lastly, an analysis of the area planted and uprooted.

CHAPTER FOUR

STRUCTURE OF THE SOUTH AFRICAN WINE INDUSTRY

4. 1 DESCRIPTION OF THE WINE REGIONS OF SOUTH AFRICA

South Africa's wine grape growing regions are characterized by their biodiversity. Viticulture originated and still mainly takes place at latitudes of 27°-34° south in an area with a mediterranean climate (WOSA, 2004b).

The definition of the wine regions has changed over time, and therefore it becomes important at this point to understand the different classification of the wine production regions. The first one is the administrative wine region classification which is based on the former KWV regions (Wait, 2005). This system uses the former divisional councils to describe the wine grape production regions. From the administrative point of view, based on institutional considerations, the production area of the South African wine industry is divided into eight wine regions (Lombard, 1999:2).

The second classification is the "Wines of Origin" scheme which was instituted in 1972/3. According to this system, the wine production zones have been designated as 'regions', 'districts' and 'wards' (Van Zyl, 2003:11; Schweitzer, 1998:4). This scheme protects wines of origin and wines made from specific cultivars. It also complies with the EU regulations and addresses principles such as business honesty, factual terms, titles and marketing truths and free participation (Saayman, 2004:94). Regions constitute umbrellas including certain districts or part of districts; districts are geographical demarcations while wards are smaller homogeneous areas within the borders of a district. The smallest production unit under the wine of origin system is an estate, which can consist of one or more farms as long as the farm is administered as a unit and includes a production cellar where the wine is made (Van Zyl, 2003:11; Du Plessis, 2003:117-118; Williamson & Wood, 2003:22). In 1993 however, the 'Wine of Origin, scheme was amended to make provision for defining a geographical unit. Currently, two geographical units have been demarcated, namely Western Cape and Northern Cape (WOSA, 2004b).

The emphasis in this study falls on the eight production zones based on the administrative classification. This was selected because SAWIS data were used for statistical analysis and SAWIS collects and compiles their data based on the former KWV regions. The following is a description of each of the production areas (refer to Figure 4.1 for a breakdown of the wine producing regions of South Africa).

4.1.1 Little Karoo

This region includes those portions or former divisional council areas of Wynland, Bredasdorp-Swellendam, Langeberg and Outeniqua north of the Langeberg and Outeniqua mountain ranges as well as the former divisional council area of Klein Karoo-Langkloof, and with the remainder of the former Cape Province which has not been included in any other area (Wait, 2005). The area is semi-arid with high summer temperatures and relatively low rainfall. Most vineyards are planted in alluvial soils and rely on irrigation. Little Karoo produces some of South Africa's most renowned fortified wines. In recent years, producers have expanded their range to include noble cultivars such as Chardonnay and Merlot. Chenin Blanc, with its high acidity and natural fruitiness, is also well suited to the warm climate (Du Plessis, 1999:96).

4.1.2 Malmesbury

Malmesbury is the former divisional council of Swartland (Wait, 2005). Summer temperatures can be high, but there is some cooling effect from sea breezes off the Atlantic west coast. Rainfall is low but vineyards are normally not irrigated, except those along the Berg River (Du Plessis 1999:99).

4.1.3 Olifants River

The Olifants River has its origin in the mountains near Ceres and reaches the Atlantic ocean at Lamberts Bay. The region stretches from Citrusdal in the south, past Clanwilliam, Trawal and Klawer to Vredendal and Lutzville in the north. The southern half of the valley, from Citrusdal to Clanwilliam, has the rugged massif of Cedarberg towering over it to the east (Du Plessis, 1999:96). This region is in the former divisional council areas of Cederberg and Calvinia (Wait, 2005). The summers in this valley range from relatively warm to cool compared with some of South Africa's other wine areas and rainfall is low (WOSA, 2004b). Water from the Olifants River, controlled by a dam in Clanwilliam, is extensively used for irrigation. Soils vary from sandy to red clay loams and vineyards are concentrated in the northern parts (Du Plessis, 1999:97).

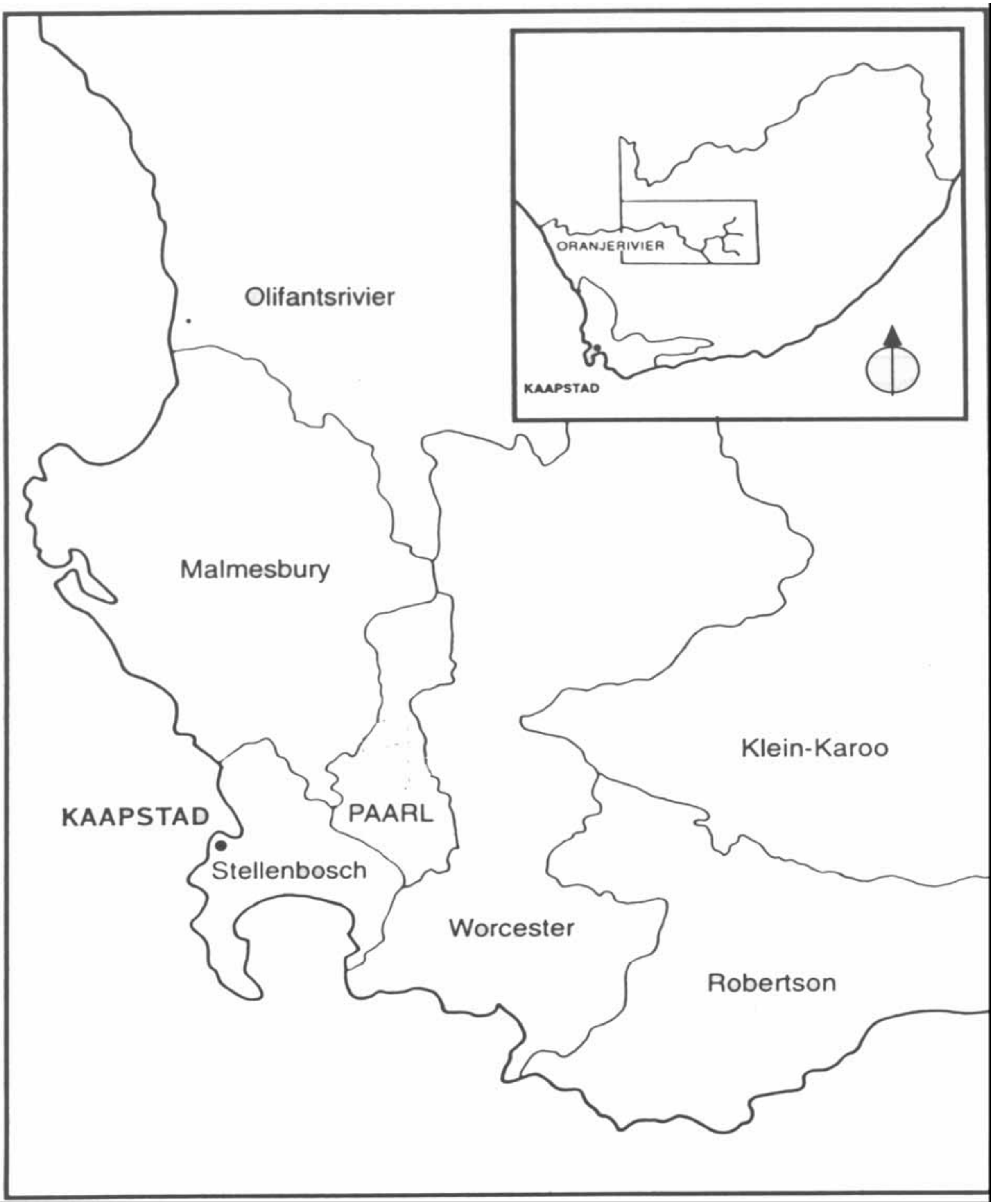

Figure 4.1 Administrative wine regions of South Africa
Source: SAWIS, 2005

4.1.4 Orange River

This region includes the former divisional council areas of Namaqualand, Kenhardt, Prieska, Gordonia, Kurman, Hay, Vaal River, Vaalharts, Stellaland as well as the provinces of Transvaal, Natal and the Orange Free State (Wait, 2005). Temperatures vary between low winter extremes and summer highs, with very low rainfall. Vineyards may be starved of water when the river is low in one year, and be buried in silt the next year. The region is traditionally known for sultana raisins (Du Plessis, 1999:97). However, the Sultanas have been excluded from this study (refer to Section 3.1).

4.1.5 Paarl

The historic town of Paarl lies in the fertile Berg River valley at the foot of Paarl Mountain with its distinctive granite boulders. It is one of the premier wine-producing districts and the region includes the former divisional council area of Paarl, as well as a portion of the former divisional council of Witzenberg situated in the north, north-east and west (Wait, 2005). It falls within the Mediterranean climate region, with long, hot summers and winter rainfall of about 650mm per year. Irrigation is used on a limited scale. Three main soil types occur, depending on the location in the valley (Du Plessis, 1999:97-98).

4.1.6 Robertson

This region includes portions of the former divisional council of Wynland, Bredasdorp-Swellendam, Langeberg and Outeniqua south of the Langeberg and Outeniqua mountain ranges (Wait, 2005). The annual rainfall of around 400mm, which mainly falls in winter, is supplemented by irrigation from the Breede River and the Brandvlei Dam. The region has a variety of soil types extremely rich in lime. Natural vegetation tends towards Karoo shrub land (Du Plessis, 1999:98).

4.1.7 Stellenbosch

This region is situated east of Cape Town and it is boarded on the south by False Bay. This region includes the former divisional council areas of Stellenbosch and Cape (Wait, 2005). The generally Mediterranean climate, with annual rainfall of 600-800mm and variety of soil types and micro-climates is well suited for the production of noble cultivars (Du Plessis, 1999:98-99). It produces wines reflecting the fertile soils and coastal influence needed to produce world-class products (Schweitzer, 1998:3).

4.1.8 Worcester

Worcester covers several former divisional councils which include Caledon, Matroosberg south of and including the southerly slopes of the divisional area of Witzenberg situated south, south-east and east of an imaginative line drawn from the south eastern most beacon of the land known as Kasteels Kloof on the boundary between Witzenberg and Paarl (Wait, 2005). Soil types and micro-climate vary greatly across the length and width of the valley, with annual rainfall of up to 500mm at Slanghoek in a picturesque mountain and as low as 35mm further east (Du Plessis, 1999:100). With its lime-rich soils, it is becoming known for high-quality reds and whites, especially Shiraz and Chardonnay (Schweitzer, 1998:3).

4.2 STRUCTURE OF PRODUCTION

Anderson and Norman (2003) stressed that, in order to more accurately assess the likelihood of success of the wine industry in any country, there is the need to understand global trends in the wine market. The key features of the South African wine industry that are explained in this study include among others the current structure of production, export markets and the supply and value chain of the industry.

In 2004, South Africa had 111 599 hectares[13] of land planted to wine grapes. This represented an increase over 1990 of 21 percent in the total area planted. Total production, on the other hand, increased by only 8.2 percent[14] from an average of 864 million tons of wine grapes in 1990-1992 to an average of 935 million tons in 2002-2004. It is this anomaly between the rate of expansion in land used and output that is the key to a deeper understanding of the South Africa's wine industry, because the gross value of output from the South Africa's output grew from R594 million in 1990 to R2.6 billion in 2003 or 4.4 times (SAWIS, 2004).

South Africa's wine industry rank fifth in the world in terms of the average grape yield per hectare, well above Australia (15th) and France (18th) (Vink *et al*, 2004:240). Table 4.1 shows the average yield per hectare for the South African wine regions. The data shows that the regions that produced the most wine grapes (Worcester, Orange River, Robertson and Olifants River, respectively) also produced the highest yields per hectare. On the other hand, farms in the regions such as Paarl, Stellenbosch and Malmesbury produced lower yields per hectare. Similarly, it is observed that the higher yields per hectare are in the irrigated regions with Orange River ranking the first.

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[13] This figure includes the total area planted with Sultanas. Excluding the total area planted to Sultanas, the total area under wine grapes is 100 207 hectares.
[14] Refer to Appendix 3 for the calculation of this figure.

Table 4.1: Average yield per hectare for the South African wine regions, 2004

Region	Grape production (tons)	Grape production (%)	Area * (ha)	Area (%)	Yield per hectare (tons/ha)
Worcester	341 167.840	26.0	18 871	18.8	18.09
Paarl	139 091.504	10.6	18 185	18.2	7.65
Stellenbosch	115 472.192	8.8	17 376	17.3	6.65
Malmesbury	103 662.536	7.9	15 277	15.3	6.79
Robertson	183 705.760	14.0	13 014	13.0	14.12
Olifants River	178 457.024	13.6	9 746	9.7	18.31
Orange River	206 012.888	15.7	4 761	4.8	43.27
Little Karoo	44 614.356	3.4	2 976	2.9	14.99
Total	**1 312 184**	**100**	**100 207**	**100**	

Source: SAWIS, 2005

The current production structure of the wine industry is explained in Table 4.2. This structure has been changing rapidly at the same time as the area under vines has been increasing. In the South African circumstances, the replanting of vines is arguably affecting the structure of output more than the expansion of the area under vines; although both are adding to the proportion of noble cultivars in the total crop (Vink *et al*, 2004:241).

The primary producers per production category are also shown in Table 4.2. There are an estimated 4 810 wine grape producers in South Africa. The majority of these producers farm wine grapes on a relatively small scale, with 34.3 percent of producers delivering less than 100 tons of wine grapes for pressing to wine cellars. It is also evident that 21.6 percent are registered as primary producers yet they do not deliver wine grapes.

Table 4.2: Wine industry structure, South Africa, 2004

Number of primary wine grape producers	Per production category	
	Tons	Number of producers
	0	1 039
	1 - 100	1 648
	> 100 - 500	1 421
	> 500 - 1 000	432
	> 1 000 - 5 000	265
	> 5 000 -10 000	5
	TOTAL	**4 810**
Number of wine cellars which crush grapes	66	CO-OPS
	477	PRIVATE WINE CELLARS
	18	PRODUCING WHOLESALERS
	561	**TOTAL**
Number of bulk wine buyers	76	WHOLESALERS(including producing wholesalers)
	27	EXPORTERS (buy wine for export only)
	103	**TOTAL**

Source: VINPRO, 2005 & SAWIS, 2005

Three main types of cellars can be distinguished namely; private cellars (estates and non-estates), co-operatives and producing wholesalers. A wine estate is essentially a wine farm that grows wine grapes, makes wine and bottle on a single property. Non-estate private cellars buy both wine and wine grapes and bottle under their own brand names. There has been a significant increase in their number, up by more than 150 between 1999 and 2004. By 2004, there were 477 private wine cellars (refer to Table 4.2). Table 4.3 shows that more than half of these producers crush less than 100 tons of wine grapes and 79 percent crush less than 500 tons.

Table 4.3: Number of wine cellars per production category, South Africa, 2004

Categories (tons of wine grapes crushed)	Number of wine cellars			
	Private wine cellars	Co-operatives	Producing wholesalers	Total
1 - 100	266	-	6	272
> 100 - 500	110	-	4	114
> 500 - 1 000	54	1	1	56
> 1 000 - 5 000	46	11	3	60
> 5 000 -10 000	1	20	-	21
> 10 000	-	34	4	38
Total	**477**	**66**	**18**	**561**

Source: SAWIS, 2005

The sixty six co-operative producers are an important constituency, due to the large number of producers they represent. In 2004 they accounted for roughly two-thirds of the total quantity of wine grapes crushed (87% of all white wines and 62% of all red wine). Their primary focus historically was on basic wines sold in bulk. However, many co-operatives also produce some quality wine. In 2004, they accounted for 19 percent of the production of certified wine (SAWIS, 2005). South Africa's top wine brands in international market include ones owned by co-operatives (Rabobank International, 2004).

There is an estimated 76 wholesalers operating in South Africa. This group dominates wine sales, accounting for some 65 percent of certified wine sales (SAWIS, 2005). The primary function of the wholesaler in the supply chain is marketing, sales and distribution. Eighteen wholesalers, including some of the largest ones, buy in wine grapes and make their own wine in addition to buying wine in bulk or bottled form. These are referred to in the industry as 'producing wholesalers'. The remaining wholesalers are not involved in wine production, but they buy produced wine in bulk. The other category of bulk buyers are the thirty exporters who buy wine for export only.

Table 4.4 shows the cultivars utilized as a percentage of total crushed by different groups in the wine industry structure. It is evident in Table 4.4 that of the total wine grapes received by co-operatives, 76.6 percent represents white wine grapes crushed and 23.4 percent red wine grapes. On the other hand, the producing wholesalers' crushed 66.2 percent red wine grapes and 33.8 percent white wine grapes. The implication is that co-operatives receive more white wine grapes while producing wholesalers receive more red wine grapes.

Table 4.4: Cultivars utilized for wine making purposes during 2004

Cultivar	**Percentage of cultivar crushed by:**			
	All wine cellars	**Private wine cellars**	**Co-ops**	**Producing wholesalers**
Chenin Blanc	21.0	11.0	23.6	10.6
Colombar	20.0	7.1	23.7	1.7
Hanepoot	4.0	2.2	4.6	0.6
Sauvignon Blanc	3.8	9.7	2.3	9.2
Chardonnay	4.9	8.3	4.1	7.3
Other white cultivars	11.9	10.1	13.0	4.4
Table grapes	4.6	2.6	5.3	0.0
Total white cultivars	**70.2**	**51.0**	**76.6**	**33.8**
Cabernet Sauvignon	5.8	13.1	3.5	19.3
Cinsaut Noir	2.3	1.8	2.3	3.4
Pinotage	6.0	7.7	5.2	12.4
Merlot	4.3	9.4	2.8	11.4
Shiraz	5.4	10.0	3.9	13.8
Other red cultivars	4.2	7.0	3.5	5.8
Table grapes	1.8	-	2.2	0.1
Total red cultivars	**29.8**	**49.0**	**23.4**	**66.2**

Adapted from SAWIS, 2005

4.3 MARKETING AND PRICE FORMING MECHANISM OF THE WINE INDUSTRY

A pricing mechanism can be described as the complex set of institutions and methods used to establish prices (Tomek & Robinson, 1981:213). Various categories cover most of the pricing systems in agriculture. However, the concern in this section is on the bargaining conducted by co-operatives in the wine industry in South Africa.

Prior to 1997, the wine industry was regulated by the KWV, a co-operative vested with statutory powers whose purpose was to stabilize the industry through controlling and absorbing wine surpluses (Vink *et al*, 2004). Policies to achieve this included a quota system that prescribed the quantities and prices of grapes and wine, the grape cultivars and the location of vines that producers were allowed to plant (Williamson and Wood, 2003:6). Standard prices were set for wine grapes irrespective of the quality. Though these policies protected farmers' income, they discouraged competition among buyers; wholesalers' ties to retail outlets discouraged competition among sellers (Ewert *et al*, 1998). This facilitated the process of concentration of markets for wines by Stellenbosch Farmers Winery (SFW) and for spirits by Distillers (Vink *et al*, 2004). These two however merged to Distell in 2000.

At the level of primary production an important part was played by the co-operative cellars, which came to dominate wine production. Most of these implemented a 'pool system' in terms of which grapes of a particular cultivar were sold in bulk, with farmers being paid according to the number of tons delivered and the selling price realized for the pool as a whole. An important objective of every co-operative was to realise the highest possible financial return ('payouts') for its members (Ewert & Henderson, 2005).

Farmers and their co-operatives sold most of their wine in bulk to the KWV and other producing wholesalers. Although they were guaranteed a minimum price, periodic surplus production and a limited domestic market continued to favour the wholesalers well into the 1990s. With the lifting of sanctions and the abolition of the quota system, the KWV found their power base eroded. The amended price system intended to allow market forces to function freely while keeping in place the basic stabilizing mechanisms (Morgan, 1999). The task of regulating production was transferred to the co-operatives and they were encouraged to define, limit and even charge their members' rights to crush grapes. The co-operatives similarly needed to discriminate more carefully in the prices paid to their members for different cultivars and for grapes, or even vineyards or different quantities (Vink *et al*, 2004).

Wine grape producers have experienced the effects of the expanding market for quality wines sold in the medium and premium price categories (Ewert *et al*, 1998). They face a sellers market for wine grapes from noble cultivars, which seems to have strained the loyalty of some members who have opted for independent delivery to other buyers. The co-operative wineries on the other hand are heavily dependent on the kind (cultivar) and quality of wine grapes delivered by members to eventually realize their production strategies (Vink *et al*, 2004). In the longer term, they can provide incentives and penalties to their members in order to change the composition of the wine grapes delivered (Ewert *et al*, 1998). However, co-operatives compete in the purchase of wine grapes with the producer wholesalers and therefore the prices offered by producer wholesalers might influence the price that co-operative can offer to their members.

There is, however, little information on the pricing mechanism of co-operatives from the literature and a questionnaire was devised to obtain this information. A broad discussion on the co-operative price forming mechanism is explained in Chapter 5 as per the responses from the questionnaire.

4.4 MARKET CONDITIONS FOR THE SOUTH AFRICAN WINE INDUSTRY

4.4.1 Global trends

For much of the past decade the global wine industry has been in a situation of oversupply. Old World[15] producers have been losing market share to New World[16] producers (Williamson & Wood, 2003:39). This dramatic entry on the international stage by New World producers has presented and will continue to present some serious challenges to producers in both Western and Eastern Europe (Anderson *et al*, 2004:14). Since 1999, close to 240 million hectoliters of wine have been produced annually and 20 to 25 million litres of produced wine is in excess to global consumption requirements (Williamson & Wood, 2003:39).

In terms of retail value, the industry turns over $100 billion annually, with the United States representing the largest market in terms of value, as it is worth $16 billion, which however represents only 10 percent of global production in volume. France is the world's largest consumer by volume and 60 percent of wine consumption takes place in France, Italy and Spain. Much of this wine is low priced because of EU subsidies, and locally produced, and these countries are therefore not ideal export destinations (Williamson & Wood, 2003:39).

[15] Old World: Western European countries such as France, Spain, Italy, Germany, Bulgaria
[16] New World: Australia, New Zealand, Chile, South Africa, USA, Argentina

4.4.2 The domestic market

South Africa's domestic market is stagnant, and the country has a relatively low per capita consumption compared to other wine producing countries. While the global transformation has engendered radical transformation over the past decades, total wine consumption in South Africa is growing by only 1.2 percent per year and per capita consumption is 9.04 litres per annum (SAWIS, 2004). Of the total wine production, 66.5 percent is consumed locally and the share of domestic sales of wine sold in glass containers has decreased from above 40 percent of the total to between 30 and 35 percent over the 1990's (Vink *et al*, 2004:245). Domestic consumption of natural wine showed a 12.1 percent decrease in 2003 compared to 2002 (Du Plessis, 2003:16) and a further decrease was expected in 2004. However, there was an increase of 0.17 percent in 2004 compared to 2003 (SAWIS, 2005).

Table 4.5 shows that from 1990, the total per capita consumption of both drinkwine and spirits increased with a small margin until 1997. Since then it has been decreasing, still with a small margin and with drinkwine having a higher per capita consumption than that of spirits.

Table 4.5: Per capita consumption in South Africa

Year	Drinkwine (litres per capita)				Spirits (litres per capita)			
	Natural wine	Sparkling wine	Fortified wine	Total	Brandy	Other spirits	Whisky	Total
1990	7.45	0.26	1.30	9.01	0.47	0.44	0.21	1.12
1995	8.03	0.19	0.85	9.07	0.52	0.33	0.23	1.08
1996	8.29	0.19	0.87	9.35	0.55	0.33	0.23	1.11
1997	8.65	0.19	0.91	9.75	0.57	0.34	0.24	1.15
1998	8.17	0.20	0.79	9.16	0.47	0.35	0.21	1.03
1999	8.24	0.23	0.72	9.19	0.43	0.35	0.20	0.98
2000	8.21	0.13	0.66	9.00	0.38	0.34	0.19	0.91
2001	8.20	0.15	0.66	9.01	0.40	0.33	0.19	0.92
2002	8.04	0.17	0.70	8.91	0.40	0.31	0.17	0.88
2003	7.00	0.17	0.75	7.92	0.41	0.30	0.17	0.88
2004	6.73	0.17	0.75	7.65	0.41	0.29	0.17	0.87

Source: SAWIS, 2005

Beer largely dominates alcohol consumption in South Africa, as indicated in Figure 4.2. Reasons for this are that wine has an elitist image and has little presence in the black market (Williamson & Wood, 2003).

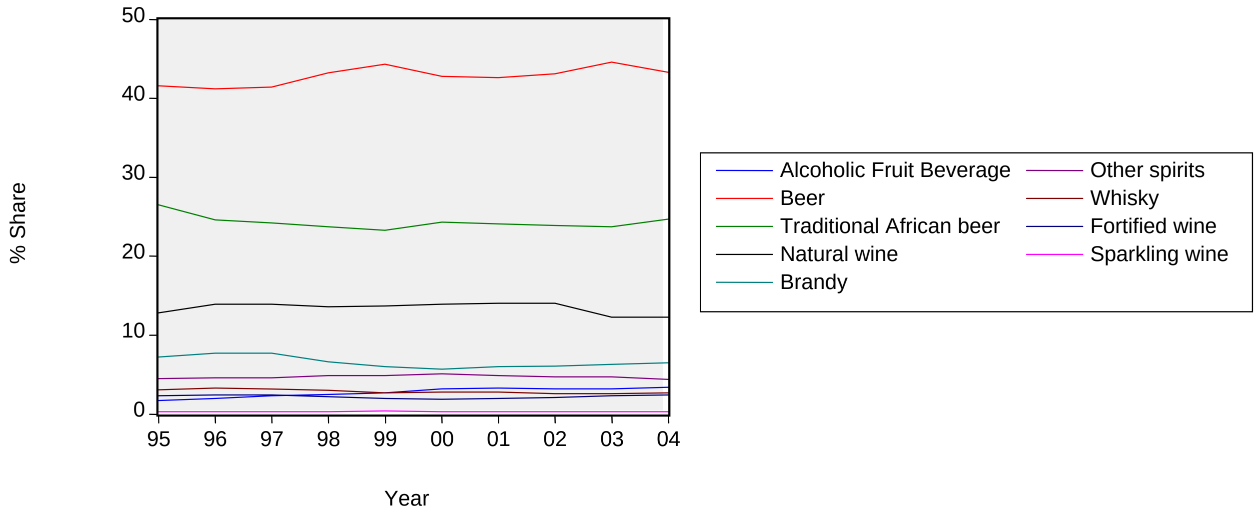

Figure 4.2: Percentage market share for alcoholic beverages in South Africa, 1995-2004

Source: SAWIS, 2005

Distell reports that the local market is difficult to penetrate, and investments they have made in this area have yielded low returns. They describe wine in South Africa as being a niche consumer product, with all of the challenges that accompany its marketing. It appears that wine producers feel that marketing budgets are better invested in international markets, even though marketing channels have taken experience and time to understand. (Williamson & wood, 2003:45).

4.4.3 Export orientation

Throughout its long history, the South African wine industry has faced successive 'boom and bust' conditions. In the past, prosperity has often resulted from preferential access to export markets, and adversity has always occurred as a result of the overproduction of lower quality wines due to an inappropriate production mix rather than a true surplus (Visser *et al*, 1998:4).

During the eighteenth century, South African viticulture expanded slowly, without reaching significant heights (Burger, 1977). In 1806 England took the Cape from the Dutch, with a resultant increase in demand for wine. When preferential tariffs were introduced in 1813, wine exports increased dramatically and for about 15 years viticulture was greatly stimulated (Saayman, 2004:93). But the protected English market also created an opportunity for unscrupulous merchants to export inferior quality wine with a resultant drop in prices, a bad reputation for South African wines and a low point in exports in the early 1850's.

Exports picked up again because of the oidium epidemic in Europe, but crashed completely during the rest of the nineteenth century when England cancelled preferential tariffs (Burger, 1977). On top of this, phylloxera hit the South African vineyards in 1886 and although readily overcome by building on European experience and imports of American rootstocks (Perold, 1936:110), the disaster compelled many wine grape producers to change to deciduous fruit production (Burger, 1977).

Nevertheless, the industry singled out to such an extent that overproduction occurred towards the end of the nineteenth century, compelling the formation of co-operative cellars, culminating in 1918 in the formation of central co-operative wine farmers association (KWV). This organization controlled production by granting quotas, fixing minimum prices and selling surpluses in the form of distilled products on the overseas markets. This guided the industry through the troubled early twentieth century and stimulated growth from 500 000 hectolitres per wine in 1918 to 5 million hectolitres in 1975 (Burger, 1977). However, the quota system also prevented the development of new areas with high wine quality potential, until when the quotas and the regulatory functions of the KWV were abolished (Saayman, 2004:94).

The nineties and beginning of 21st century saw tremendous improvements in wine quality and exports. In 1992 for instance, South Africa accounted for 3 percent of world wine production and less than 0.3 percent of world wine exports (Wood & Kaplan, 2004:4). This reflected the country's isolation under apartheid. The lifting of sanctions on South Africa created a favorable environment for export growth. Much of the growth in the South African wine industry has been due to its export performance. Exports grew from 23 to 267 million litres between 1991 and 2004 (refer to Table 4.6).

With respect to destination, South Africa's wine exports are heavily concentrated in the European Union, with the United Kingdom absorbing 46 percent of exports, followed by Netherlands (17%), Sweden (8%) and Germany (8%) - refer to Appendix 2 for a complete list. Focusing on the UK market, in 2004 for the first time South African wine sales into this country exceeded the 10 percent mark of the total sales in both volume and value. Furthermore, while other wine producing countries have been forced to reduce their retail prices in the UK market, South Africa has managed to increase its average selling price from £3,68 to £3,80 per bottle (WOSA, 2004a). South Africa's largest export markets for wine are listed in rank order in Table 4.7.

Table 4.6: Total volume of drinkwine exported for the period 1991-2004, South Africa.

Year	Natural wine	Fortified wine	Sparkling wine	Total
1991	21 779 607	993 321	317 124	23 090 052
1992	20 719 619	900 692	375 471	21 995 782
1993	23 249 930	772 278	574 749	24 596 957
1994	48 446 024	1 284 187	961 597	50 691 808
1995	71 207 264	793 035	806 708	72 807 007
1996	-	-	-	99 900 000*
1997	108 489 119	1 265 310	805 064	110 559 493
1998	116 766 480	1 116 781	524 687	118 407 948
1999	127 636 278	695 380	809 625	129 141 283
2000	139 800 203	471 538	685 248	140 956 989
2001	175 986 098	548 397	779 312	177 313 807
2002	215 759 308	523 169	1 401 483	217 683 960
2003	237 212 282	530 699	1 630 481	239 373 462
2004	266 506 695	425 811	1 566 174	268 498 680

***Only the total value is available.**

Sources: Du Plessis, 1999, 2002, & 2003 and SAWIS, 2005

Table 4.7: South Africa's export markets in order of rank, 2003

Rank	Bottled wine	Fortified wine
1	United Kingdom	United Kingdom
2	The Netherlands	Australasia
3	Germany	The Netherlands
4	Sweden	France
5	Belgium	Belgium
6	Denmark	Germany
7	The United Stated	Canada
8	Canada	Denmark
9	Finland	Switzerland
10	Japan	Japan

Source: WOSA, 2004a

The profitability of export sales has recently come under scrutiny as the industry has had to contend with an appreciating rand. At the end of 2001, the rand had depreciated to an average of R12 to the US dollar while the average for 2004 was R6.50. This volatility has made export planning and management complex (Connigarth Economists, 2004).

According to WOSA (2004a), there are key drivers in South Africa's export markets that are likely to impact on the local market, namely:

- Shifts in global markets
- Consumers trading up
- Increase in red wine consumption
- Increase in consumption in New World wines
- Growth in brands
- E-commerce
- Oversupply and
- Industry consolidation

4.4.4 Imports

The import penetration of wine products into the South African market is estimated at 3.4 percent (Tregurtha, 2004:4). However, wine imports into South Africa are fairly erratic as imports are typically used as a mechanism to balance local production, domestic sales and exports. For example, most wine imports that entered the South African market in 2004 were bulk red wines unlike in 2003 where most of the wine imports were bulk white wines from Argentina, intended for the bottom end of the local market (SAWIS, 2005). This is presented in Table 4.8.

Table 4.8: Imports to South Africa – bottled and bulk, 2004

	Litres		
	Bottled	**Bulk**	**Total**
Beer	70 000 000	-	70 000 000
Grape juice	-	-	-
Natural wine (white)	135 618	10 126	145 744
Natural wine (red)	190 593	566 869	757 462
Fortified wine	33 492	-	33 492
Sparkling wine	315 672	-	315 672
Vermouth	116 956	-	116 956
Other (e.g coolers)	22 860	-	22 860

Source: SAWIS, 2005

The local wine industry is well protected from imports via a Most Favoured Nations (MFN) duty of 25 percent. This is significantly higher than the 1.8 percent weighted average tariff for all South African agricultural products. The implication is that the industry is vulnerable to existing and new trade agreements (Tregurtha, 2004:4).

4.4.5 International comparison

The South African wine industry has long shared a number of characteristics with Australia, as both were predominantly producers of distilling and fortified wines for the first half of the twentieth century and then switched, initially to the production of sweet table wines. Table wine production exceeded that of fortified wine production for the first time in South Africa in 1953 and in Australia in 1968 (Osmond & Anderson, 1998:48). Today South Africa differs from its competitors among the 'New World' including Australia, New Zealand and Chile, which all export a high proportion of their vintage.

Historically, South Africa produced large quantities of cheap wine for its domestic market. This pattern of demand and supply constrains the capacity to adapt to a more differentiated international demand (Vink *et al*, 2004:228). In terms of percentage increases in volumes, South African wine exports grew more rapidly over the decade 1992-2002 than other New World producers (refer to Table 4.9). However, South African growth was from a low base. Australia and Chile had significantly larger increases in export volumes.

Table 4.9: Export volumes of selected New World producers

Year	Australia	Chile	NZ	USA	RSA
	(million litres)				
1992	88	74	7*	147	20
2002	453	355	23	282	177
1992-2002 (% Δ)	415	380	229	91	785

* Estimated figures

Sources: Australia Bureau of Statistics, 2002; Chilevid, 2004; New Zealand Wine, 2004; Wine Institute, 2004 and SAWIS, 2003

Growth in the value of New World wine exports was even more dramatic than gains in volume. As shown in Table 4.10, Australia, Chile, New Zealand and South Africa exhibited very large increases in export values.

Table 4.10: Export volumes of selected New World producers

Year	Australia	Chile	NZ	USA	RSA
	($million)				
1992	263	110*	40	181	30*
2002	2 250	608	246	548	286
1992-2002 (% Δ)	756	453	516	203	853

* Estimated figures

Sources: Australia Bureau of Statistics, 2002; Chilevid, 2004; New Zealand Wine, 2004; Wine Institute, 2004 and SAWIS, 2003

What is most significant however is the ratio of increases in value to increases in volume. For Australia, New Zealand and the US, export value growth substantially exceeded export volume by more than 80 percent in each case. In the case of South Africa too, export value increased more rapidly than export volume, but the difference is much smaller at 9 percent. Even Chile, which is more similar to South Africa, has a higher ratio with export value growth exceeding volume growth by 19 percent. Clearly average exchange prices for South African wines grew by significantly less during the 1990's than for Australia, New Zealand, the US as well as Chile (Wood & Kaplan, 2004:4).

South Africa is the world's fifteenth largest in terms of area under vines, and the ninth largest wine producer accounting for 2.7 percent of global production (SAWIS, 2005). Table 4.10 illustrates that, compared to other New World wine producing countries, the South African wine industry lacked exposure to international market forces by 1998, with the result that a shortage of noble cultivars was experienced. However, South Africa is moving towards cultivation of red cultivars as can be seen in Table 4.11. Yet it still has a higher percentage area under white cultivars than the other New World wine producing countries.

Table 4.11: Percentage area under vines for white and red wine grape cultivars, 1998 and 2004

Cultivar	Australia		Chile		USA		RSA	
	1998	**2004**	**1998**	**2004**	**1998**	**2004**	**1998**	**2004**
Chardonnay	14.9	15.3	8.8	6.9	21.8	20.7	5.7	6.1
Sauvignon Blanc	1.9	1.9	9.0	6.7	2.9	3.2	4.9	6.2
Other whites	34.8	22.2	-	10.1	20.9	15.3	67.4	47.1
Total white cultivars	**51.6**	**39.4**	-	**23.7**	**45.6**	**39.2**	**78.0**	**59.4**
Cabernet Sauvignon	14.9	18.3	27.7	35.8	12.1	15.9	5.6	11.9
Merlot	3.9	6.6	11.1	11.7	9.7	11.0	2.6	6.2
Pinotage	-	-	-	-	-	-	4.7	6.2
Shiraz	18.2	23.5	-	-	-	-	2.0	7.9
Other reds	11.4	12.2	-	28.8	32.6	33.9	7.1	8.4
Total red cultivars	**48.4**	**60.6**	-	**76.3**	**54.4**	**60.8**	**22.0**	**40.6**
Total	**100**	**100**	-	**100**	**100**	**100**	**100**	**100**

Source: SAWIS, 2000 and 2005

4.5. SUPPLY AND VALUE CHAIN STRUCTURE IN THE SOUTH AFRICAN WINE INDUSTRY

4.5.1 Supply chain

A supply chain is defined as the series of functional stages that use various resources to transform a raw material into a finished product or a service and to deliver this product or service to the ultimate consumer (Cox 1997:211). This conception of a supply chain is similar to that employed by the mainstream literatures on logistics, operations management and supply chain management. According to Lysons (2000:67), a supply chain is the network of organizations that are involved through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer.

The South African wine supply chain is complex. Figure 4.3 describes the flow of products between the various participants in the supply chain[17]. The complicated nature of the flows reflects the recent marketing innovations that are creating direct links between wine producers and all types of buyers (Collison, 2001:7). The previous dominant role of wholesalers has been

[17] Refer to Appendix 5 for a supply chain analysis and challenges in the supply chain: (Van Rooyen, 2004).

undermined by the greater responsibility that wine producers are taking for their own marketing. They can sell directly to the wholesalers without trading through the co-operatives.

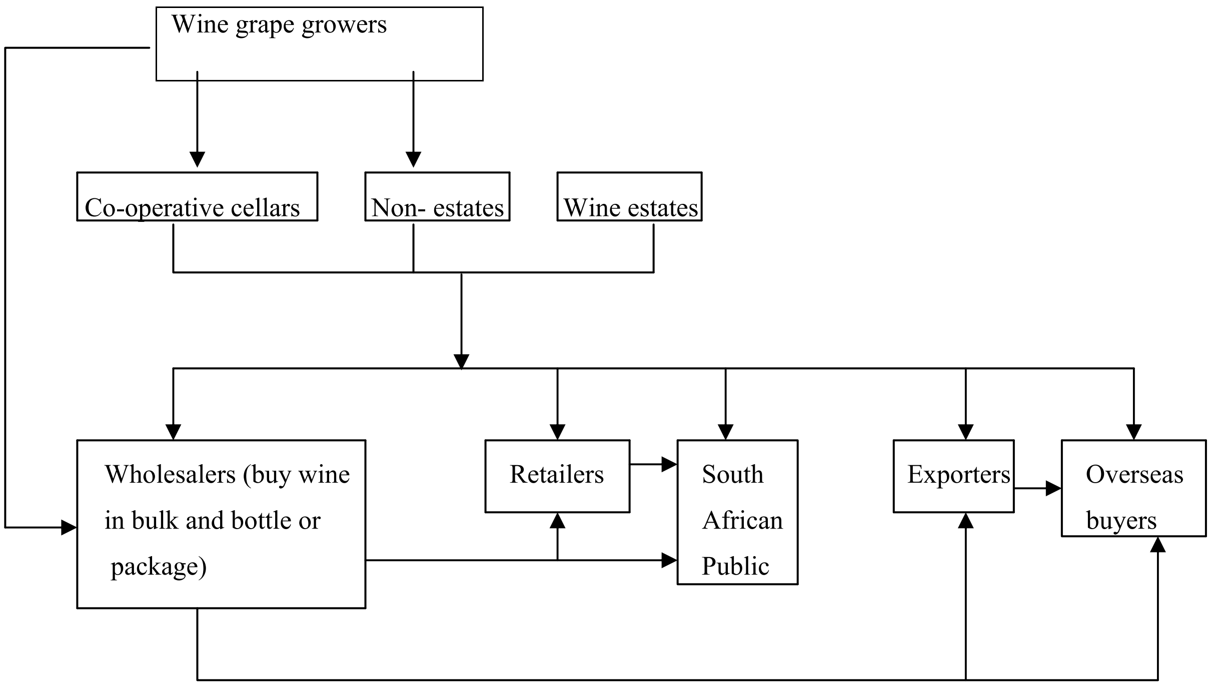

Figure 4.3: Supply chain flow
Adapted from Ewert *et al*, 1998

At the strategic level, co-operative cellars follow one of two routes: either they keep selling their wine in bulk to the wholesaler or they begin self-marketing, including the bottling of wine and the establishment of 'brands' in both local and overseas markets. In general, product flows to UK supermarkets are much simpler. Supermarket buyers usually have direct contact with South African wineries and buy either directly or through UK wine importers. Own label wines are bottled either by wine producers or through wholesalers.

4.5.2 Value chain structure

In view of the critical and increasing importance of branding and marketing activities in wine, it is necessary to discuss the value chain in the South African wine industry. This is particularly important in view of the historical weakness of South African wine marketing by comparison with leading New World producers (Wood & Kaplan, 2004:9).

The value chain structure of the South African wine industry is extremely fragmented and the mix compares well with that of the wine producing countries in the Old World (Meissenheimer *et al*, 2001:15). The value chain in the South African wine industry lacks a set of linked actions for production, marketing, distribution and storage (Kruger, 1999). Actions in the value chain are strictly regulated and quality control takes place through physical inspections and/or the testing of products at certain points. Although record-keeping is a regulatory requirement, it is limited to production factors, and market information is not readily available. Meissenheimer *et al* (2001) identified six primary activities and four supporting activities in the value chain of the South African wine industry.

a) Primary activities

i) Soil and plant material

The production potential of wine grapes is based on the integration of soil, climate and crop requirements. The industry uses two sources for the generation of plant material, namely local selection from existing vineyards, and imported plant material. After locally selecting or importing cuttings, the cuttings undergo a process of virus decontamination, followed by establishment in a nursery. They are then moved to a mother block, and finally to commercial nurseries where the cuttings are ordered by and sold to producers.

ii) Viticultural practices

Viticultural practices can be divided into two categories, namely terroir and optimum practices. The concept terroir includes climate, soil and slope choices for the establishment of wine grapes, while optimum vineyard practices include short-, medium- and long-term practices for managing the quality of grapes (Carey *et al*, 2002:12). The quality therefore depends on the correct choice of terroir supported by optimum viticultural practices.

iii) Cellar practices and wine-making

Cellar practices include all activities from when the wine grapes are offloaded at the cellar to the final product before bottling. The making of vintage wine requires stability and temperature control in the cellar, proper cellar hygiene as well as the correct technology and appropriate machinery. The layout and design of the cellar should also be adapted to the type of wine being produced. The process used by the wine maker to make the wine ultimately becomes part of the cellar's marketing strategy.

iv) Packaging and distribution

Wine is packaged in three formats, namely bottles, casks and foil bags. Packaging has two functions: Firstly, to protect the quality of the wine, which could be severely compromised if the wine is packaged incorrectly. Secondly, packaging influences the buyer's perception of the quality of the wine that he/she is buying.

v) Market development and marketing

The market place comprises a collection of individual markets. The reasons why a specific bottle of wine meets a buyer's needs can be established through market research and suitable products and strategies can be developed to meet those needs. The quality of the wine, cultivar specificity, the price of the wine and its image play a decisive role in market development. South African wines are distributed locally as well as abroad. Although the local distribution network is reliable, South Africa is perceived internationally as not able to deliver its wine on time (SAWSEA, 1999).

b) Supporting activities

The six primary activities in the South African value chain are supported and complemented by four supporting activities. Although the supporting activities are not directly concerned with the wine making process, they play a key role in the efficiency, effectiveness and image of the South African wine industry.

i) Logistics

The process flow of wine grapes and wine requires a system that would provide the final consumer with a guarantee regarding the quality and integrity of the product. The effective flow of throughputs makes a significant contribution to the marketing costs in the chain.

Logistics are involved in all links of the value chain and influence its effectiveness. In the supply chain of the South African wine industry, logistics involve the provisions, flow and maintenance of information, inventory, products, labour and facilities at every link in the value chain.

ii) Technology

Technology involves creation of new knowledge. New knowledge in the South African wine industry is mainly generated by the Agricultural Research Council and the University of Stellenbosch. Once the knowledge is packaged and integrated, it is made available to the industry. Technology transfer in the wine industry takes place through various institutions, including WINETECH, VINPRO, the Western Cape Provincial Department of Agriculture and Distell. Due to the fact that a large number of institutions focus on various parts of the supply chain when it comes to technology transfer, technology does not reach the consumer as quickly as desired, while various institutions provide contradictory technology information flows (Van Zyl, 2000).

iii) Labour

Approximately 345 000 farm workers (including dependants) work in the industry as well as 3 500 cellar personnel (SAWIS, 2004). Regarding the racial composition of farm workers, the ratio of coloured to black people is 90:10. The level of education of these workers is very low, which leads to a lack of productivity and requires strict supervision. As a result, formal management on farms is given little attention and most producers have not yet implemented formal written contracts with labourers (Ewert, 1999).

The ratio of wine makers and trained viticulturists per hectare of wine grapes is much lower in South Africa than in other New World wine producing countries. This affects the quality of wine produced and makes the industry less competitive internationally (Wine Strategy Task Force, 1999).

iv) Institutional framework

There are four reasons why the wine industry will always be subject to government regulations even though the environment in which it functions has been deregulated. Firstly, regulations are required to ensure that the industry complies with international agreements. Secondly, intervention is necessary to ensure and maintain general consumer safety. Thirdly, regulation will always be part of any industry that sells alcohol and fourthly, regulations intended to conserve the environment are becoming increasingly important in all industries (Vink, 1999). The key question remains, however, whether regulations contribute to an internationally more competitive industry, or whether they obstruct international competitiveness (Meissenheimer *et al*, 2001:20).

4.6 ANALYSIS OF CHANGE IN AREA UNDER WINE GRAPE CULTIVARS

As indicated earlier, the total area under vines has increased consistently since 1990, and by the end of 2004 there was 111 599 hectares of land under vines which represented a 20 percent increase since 1990. This is presented in Table 4.12.

Table 4.12: Total area planted and uprooted for the period 1990-2004

Year	Area newly planted (ha)	Area uprooted (ha)	Corrections* (ha)	Total Area planted (ha)
1990	2 893	2 402	-1 734	92 038
1991	3 110	2 782	-424	91 942
1992	3 322	3 191	321	92 393
1993	3 250	2 799	404	93 247
1994	3 055	3 011	390	93 680
1995	3 398	3 584	395	93 889
1996	3 608	2 718	942	95 721
1997	4 189	2 916	1 209	98 203
1998	4 372	2 870	1 274	100 979
1999	5 589	5 168	2 779	104 179
2000	6 043	8 013	3 357	105 566
2001	4 554	6 018	2 229	106 331
2002	4 229	4 937	2 374	107 998
2003	4 802	3 920	1 320	110 200
2004	-	-	-	111 599

Source: SAWIS, 2005

*****These corrections are as a result of recounting of vines as well as plantings and uprooting of the previous years which were not previously taken into account.

The net change in the area under vines for each region is given in Table 4.13. It can be seen from Table 4.13 that there was a decrease in the total net area planted in 1995. From 1996-1999 the total net area planted increased each year then declined from 2000-2002. In 2003, there was an increase once again.

From 1995 to 1997, the largest increase was in Orange River namely: 178 hectares, 391 hectares and 513 hectares respectively while the largest decrease was in Paarl (371 ha) in 1995 and Stellenbosch (60 ha in 1996 and 33 ha in 1997 respectively).

Table 4.13: Net change* in the area (ha) under wine grape cultivars in South African wine regions for the period 1995-2003

Region	1995	1996	1997	1998	1999	2000	2001	2002	2003
Orange River	+178	+391	+513	+192	+257	-74	-303	-749	-147
Olifants River	-53	+203	+248	+270	+221	+45	-234	+7	+57
Malmesbury	+9	+214	+218	+287	+203	-577	-121	+85	+297
Little Karoo	-5	-8	+39	+71	-48	-144	-245	-79	-27
Paarl	-371	+28	-10	+38	-342	-267	-222	+50	+217
Robertson	+165	+136	+106	+263	+114	-95	-357	-10	+268
Stellenbosch	-181	-60	-33	-9	-278	-577	-43	-63	-156
Worcester	+70	+207	+352	+390	+293	-282	+60	+52	+373
Total	**-187**	**+1 111**	**+1 433**	**+1 502**	**+420**	**-1 971**	**-1 465**	**-707**	**+882**

Source: Botha, 1999 and Davids, 2004

***Net change = area newly planted (in ha) minus area uprooted**
Note: Increase (+), Decrease (-)

For 1998 and 1999 the largest increase of 390 hectares and 293 hectares was in Worcester while the largest decrease once again was in Stellenbosch (9 ha) in 1998 and Paarl (342 ha) in 1999.

In 2000, the largest increase of 45 hectares was in Olifants River while Stellenbosch and Malmesbury showed the largest decrease of 577 hectares each. In 2001, the largest increase of 60 hectares was in Worcester while the largest decrease of 303 hectares was in Orange River.

For 2002, Malmesbury showed the largest increase of 85 hectares while in 2003 it was Worcester with 373 hectares. Once again in 2002 and 2003, Orange River showed the largest decrease of 749 hectares and 147 hectares respectively.

The above net changes for each region however, do not take account of the corrections stated in Table 4.12. This is because there is no information available for these corrections for each wine region.

4.7 ANALYSIS OF WINE GRAPE CULTIVARS PLANTED IN THE VARIOUS REGIONS

In the analysis of the wine grape cultivars planted in the various regions, this study considered wine grape cultivars that ranked among the top five in terms of the percentage of the total area planted in any of the eight regions. The wine grape cultivars were further ranked according to the total area planted in terms of their colour (red or white wine grape cultivars) and finally, the rank of the cultivars in terms of the overall total area planted of wine grape cultivars. The data provided by SAWIS in the year 2005 were used for the classification. Refer to Appendix 6 for a complete list of the ranking and Appendix 7 for the total status of selected wine grape cultivars.

4.7.1 Red cultivars

Cabernet Sauvignon was the wine grape cultivar planted most planted in Stellenbosch (23.4%), the second most in Malmesbury (16.3%) and Paarl (18.3%), and fourth most in Robertson (10.5%), Worcester (7.3%), Olifants River (7.0%) and Orange River (2.1%). After a sharp increase to 5 615 hectares in 1998, the total status of Cabernet Sauvignon further increased to 6 963 hectares in 1999, 8 824 hectares in 2000, 10 390 hectares in 2001, 13 160 in 2003 and 13 531 hectares in 2004. When looking at the red wine grape cultivars alone, in 2004, Cabernet Sauvignon ranked in the first position in terms of total area planted with red wine grape cultivars while it was in second position in the total area planted in both white and red wine grape cultivars. This is illustrated in Figure 4.4 and Figure 4.6

In 2004, Shiraz was planted the third most planted in Stellenbosch (12.9%), Paarl (11.2%) and Olifants River (10.4). It was the fourth most in Malmesbury (11.5%) and fifth most in Worcester (6.1%) and Little Karoo (4.5%). Annual new plantings showed a sharp increase since 1997 (282 ha) with new plantings reaching a peak in 2000 (1 536 ha) before dropping to 455 hectares in 2003. The total status showed a yearly increase ever since 1991 and since 1995, the area planted increased more than sevenfold. In 2004, Shiraz occupied an area of 9 414.7 hectares. As can be seen in Figures 4.4 and 4.6, in terms of area planted with red wine grape cultivars, Shiraz ranks in the second position while it ranks fourth in total area.

Merlot was in the fifth position in Stellenbosch (12.6%), Paarl (7.8%) and Malmesbury (6.3%) when looking at the total plantings. The total area planted with Merlot in 2004 was 6 968.5 hectares. Merlot ranks in the third position in terms of total red wine grape cultivars and the sixth position in the total area planted with both white and red wine grape cultivars in the year 2004 (refer to Figure 4.4 & 4.6).

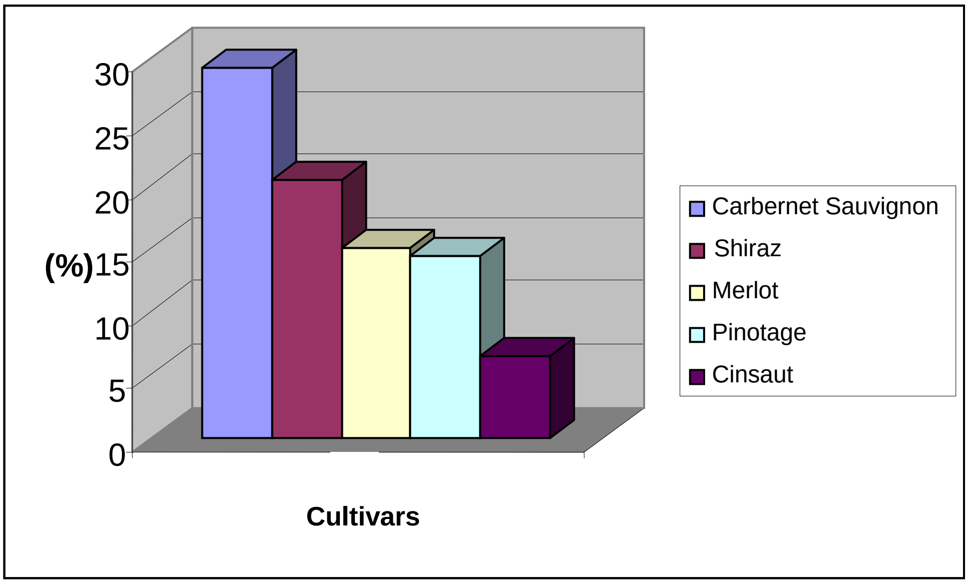

Figure 4.4: Percentage of total area planted with red wine grape cultivars, 2004

Source: Adapted from SAWIS, 2005

Pinotage was the third most in Malmesbury (11.7%) and fifth most in Olifants River (6.4%) and Orange River (6.4%).The descending status of Pinotage since 1986 was overturned in 1993 with rising plantings in the years to follow. However, since 1999, Pinotage plantings showed a decrease again, with a sharp decrease to only 19 hectares of area newly planted in 2004. However, the area planted with Pinotage is 6 663.6 hectares and it ranked in fourth position in terms of the total area planted with red wine grape cultivars and the eighth position in terms of total area planted with wine grape cultivars.

Cinsaut was the fifth most wine grape cultivar in Paarl (6.6%). The total area planted in 2004 was 3 035.4 hectares and it ranked in fifth position in terms of total area planted with red wine grape cultivars and ninth position in the total area planted with red and white wine grape cultivars as illustrated in Figure4.4 and 4.6.

4.7.2 White cultivars

Chenin Blanc was the wine grape cultivar most planted in Malmesbury (25.5%), Worcester (22.8%), Olifants River (21.9%) and Paarl (20.6%). It was the second most in the Little Karoo (21.3%) and Orange River (18.4%), the third most planted in Robertson (13.8%) and fifth most in Stellenbosch (10.1%). Since 1990, after the yearly new plantings stabilized between 340 and 581 hectares, it decreased sharply in 2000 to 191 hectares. New plantings increased, however to 385 hectares in 2002 and to 693 hectares in 2004. The total area planted with Chenin Blanc in 2004 was 19 148 hectares. As seen in Figure 4.5 and 4.6, Chenin Blanc ranks in the first position in terms of the total area planted with white wine grape cultivars and on the overall total area under wine grape cultivars.

Colombar was the most planted wine grape cultivar in the Orange River (55%), Little Karoo (26.7%) and Robertson (16.3%). It was the second most in the Olifants River (21.2%) and Worcester (13.5%). Colombar showed constant growth since 1990 and a negative trend from 2001 - 2002. There was a decline in the total area under Colombar from 11 673 hectares in 1999 to 11 013 hectares in 2000 and an increase to 11 026 in 2003 and 11 258 hectares in 2004. New plantings of Colombar decreased from 624 hectares in 1997 to 378 hectares in 2003. However, in 2004 the new plantings increased to 496 hectares. Colombar ranked in the second position in terms of the total area planted with white wine grape cultivars and ranked the third in the total area planted in 2004. This is also shown in Figure 4.5 and 4.6.

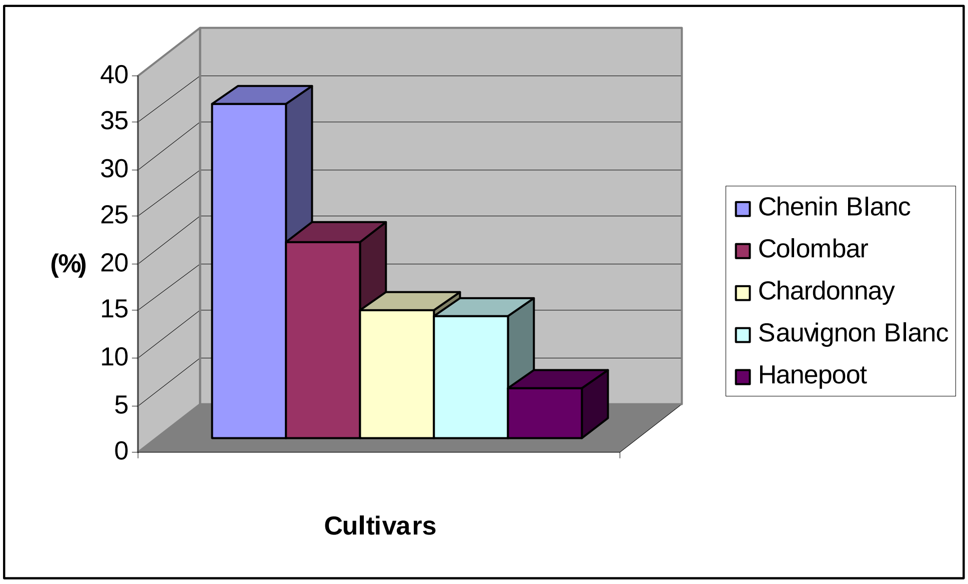

Figure 4.5: Percentage of total area planted with white wine grape cultivars, 2004
Source: Adapted from SAWIS, 2005

Chardonnay was the second most prevalent wine grape cultivar in Robertson (14.3%), the third most in Worcester (8.3 %) and the fourth most in the Little Karoo (7.7%). From 1986 (379 hectares) to 2000 (6 067 hectares) however, there was an annual increase in the total planting of Chardonnay due to new plantings and little or no uprooting. The total area planted with Chardonnay in 2004 was 7 283.1 hectares. In 2004, Chardonnay ranked third in terms of total area planted with white wine grape cultivars while it ranked fifth in the total area (refer to Figure 4.5 and 4.6).

Sauvignon Blanc was the second most wine grape cultivar planted in Stellenbosch (13.2%), and fifth most in Robertson (8.6%). From 1986 (2 619 hectares) to 2004 (6 944 hectares) there has been an annual growth in the total planting of Sauvignon Blanc, representing a 165 percent increase over this period. As shown in Figure 4.5 and 4.6, Sauvignon Blanc ranks fourth in terms of total area planted with white wine grape cultivars and seventh in terms of the total area planted.

Hanepoot was the third most planted wine grape cultivar in the Little Karoo (9.3%) and Orange River (6.8%). The total status of Hanepoot in 2004 was 2 825.1 hectares and it ranked in the fifth position in the area under white wine grape cultivars and tenth position in the total area planted, as seen in Figure 4.5 and 4.6.

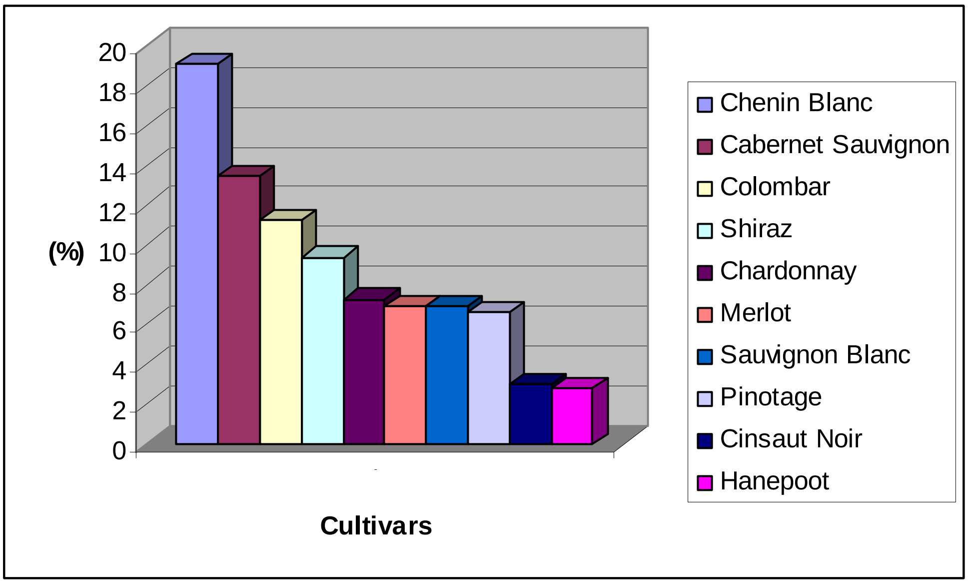

Figure 4.6: Percentage of total area planted with red and white cultivars, 2004
Source: Adapted from SAWIS, 2005

The patterns in total area planted showed that there were more white wine grape cultivars such as Sauvignon Blanc, Chenin Blanc, Colombar and Chardonnay planted in 2004 in comparison with the trend since 1999. Planting pattern of red wine grape cultivars such as Pinotage, Merlot and Cabernet Sauvignon decreased against previous years, but Cabernet Sauvignon remained under the top five planted wine grape cultivars. Shiraz showed an increase in plantings in 2004 compared to the previous year.

Appendix 8 shows the comparison on the percentage composition of selected wine grape cultivars planted in the regions under study. Although Chenin Blanc showed the highest percentage composition in 2004, comparing with 1997, its percentage composition declined in all the regions except in Orange River. The trend is also moving towards the cultivation of red cultivars with Cabernet Sauvignon showing a sharp increase in composition in all the regions except in Orange River.

4.8 AREA PLANTED AND AGE DISTRIBUTION OF VINEYARDS

The ending of the quota system in the early 1990s led to widespread changes in production. This included a shift toward wine grape cultivars for which global demand was increasing (SAWB, 2003). Thus the share of red wine production more than doubled between 1995 and 2003 (SAWIS, 2004). There was extensive new planting, concentrated on noble varieties including Cabernet Sauvignon, Shiraz, Merlot, Sauvignon Blanc and Chardonnay. The extent of these planting activities is illustrated by vineyard age per region in Appendix 9. In 2004, 55.4 percent of the vineyards were less than ten years old (SAWIS, 2005). These relatively young vineyards are relatively high in each region with Orange River (64 %) having the highest percentage of its area planted and Little Karoo (48.6%) having the smallest percentage of young vineyards.

Terroir considerations and particularly soil analysis played a major part in planting decisions and this was supported by widespread use of viticulture consultants, local research and technology transfer institutions. Changes in vineyard practices were also widespread as the focus shifted to improving wine grape quality and reducing the quantity of vineyard yields (Wood & Kaplan, 2004:3). Decrease in prices of wine grape cultivars after the removal of quotas also played a role in the shift from high quantity, low quality wine grape cultivars to low quantity high quality wine grape cultivars.

4.9 SUMMARY

The South African wine industry has experienced significant changes during the past decade. Deregulation of the industry and the lifting of sanctions exposed the industry to international markets, and initial experiences found the industry ill-prepared to cope with the complexities of international marketing, which necessitated a dramatic learning curve.

The deregulation of the industry also meant that wine grape producers were now able to plant the wine grape cultivars after price. This also enabled South Africa to take full advantage of the biodiversity that is a natural competitive advantage of the country. The international demand for red wines further necessitated a change in focus from producing low quality high yielding white grape cultivars to high quality red wine grape cultivars. Chenin Blanc is still the cultivar occupying the largest area planted. However, its status is decreasing each year and it is being replaced with noble cultivars such as Cabernet Sauvignon, Merlot, Shiraz, Pinotage, Chardonnay and Sauvignon Blanc.

The South African supply and value chain structure is highly fragmented. This fragmented value chain, the set ideas of some of the role-players and the international image of the industry demand strong leadership and focused actions if the industry wants to become more competitive internationally (Spies, 2000).

Chapter 5 contains the results from the questionnaire on the price forming mechanisms of co-operatives and also the analysis of results and discussion of the factors explaining the area newly planted and area uprooted for the selected wine grape cultivars in the wine regions.

CHAPTER FIVE

ANALYSIS OF PRODUCERS' CHOICE OF WINE GRAPE CULTIVARS

5.1 INTRODUCTION

A questionnaire was compiled to collect information on the price forming mechanisms of co-operatives. The results focus on a number of aspects as they appear on the questionnaire in Appendix 1 and were categorized according to the co-operative details and price forming mechanism.

Data from SAWIS was also analysed using ordinary least squares (OLS) to determine the factors that explain the area newly planted and area uprooted in each wine region and hence to identify the factors that determine the producers' choice of wine grape cultivars. This will be discussed in Section 5.5.

5.2 RESEARCH RESPONSE

Before discussing the results on co-operative details, it is necessary to comment on the number of respondents to the questionnaire. The number of co-operatives (respondents) which participated in the survey is indicated in Table 5.1.

Table 5.1: Research response

Total population of co-operatives (as per the list)[18]	72
Total number participated in the survey	46
Total response	22
Percentage responses as per total population (%)	30.6
Percentage response as per the number participated (%)	47.8

The aim was to interview the whole population. However, only 46 co-operatives gave their contacts hence becoming the number of co-operatives which participated in the survey. It is evident in Table 5.1 that of the 46 co-operatives which participated in the survey, only 22 provided their responses which represented 30.6 percent of the total population and 47.8 percent of the number of co-operatives which participated. Practical considerations did not make it feasible to try to increase the number of these responses. The responses per region are presented in Table 5.2.

[18] This is a list containing the names and telephone numbers of co-operatives obtained from SAWIS. Refer to Section 3.2.2.2.

Table 5.2: Response per SAWIS/KWV region

Region	Total no. of co-ops	Response	Percentage (%)
Little Karoo	7	2	9.1
Malmesbury	5	3	13.6
Olifants River	6	2	9.1
Orange River	9	2	9.1
Paarl	10	2	9.1
Robertson	12	3	13.6
Stellenbosch	2	2	9.1
Worcester	21	6	27.3
Total	**72**	**22**	**100**

It is apparent from Table 5.2 that the majority of responses were from Worcester region (27.3%) while responses from Little Karoo, Olifants River, Orange River, Paarl and Stellenbosch were 9.1 percent each. However, looking at the total number of co-operatives in each region, it is evident that responses from all the co-operatives in Stellenbosch region and more than half in Malmesbury region were received.

5.3 DESCRIPTION OF CO-OPERATIVES IN THE VARIOUS WINE REGIONS

The results on the co-operative details provided some background information about the nature the co-operatives (respondents). The co-operatives years of experience are presented in a grouped arrangement (20 years interval) as indicated in Figure 5.1. The majority of the co-operatives have been in operation for between 41-60 years. It is also evident that none of the co-operatives years of operation falls between 21-40 years. It can therefore be held that the majority of co-operatives that are in operation were established more than forty years ago.

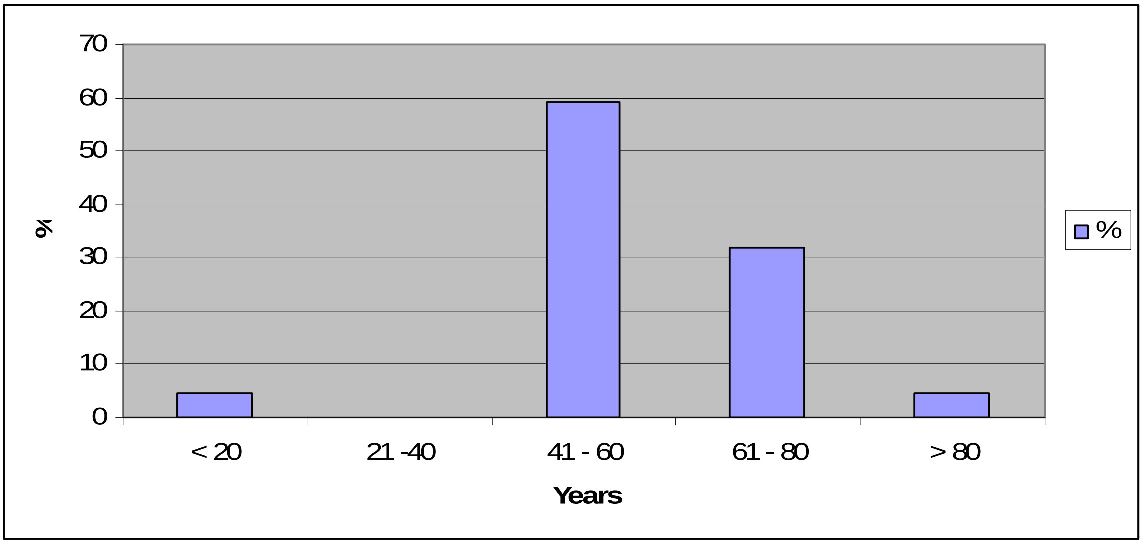

Figure 5.1: Co-operatives years of operation

The results on the nature of operation are as shown in Table 5.3. It is evident from Table 5.3 that 95.5 percent of the respondents are still operating as a co-operative. This information contributes to valuable findings on the nature of co-operatives' pricing mechanisms.

Table 5.3: Nature of operation of co-operatives

Nature of operation	**Percentage (%)**
As a co-operative	95.5
As a company	4.5
Total	**100**

In recent years however, it has been observed that co-operatives, while registered as such, operate in a manner similar to that of a company (Myburgh, 2005- personal communication). Similarly Martin (2001) in his study of 28 co-operative and former co-operative cellars showed that although they are registered as a co-operative, only five had retained their traditional co-operative structure. All others were in a process of transformation with regard to both their internal and their external organisation.

All the cooperatives indicated that they were registered with the 'Wine of Origin' scheme and on determining the year of registration the majority of these co-operatives (95.5%) indicated that they were registered since the start of the scheme. This was in 1973 which is 31 years ago and it can also be reflected from the co-operatives years of operation indicated in Figure 5.1.

With respect to the results on the co-operatives' present structure, majority of the respondents (95.5%) indicated that the co-operative were still operating individually while 4.5 percent indicated that they had merged with other co-operatives.

5.4 PRICE FORMING MECHANISM OF CO-OPERATIVES

This section provides the results on the price forming mechanism of co-operatives and pricing issues.

5.4.1 Final prices paid for wine grapes for the production year 2003/04

The results on the final prices paid for wine grapes in the production year 2003/04 for each region are presented in Figure 5.2 to Figure 5.9. The average price and standard deviation for each wine grape cultivar in each region are also presented. It is evident from these figures that all the co-operatives received the ten wine grape cultivars with the exception of Orange River region where Cinsaut grapes were not delivered to the two co-operatives and in Olifants River and Robertson where one co-operative in each region also indicated that Cinsaut grapes were not delivered to them.

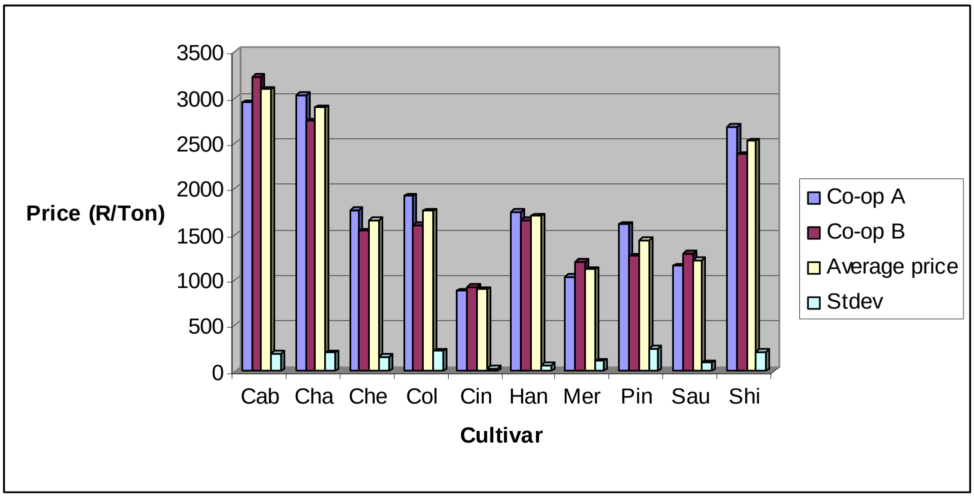

Figure 5.2: Final price paid by co-operatives in the Little Karoo region for the year 2003/04

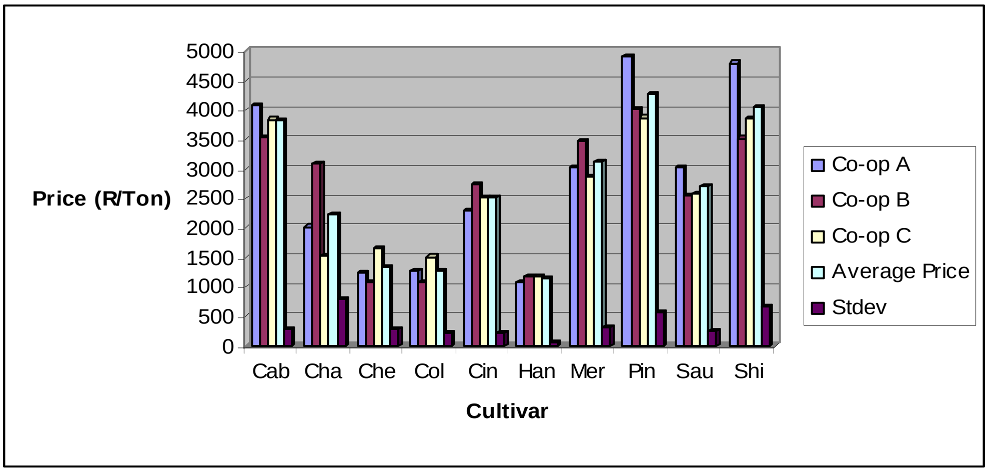

Figure 5.3: Final price paid by co-operatives in Malmesbury region for the year 2003/04

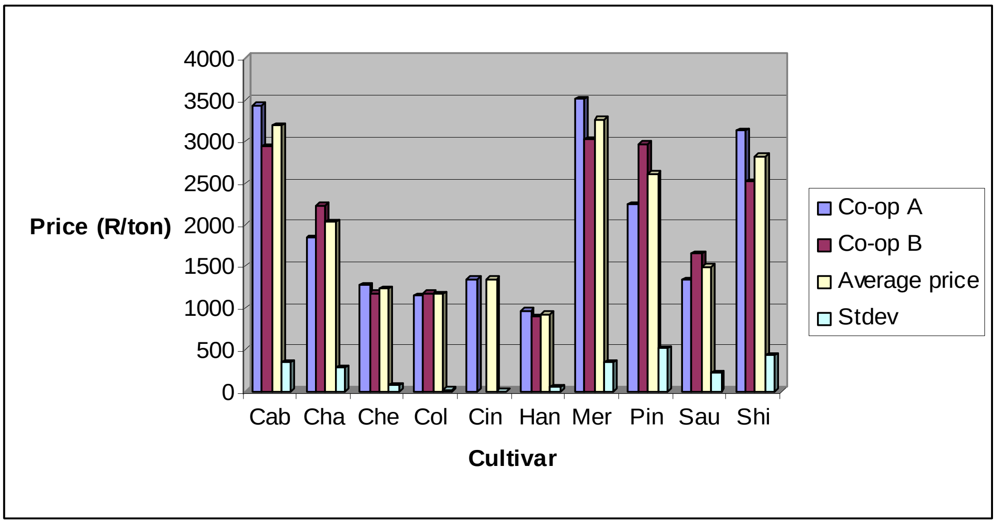

Figure 5.4: Final price paid by co-operatives in Olifants River region for the year 2003/04

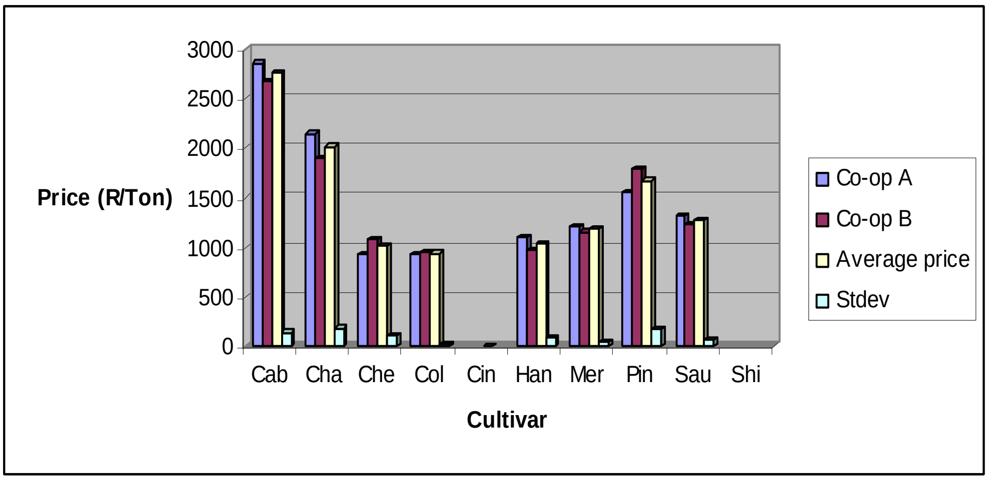

Figure 5.5: Final price paid by co-operatives in Orange River region for the year 2003/04

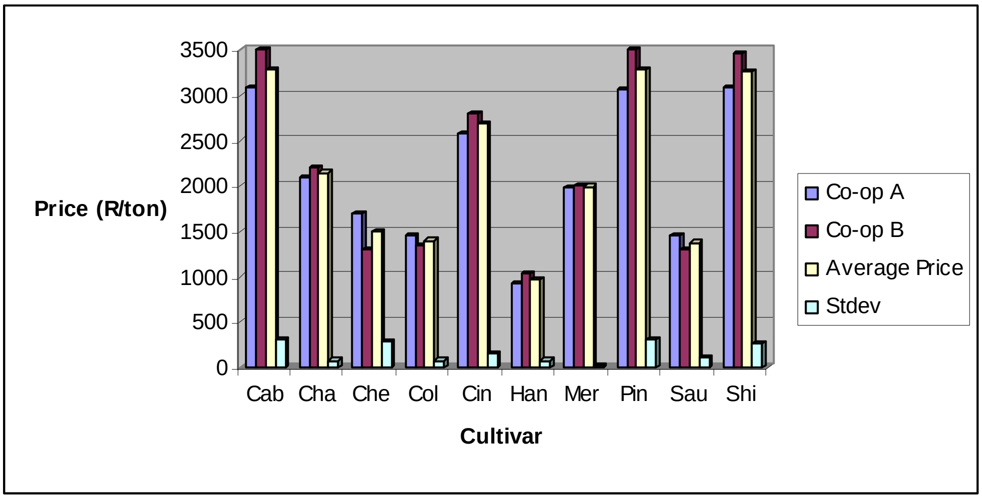

Figure 5.6: Final price paid by co-operatives in Paarl region for the year 2003/04

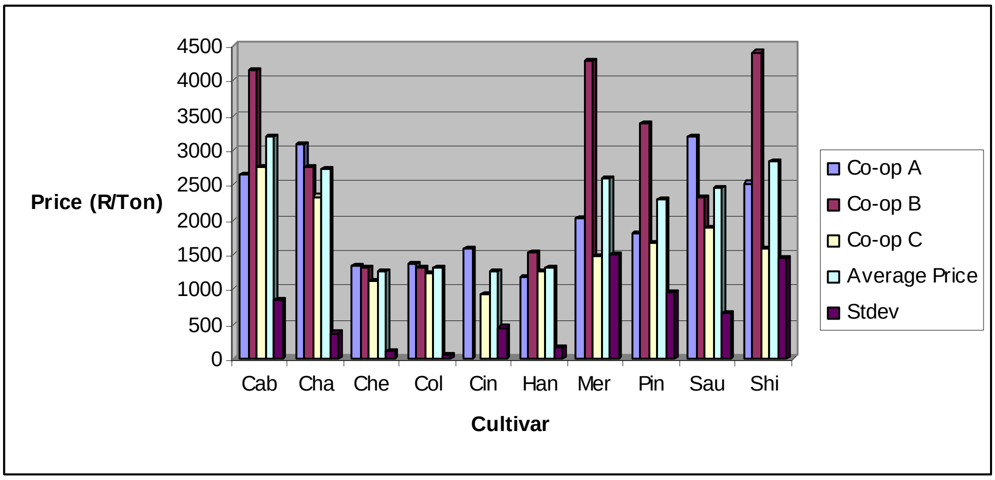

Figure 5.7: Final price paid by co-operatives in Robertson region for the year 2003/04

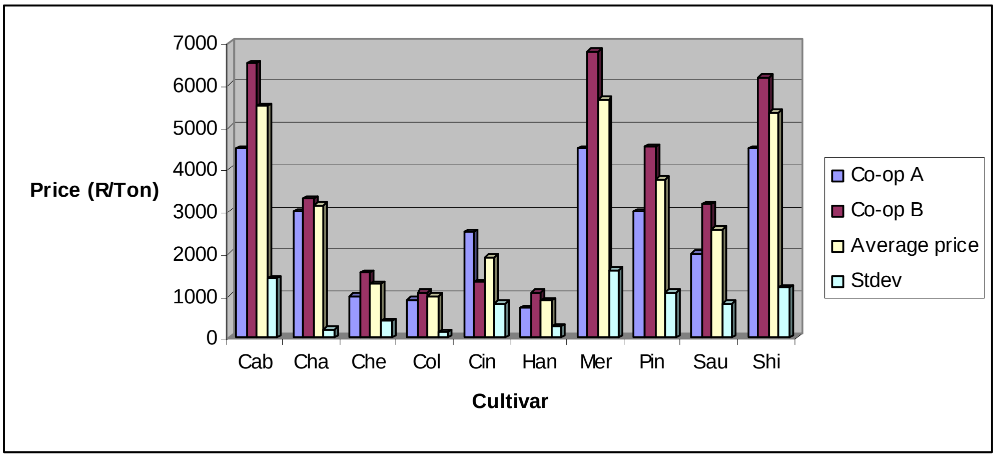

Figure 5.8: Final price paid by co-operatives in Stellenbosch region for the year 2003/04

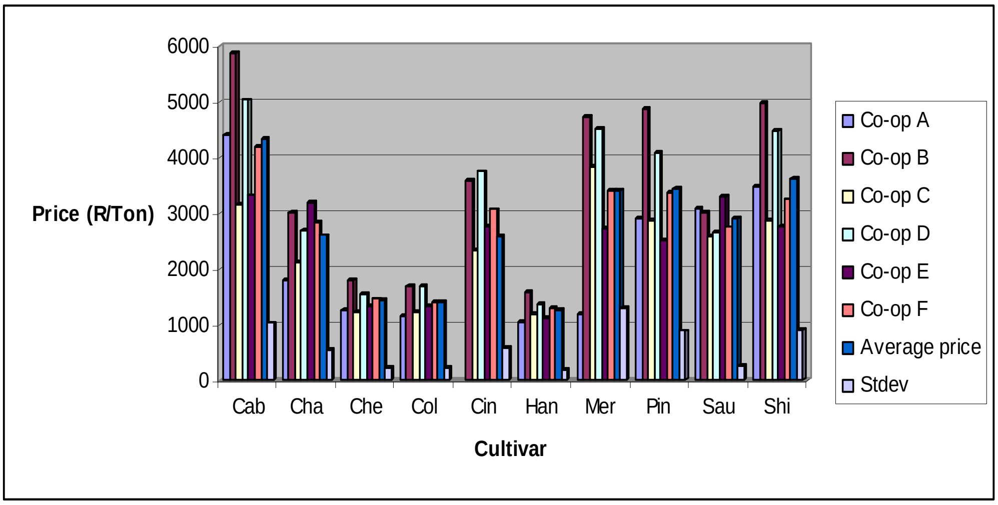

Figure 5.9: Final price paid by co-operatives in Worcester region for the year 2003/04

The most interesting results found were that those co-operatives in the same region offered different final prices for the various wine grape cultivars under study. This implies that there is no standard price for similar wine grapes from the co-operatives in the same region. This therefore indicates that co-operatives in the same region can influence the choice of a specific wine grape cultivar differently depending on the price offered.

It was also observed from the results that the price of Merlot is widely dispersed around the mean in Stellenbosch, Robertson and Worcester regions as indicated by the standard deviation values. Other wine grape cultivars with high standard deviations included Cabernet Sauvignon, Shiraz and Pinotage in Stellenbosch, Robertson and Worcester regions; Sauvignon Blanc in Stellenbocsh region and Chardonnay in Malmesbury region. All these wine grape cultivars with high standard deviations are noble cultivars.

5.4.2 Wine grapes received and processed

Table 5.4 indicates the percentage of wine grapes received and processed for the three year period namely 2002/03, 2003/04 and 2004/05. It is evident from the results that the majority of the wine co-operatives received and processed wine grapes within the range of 15 001 – 20 000 tons for each of the three periods.

Table 5.4: Percentage wine grapes received and processed by co-operatives for the period 2002/03 to 2004/05

Tons	2002/03 (%)	2003/04 (%)	2004/05 (%)
< 5000	0.00	0.00	0.00
5 001 -10 000	22.73	13.64	22.73
10 001 - 15 000	13.64	27.27	18.18
15 001 - 20 000	50.00	36.36	40.91
20 001 - 25 000	9.09	18.18	13.64
25 001 - 30 000	4.55	0.00	4.55
> 30 000	0.00	4.55	0.00
Total	**100**	**100**	**100**

None of the co-operatives received and processed less than 5 000 tons of wine grapes, while one co-operative received and processed more than 30 000 tons in 2003/04. According to published statistics by SAWIS (2002; 2003 & 2004) the majority of co-operatives crush more than 10 000 tons. The finding in this research shows that the majority of the co-operatives crush between 15 001 - 20 000 tons per year.

5.4.3 Factors considered in price formation

Table 5.5 shows response of the co-operatives on the factors considered in the price forming mechanism for the various wine grape cultivars. It is evident that most of the respondents strongly consider the predictable demand for a specific wine grape cultivar in their price formation with Cabernet Sauvignon indicating the highest response of 72.7 percent. The present price of other wine grape cultivars is not considered in price formation, with the exception of Hanepoot.

Table 5.5: Factors considered by co-operatives in the price formation process

Cultivar	Factor				
	Production cost wine grapes (%)	Present price of specific cultivar (%)	Present price of other grape cultivar(s) (%)	Predictable demand for that grape cultivar (%)	Present quantity for that specific cultivar (%)
Cabernet Sauv	45.5	31.8	0	72.7	50.0
Chardonnay	45.5	27.3	0	63.6	54.5
Chenin Blanc	50.0	27.3	0	68.2	54.5
Cinsaut	45.5	27.3	0	59.1	45.5
Colombar	54.5	31.8	0	68.2	50.0
Hanepoot	50.0	31.8	4.5	63.5	50.0
Merlot	45.5	31.8	0	59.1	50.0
Pinotage	45.5	31.8	0	59.1	54.5
Sauv. Blanc	45.5	27.8	0	63.6	59.1
Shiraz	45.5	31.8	0	59.1	54.5

From the results the most important factors that the co-operatives consider are the predictable demand for wine grape cultivar, quantity supplied for the specific wine grape cultivar, production cost and present price of a specific wine grape cultivar. The results also indicated that the present price of other wine grape cultivars does not play a significant role. Some co-operatives further mentioned quality as a factor which they considered. However, quality was used an important element only on some specific wine grape cultivars such as Cabernet Sauvignon, Chardonnay, Chenin Blanc, Sauvignon Blanc and Shiraz.

Some co-operatives went further and explained that the production cost used in their price formation is as per VINPRO figures. Other co-operatives explained that prices are determined as wine grapes are received. This implied that prices were determined by the quantity supplied of the specific wine grape cultivar. From the results it was found that the co-operatives determine price in the following manner: Initially a price is determined by considering the demand for the wine grape cultivar and quantity supplied for a specific wine grape cultivar. The price bracket for each cultivar is then determined. Finally the production cost of wine grapes is subtracted from the price bracket obtained and the difference becomes the price paid or offered to wine grape producers for each wine grape cultivar.

5.4.4 Communication of next season's wine grape prices

Table 5.6 shows the percentage of the responses on the time period when the wine grape prices for the next season and for the various wine grape cultivars are communicated to the producers. It is evident from Table 5.6 that for all the wine grape cultivars, 77.3 percent of the respondents indicated that they communicate the next season's price after harvesting, 13.6 percent before harvesting and 9.1 percent either before or after harvesting. None of the respondents communicated the next season's wine grape prices to farmers during harvesting. The price communicated after harvesting would probably reflect the true next seasons wine grape prices since it is based on the actual wine grapes produced in a specific season.

One interesting finding on this question was that all the co-operatives have consistent policy with regard to the time of communicating next season's wine grape prices to producers for all the wine grape cultivars.

Table 5.6: Time period for communicating next season's wine grape prices to producers

	Time period			
Cultivar	**Before harvesting (%)**	**During harvesting (%)**	**After harvesting (%)**	**Both before and after harvesting (%)**
Cabernet Sauvignon	13.6	0	77.3	9.1
Chardonnay	13.6	0	77.3	9.1
Chenin Blanc	13.6	0	77.3	9.1
Cinsaut	13.6	0	77.3	9.1
Colombar	13.6	0	77.3	9.1
Hanepoot	13.6	0	77.3	9.1
Merlot	13.6	0	77.3	9.1
Pinotage	13.6	0	77.3	9.1
Sauvignon Blanc	13.6	0	77.3	9.1
Shiraz	13.6	0	77.3	9.1

The form of these prices (whether preliminary or final) for the time periods when co-operatives communicate the wine grape prices are presented in Table 5.7.

Table 5.7: Form of the price communicated by co-operatives to producers

Time period	Form of the price	
	Preliminary (%)	Final (%)
Before harvesting	13.6	0
During harvesting	0	0
After harvesting	77.3	0
Before and after harvesting	9.1	0

From Table 5.7 it is evident that 77.3 percent of the respondents communicate a preliminary price for the next season after harvesting, while 9.1 percent indicated that they provide both a preliminary price before harvesting and a final price after harvesting. 13.6 percent of respondents indicated that they communicate the preliminary price before harvesting.

Though the time period of communicating the next season wine grape price is important, its form at the time of communication is more significant. From the results the majority of respondents indicated that they communicated a preliminary price after harvesting.

5.4.5 Mode of communicating grape price

This was an open ended question in the questionnaire and the findings here indicated that there were several ways in which the co-operatives communicate the wine grape prices to producers. These included visits and contracts, meetings and budgets with farmers, letters, faxing and e-mailing, vineyard study groups and printing lists for each wine grape cultivar. Most of the respondents indicated that they use more than one of these channels to communicate the wine grape prices. However, from the responses the majority indicated that they communicate through meetings with farmers and via letters. The regularity of the meetings was not indicated. One of the respondent further indicated that during the meetings they communicate the supply and demand trends in the industry as well as the price brackets which are available.

5.5 VARIABLES EXPLAINING THE AREA NEWLY PLANTED AND AREA UPROOTED IN EACH WINE REGION

This section provides a description of the variables explaining the area newly planted and area uprooted based on the data from SAWIS and equations provided in Section 3.3.2 for each wine grape cultivar in each region. Since the number of independent variables were greater than the number of observations, it was not possible to run the regression with all the independent variables at once. According to Myers (1986) and Miller (1990) there are numerous methods for selecting a subset of predictor variables in regression. The ones that were used were forward stepwise regression as applied in STATISTICA, rejecting variables that were not statistically significant at a five percent level of significance and STATISTICA's All Subsets Regression using R squared (R^2) , adjusted R squared (Adj. R^2) and Mallows' Cp-criterion. EVIEWS was then used to run the regression for the selected predictors. An attempt was made to use relative prices (price ratios) rather than real prices as the independent variables. However the results using the relative prices were no better than using the real prices.

The equations were fitted and analysed for various lag periods (1, 2, 3 & 4). However, due to the limited number of observations, there was a danger of loss of degrees of freedom. Therefore the independent variables lagged by one period were used. The presence of multicollinearity among variables for all the equations based on the selected predictors was measured. The possibility of the presence of multicollinearity was however minimized because of dropping the variables which were not statistically significant by means of the stepwise regression. Further, autocorrelation among the residuals was also considered. This is because in regressions involving time series data the successive observations are likely to be interdependent. The Durbin-Watson statistic (*d*) was used as a measure to detect the presence of autocorrelation. This is because the *d* statistic is based on estimated residuals which are routinely computed in regression analysis. If there is autocorrelation the ordinary least square estimates are no longer efficient and as a result the usual t and F tests of significance are no longer valid and if applied they are likely to give seriously misleading conclusions about the significance of the estimated regression coefficients. The results for each of the wine regions are presented in the next sections.

5.5.1 Little Karoo

The regression results in the Little Karoo region on the factors affecting the area newly planted and area uprooted for each wine grape cultivar are presented in Table 5.8. It is evident that the R^2 for the various equations in the region ranges from 0.47 to 0.92 percent. The factors explaining the area newly planted with Chardonnay (ANPCHA) are real prices of Chardonnay and Hanepoot lagged one period. The area uprooted with Chardonnay (AUCHA) is only explained by dummy variable D2 which shows a positive effect on the area uprooted with Chardonnay.

Table 5.8: Results of Area Newly Planted and Area Uprooted for wine various grape cultivars, Little Karoo

Dependent variables	**ANPCHA**		**AUCHA**		**ANPCHE**		**AUCHE**		**ANPCOL**		**AUCOL**		**ANPHAN**		**A**
Predictors	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coe
Intercept	0.09	0.02	0.73	2.93	20.36	4.16	20.99	2.65	71.45	6.19	-2.09	-0.37	24.18	5.31	9.8
$RPCHA_{t-1}$	-0.13	-3.27													
$RPCOL_{t-1}$					0.09	4.00									
$RPHAN_{t-1}$	0.05	4.51			-0.07	0.02	-0.04	-3.31							
$RPAPR_{t-1}$					-0.002	-3.08									
$RPPEC_{t-1}$															-0.0
$RPPLU_{t-1}$							0.009	8.00	-0.007	-3.13	0.005	4.73			0.0
D2			1.9	4.26											
$APHAN_{t-1}$													-0.03	-4.11	
R^2	0.68		0.62		0.67		0.87		0.47		0.67		0.61		
Adj R^2	0.61		0.59		0.56		0.84		0.42		0.64		0.57		
F	10.57		18.18		6.01		33.02		9.82		22.34		16.85		
d	1.81		2.06		3.16		3.04		1.12		2.24		2.46		

Based on economic theory, it is expected that producers would respond positively, in terms of the area newly planted with a specific grape cultivar, to an increase in the price of the specific grape cultivar, and negatively with an increase in the price of other grape cultivars and competitive products. Conversely, producers would respond negatively in terms of the area uprooted to an increase in the price of the specific grape cultivar and positively with an increase in the price of other grape cultivars and competitive products. The coefficient signs for lagged real prices of Chardonnay and Hanepoot in the ANPCHA equation are not as predicted by theory. One of the suggestions for this disparity can be obtained from the findings of the questionnaire in Section 5.4.1. Since the co-operatives in the same region offer different prices for the same wine grape cultivar, this may affect the producers' response on the choice of wine grape cultivars. However, the lagged real price of Chardonnay appears to have a larger effect on the ANPCHA than the real price of Hanepoot.

The area newly planted with Chenin Blanc (ANPCHE) is explained by real prices of Colombar, Hanepoot and apricots while the area uprooted with Chenin Blanc (AUCHE) is explained by real price of Hanepoot. It is, however, noticeable that the coefficient sign for real price of Colombar in the ANPCHE equation and real price of Hanepoot in the AUCHE equation are not as predicted by theory. The real price of plums appears to explain both the area newly planted and area uprooted with Colombar (ANPCOL & AUCOL). The coefficient sign in both equations is also as predicted in theory. The area newly planted with Hanepoot (ANPHAN) is explained by the area planted with Hanepoot lagged one period. This implies that an increase in the area planted[19] with Hanepoot in the previous year leads to a decrease in area newly planted with Hanepoot in the current year. The area uprooted with Hanepoot (AUHAN) on the other hand is explained by the real price of peaches and the real price of plums. However the coefficient sign for the real price of peaches is not as predicted by theory. Plums seem to be the competitive product determining the choice of Chenin Blanc, Colombar and Hanepoot in this region.

The Durbin-Watson statistics for the equations indicate that there is no autocorrelation except for ANPCHE, AUCHE and ANPCOL which do not allow a decision to be made regarding the presence of autocorrelation among the residuals. However, when using the modified *d* test, the result shows that there is statistically significant evidence of negative autocorrelation for ANPCHE and AUCHE and a positive autocorrelation for ANPCOL. It therefore becomes

[19] Note that area planted is as defined in Chapter 1.

difficult to rely on the conclusions from these equations for forecasting even though the t and F tests are statistically significant. It can be held from the results that the factors that determine the producers' choice of each wine grape cultivar in the Little Karoo region are as summarized in Table 5.9.

Table 5.9: Determinants of producers' choice of wine grape cultivars, Little Karoo

Cultivar	Determinants
Chardonnay	Lagged prices of Chardonnay and Hanepoot
Chenin Blanc	Lagged prices of Hanepoot, Colombar, apricots and plums
Colombar	Lagged price of plums
Hanepoot	Lagged prices of peaches, plums and area planted with Hanepoot

Price lagged one period for Hanepoot is the variable that influences the producers' choice of both Chardonnay and Chenin Blanc. Hanepoot is the third most important cultivar in terms of the total area planted in Little Karoo after Colombar and Chenin Blanc (SAWIS, 2005). Other wine grape cultivars, especially the noble cultivars such as Merlot, Shiraz, Cabernet Sauvignon and Pinotage have recently been introduced in the region. However, since the data for these wine grape cultivars were not available as from the start of the period under analysis in this study, they were not included in the regression equation.

5.5.2 Malmesbury

The results for Malmesbury region are presented in Table 5.10 (a) and 5.10 (b). It can be seen from Table 5.10 (a) that the variables explaining the area newly planted with Cabernet Sauvignon (ANPCAB) are lagged real prices of Pinotage and Sauvignon Blanc while the area uprooted with Cabernet Sauvignon (AUCAB) is explained by lagged real prices of Sauvignon Blanc and apricots. Real price of Sauvignon Blanc has a relatively larger effect on the ANPCAB than the real price of Pinotage. It can also realised that the real price of Pinotage in ANPCAB equation and real price of Sauvignon Blanc in AUCAB are not as predicted by theory. The same reason as given in Section 5.4.1 may be advanced.

The dummy variable D3 seems to be the only variable that explains the ANPCHA. The dummy variable was defined as 1 for the period 1999-2002 and zero otherwise. The negative coefficient sign suggests that the weakening of the rand in 2000/01 influenced negatively on the ANPCHA. The AUCHA, on the other hand, is influenced by lagged real prices of Colombar, and peaches and the simple time variable TIME. The coefficient signs are as expected by theory and the real price of Colombar relatively seems to have a larger effect on the AUCHA than the real price of peaches. The negative TIME coefficient implies that, with the increase in technology, the AUCHA is decreasing by 2.91 hectares every year.

There was no variable that was statistically significant at five percent significant level for the area newly planted with Chenin Blanc (ANPCHE) in this region. The area uprooted with Chenin Blanc (AUCHE) however, is explained by lagged real price of plums and area planted with Chenin Blanc in the previous year. An increase in the area planted with Chenin Blanc in the previous year by one hectare, therefore, explains an increase in area uprooted with Chenin Blanc of 0.17 hectares.

Similarly, there was no variable that was statistically significant at five percent level of significance for the area newly planted with Cinsaut (ANPCIN). The area uprooted with Cinsaut (AUCIN) is, however, influenced by lagged real prices of Chardonnay and plums. The coefficient sign for real price of Chardonnay is not as predicted by theory and similar findings from the results on the questionnaire in Section 5.4.1 may be provided as explanation. The negative sign of the quadratic time variable TIME2 in the ANPCOL equation implies that the area newly planted with Colombar in Malmesbury region is decreasing at a rate of 0.13 hectares per year. The AUCOL on the other hand is influenced by lagged real prices of Sauvignon Blanc and apricots.

It is evident from Table 5.10 (b) that the factors explaining the area newly planted with Merlot (ANPMER) are the lagged real prices of Merlot and pears while the factors influencing the area uprooted with Merlot (AUMER) are lagged real prices of Cabernet Sauvignon and apricots. The real price of Cabernet Sauvignon in AUMER equation is not as predicted by theory.

The factors explaining the area newly planted with Pinotage (ANPPIN) as indicated in Table 5.10 (b) includes lagged real prices of Colombar, apples, pears and price of inputs. The real price of Colombar seems to have a greater impact on the ANPMER than the real prices of apples and pears. It is however realised that the coefficient signs for these variables are not consistent with *a priori* expectations. Similar suggestion as found in Section 5.4.1 may be given as an explanation.

Table 5.10 (a): Results of Area Newly Planted and Area Uprooted for various wine grape cultivars, Malmesbury

Dependent variables	**ANPCAB**		**AUCAB**		**ANPCHA**		**AUCHA**		**AUCHE**		**AUCIN**		**ANPCOL**		**A**
Predictors	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coef
Intercept	58.37	1.91	4.25	1.83	65.49	6.74	11.97	-4.28	915.9	-2.29	36.89	4.10	20.37	11.71	-4.61
$RPPIN_{t-1}$	0.12	4.53													
$RPSAU_{t-1}$	-0.14	-2.59	-0.007	-3.17											-0.03
$RPAPR_{t-1}$			0.002	4.07											0.01
D3					-49.2	-2.7									
$RPCOL_{t-1}$							0.019	4.59							
$RPPEC_{t-1}$							0.004	3.77							
TIME							-2.91	1.03							
$RPPLU_{t-1}$									0.06	4.79	0.009	4.61			
$APCHE_{t-1}$									0.17	2.38					
$RPCHA_{t-1}$											-0.02	-3.45			
TIME2													-0.13	-5.92	
R^2	0.83		0.62		0.37		0.88		0.77		0.69		0.74		
Adj R^2	0.79		0.55		0.32		0.82		0.72		0.62		0.72		
F	24.49		8.39		7.31		19.70		16.81		11.21		35.05		
d	1.45		2.66		1.33		2.19		2.03		1.97		1.80		

Table 5.10 (b): Results of Area Newly Planted and Area Uprooted for various wine grape cultivars, Malmesbury

Dependent variables	ANPMER		AUMER		ANPPIN		AUPIN		ANPSAU		ANPSHI		AUSHI	
Predators	Coeff	t-value	Coeff	t-value	Coeff	t-value	coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value
Intercept	40.7	4.34	-2.75	-3.62	519.4	18.22	-5.96	-1.22	15.58	1.98	-41.4	-1.32	-6.19	-4.19
$RPMER_{t-1}$	0.04	10.65												
$RPPER_{t-1}$	-0.04	-5.73												
$RPCAB_{t-1}$			-0.002	-6.9										
$RPPAPR_{t-1}$			0.002	9.65			0.004	4.74						
$RPCOL_{t-1}$					0.32	15.29					0.14	3.58		
$RPAPP_{t-1}$					0.03	2.69								
$RPPER_{t-1}$					0.08	5.14								
$PIFR_{t-1}$					-17.2	-18.18								
D3					-67.3	-3.58					203.8	7.42		
TIME					75.37	6.18								
D4							15.87	2.52						
$RPSAU_{t-1}$									0.02	3.61				
$RPSHI_{t-1}$													-0.003	-3.81
$RPPEC_{t-1}$													0.004	6.55
R^2	0.93		0.9		0.99		0.81		0.54		0.87		0.88	
Adj R^2	0.91		0.89		0.98		0.78		0.50		0.85		0.85	
F	64.87		50.36		140.82		22.59		13.06		33.74		36.23	
d	3.19		2.24		2.53		1.82		2.68		1.75		2.50	

The dummy variable D3 influenced the ANPPIN negatively. The simple time frame on the other hand implies that with improvement in technology, the ANPPIN increases by 75.37 hectares per year. The area uprooted with Pinotage (AUPIN) is influenced by lagged real price of apricots. The dummy variable D4 defined as 1 for the period 1998-2000 also explains an increase in AUPIN. The only factor explaining the area newly planted with Sauvignon Blanc (APSAU) is lagged real price of Sauvignon Blanc. There was no variable that was statistically significant at five percent significant level for the area uprooted with Sauvignon Blanc (ANPCIN). The area newly planted with Shiraz (ANPSHI) is explained by the real price of Colombar. However, the coefficient sign is not as predicted by theory. The Dummy variable D3 positively influenced the ANPSHI. The area uprooted with Shiraz on the other hand is explained by real price of Shiraz and real price of peaches.

The Durbin-Watson statistics for ANPCAB, AUCAB and AUCOL equations in Table 5.10 (a) and ANPMER and AUMER equations in Table 5.10 (b) do not allow for a decision to be made regarding the presence of autocorrelation among the residuals. But when the modified *d* test is applied, the results show that there is statistically significant evidence of negative autocorrelation. This implies that the conclusions of the results in these equations cannot be relied on for forecasting. Based on these results the determinants of producers' choice of wine grape cultivars in Malmesbury are summarized in Table 5.11.

Table 5.11: Determinants of producers' choice of wine grape cultivars, Malmesbury

Cultivar	Determinants
Cabernet Sauvignon	Lagged prices of Cabernet Sauvignon, Sauvignon Blanc and apricots
Chardonnay	Lagged prices of Colombar, peaches and technology (TIME)
Chenin Blanc	Lagged price of plums and area planted with Chenin Blanc
Cinsaut	Lagged prices of plums and Chardonnay
Colombar	Lagged prices of Sauvignon Blanc, apricots and Technology (TIME2)
Merlot	Lagged prices of Merlot, pears, Cabernet Sauvignon and apricots
Pinotage	Lagged prices of Colombar, apples, pears, apricots, price of inputs and technology
Sauvignon Blanc	Lagged price of Sauvignon Blanc
Shiraz	Lagged prices of Colombar, Shiraz and peaches

5.5.3 Olifants River

From Table 5.12 it is evident that the factors explaining the AUCHA are real price of Chenin Blanc and area planted with Chardonnay in the previous year. The ANPCHE is explained by real prices of Chardonnay and Merlot while the AUCOL is influenced by real price of Shiraz.

Table 5.12: Results of Area Newly Planted and Area Uprooted for various wine grape cultivars, Olifants River

Dependent variables	AUCHA		ANPCHE		AUCOL		ANPMER		AUMER		ANPPIN		AUPIN		A
Predictors	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coef
Intercept	7.79	1.79	128.52	10.99	24.04	5.01	11.65	1.18	-0.20	-0.16	19.17	2.06	2.52	1.90	12.6
$RPCHE_{t-1}$	-0.04	-3.24													
$APCHA_{t-1}$	0.08	5.37													
$RPCHA_{t-1}$			0.05	2.44											
$RPMER_{t-1}$			-0.05	-4.75											
$RPSHI_{t-1}$					0.02	3.78									
TIME					-3.85	-2.47									
D5							98.57	5.32			79.52	4.57			203.1
$APMER_{t-1}$									0.01	3.15					
$RPSHI_{t-1}$													0.005	3.82	
$RPSAU_{t-1}$													-0.008	-2.82	
R^2	0.78		0.83		0.69		0.70		0.47		0.63		0.65		
Adj R^2	0.73		0.79		0.63		0.68		0.43		0.6		0.58		
F	17.46		24.29		11.11		28.26		3.44		20.89		9.34		
d	3.38		1.90		2.61		1.69		9.89		0.85		2.41		

There was no variable that was statistically significant at five percent significant level for the ANPCHA, AUCHE and ANPCOL equations. The coefficient of TIME variable in the AUCOL equation implies that technological change explains a decrease in AUCOL by 3.85 hectares per year.

The dummy variable D5 seems to have positively influenced the ANPMER. The dummy variable was defined as 1 for the period 1998-2001 and zero otherwise. This implies that the conversion of KWV and the weakening of rand in 2000/01 explain an increase in ANPMER by 98.57 hectares. The AUMER on the other hand is only influenced by the area planted with Merlot in the previous year.

Similarly the ANPPIN and ANPSHI were also positively influenced by the dummy variable D5. However, the dummy variable had a larger effect on ANSHI than on the ANPMER and the ANPPIN. The AUPIN and AUSHI are also explained by real prices of Shiraz and Sauvignon Blanc. Du Plessis (2001) identifies technology and greater awareness of quality from vine to bottle as factors that have significantly resulted in the improvement seen in this region. However, from the results obtained, the only wine grape cultivar that is explained by technology (TIME) is Colombar. There were no variables that were statistically significant at five percent level of significance for ANPCHA, AUCHE, ANPCOL, ANPHAN, AUHAN, ANPSAU and AUSAU.

The signs of the estimated coefficients are consistent with *a priori* expectations except for lagged real prices of Chenin Blanc ($RPCHE_{t-1}$) in AUCHA, Chardonnay ($RPCHA_{t-1}$) in ANPCHE and Sauvignon Blanc ($RPSAU_{t-1}$) in AUPIN. Similar suggestion as found in Section 5.4.1 can be provided as explanation.

The Durbin-Watson statistics in AUCHA, AUCOL, ANPPIN and AUSHI equations provide indecisive situations in predicting the presence of autocorrelation among the residuals. However, when using the modified *d* test, the results show that there is statistically significant evidence of negative autocorrelation implying that the conclusions may not be reliable for forecasting. The factors determining the producers' choice of wine grape cultivars in Olifants River based on the results obtained are summarized in Table 5.13.

Table 5.13: Determinants of producers' choice of wine grape cultivars, Olifants River

Cultivar	Determinants
Chardonnay	Lagged price of Chenin Blanc and area planted with Chardonnay
Chenin Blanc	Lagged prices of Chardonnay and Merlot
Colombar	Lagged price of Shiraz and technology (TIME)
Merlot	Area planted with Merlot
Pinotage	Lagged prices of Shiraz and Sauvignon Blanc
Shiraz	Lagged prices of Shiraz and Sauvignon Blanc

5.5.4 Orange River

The results for Orange River are as shown in Table 5.14. It is clear from the results that the variable explaining ANPCHE is the lagged real price of Chenin Blanc while the AUCHE is explained by lagged real prices of Chenin Blanc, table grapes and quadratic time variable TIME2. SAWIS (2004) reported that there has been a major decrease in the acreage of Chenin Blanc in Orange River. The negative sign in the TIME2 variable coefficient implies that the increase in area uprooted with Chenin Blanc is increasing at a decreasing rate of 0.86 per annum. The dummy variable D8 which was defined as 1 for the period 2000-2001 and zero otherwise implies that the weakening of rand in 2000/01 explains a decrease in AUCHE.

Table 5.14: Results of Area Newly Planted and Area Uprooted for various wine grape cultivars, Orange River

Dependent variables	ANPCHE		AUCHE		ANPCOL		AUCOL		ANPHAN	
Predictors	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value
Intercept	-8.01	-0.31	-53.59	-4.66	-66.8	-0.87	-27.5	-2.52	21.21	6.90
$RPCHE_{t-1}$	0.12	2.73	0.29	5.44						
$RPTGR_{t-1}$			-0.05	-4.99						
D8			-45.85	-5.58						
TIME2			-0.86	-3.84					-0.11	-2.84
$RPHAN_{t-1}$					0.41	3.04				
$APCOL_{t-1}$							0.04	6.89		
R^2	0.40		0.93		0.46		0.81		0.40	
Adj R^2	0.35		0.90		0.41		0.79		0.35	
F	7.44		29.62		9.26		47.43		8.07	
d	0.96		2.6		0.89		1.51		2.85	

The ANPCOL is explained by lagged real price of Hanepoot while AUCOL is explained by area planted with Colombar in the previous year. This implies that the area planted with Colombar in the previous year has a positive effect on the AUCOL. The negative coefficient sign of TIME2 variable in ANPHAN implies that, with improvements in technology the ANPHAN is decreasing at a rate 0.11 every year. There was no variable that was statistically significant at five percent significant level for the AUHAN.

The signs of estimated coefficients are also consistent with *a priori* expectations except for lagged real prices of Chenin Blanc and table grapes in ANPCHE and lagged real price of Hanepoot in ANPCOL. Similar suggestion as found in Section 5.4.1 can be provided as explanation. The Durbin-Watson statistic for all the equations except for AUCOL do not allow for a decision to be made regarding the presence of autocorrelation among the residuals. But when the modified *d* test is applied, the results show that there is statistically significant evidence of negative autocorrelation. This implies that the conclusions of the results in these equations cannot be relied on for forecasting. It is apparent from the results that the factors that determines the producers' choice of wine grape cultivars in Orange River are as summarized in Table 5.15.

Table 5.15: Determinants of producers' choice of wine grape cultivars, Orange River

Cultivar	Determinants
Chenin Blanc	Lagged price of Chenin Blanc, Table grapes and technology (TIME2)
Colombar	Lagged price of Hanepoot
Colombar	Area planted with Colombar
Hanepoot	Technology (TIME2)

5.5.5 Paarl

As presented in Table 5.16 (a) the results show that the variable explaining ANPCAB is the lagged price of apricots. The dummy variable D9 defined as 1 for the period 1999-2001 and zero otherwise seems to have negatively influenced the ANPCHA. The AUCHA on the other hand is explained by lagged real prices of Sauvignon Blanc and Shiraz. The lagged real prices of Shiraz, Pinotage and price of inputs (PIFR) seems to be the factors determining the ANPCHE while AUCHE is explained by real prices of Chenin Blanc and apricots. The ANPCOL is increasing at a decreasing rate of 0.34 per annum as indicated by the variable TIME2. It is also explained by lagged real prices of Shiraz and plums. The AUCOL on the other hand is explained by lagged real prices of apricots and peaches. There were no variables that were statistically significant at five percent significant level for the AUCAB, ANPCIN and AUCIN.

It is evident from Table 5.16 (b) that the ANPMER is explained by lagged real prices of Chardonnay, Merlot and price of inputs. Real price of Chardonnay has however, a larger effect than the price of Merlot. Lagged real price of plums explains the AUMER while AUPIN is explained by price of inputs. The variable TIME2 in AUSAU implies that the AUSAU is increasing at a rate of 1.09 per annum. The price of inputs also explains the AUSAU. Its effect however is larger on the ANPCHE than on the ANPMER, AUPIN and AUSAU. Lagged real prices of Chardonnay and apricots further explain the AUSAU. Finally, the ANPSHI is explained by lagged real price of apricots and the AUSHI has been increasing at a rate of 0.10 per annum as indicated by the variable TIME2. There were no variables that were statistically significant at five percent significant level for the ANPPIN and ANPSAU

Table 5.16 (a): Results of Area Newly Planted and Area Uprooted for various wine grape cultivars, Paarl

Dependent variables	ANPCAB		ANPCHA		AUCHA		ANPCHE		AUCHE		ANPCOL		AUCOL	
Predictors	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value
Intercept	-10.9	-0.23	70.55	9.55	6.27	2.02	-74.06	3.51	185.1	3.77	38.74	8.30	18.35	2.34
$RPAPR_{t-1}$	0.04	5.48												
D9			-49.39	-3.09										
$RPSAU_{t-1}$					-0.02	-2.67								
$RPSHI_{t-1}$					0.009	4.41	0.03	2.81			0.01	5.03		
$RPPIN_{t-1}$							-0.05	-4.85						
$PIFR_{t-1}$							2.56	6.59						
$RPCHE_{t-1}$									-0.19	-2.39				
$RPAPR_{t-1}$									0.04	3.89			0.01	4.26
$RPPLU_{t-1}$											-0.007	-3.94		
TIME2											-0.34	-2.89		
$RPPEC_{t-1}$													0.007	-2.58
R^2	0.73		0.44		0.79		0.91		0.61		0.86		0.71	
Adj R^2	0.71		0.4		0.75		0.88		0.53		0.81		0.66	
F	29.99		9.57		19.31		29.39		7.88		17.98		12.83	
d	1.38		1.56		2.65		3.13		2.03		1.73		2.09	

Table 5.16 (b): Results of Area Newly Planted and Area Uprooted for various wine grape cultivars, Paarl

Dependent variables	ANPMER		AUMER		AUPIN		AUSAU		ANPSHI		AUSHI	
Predictors	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value
Intercept	124.4	5.51	-1.50	-0.66	-4.75	-0.46	65.29	4.21	-60.6	-1.74	3.97	1.99
$RPCHA_{t-1}$	0.05	5.19					-0.007	-3.33				
$RPMER_{t-1}$	0.02	2.77										
$PIFR_{t-1}$	-2.04	-4.6			0.35	2.88	-0.96	-3.23				
$RPPLU_{t-1}$			0.002	4.68								
$RPAPR_{t-1}$							-0.01	-5.83	0.04	6.43		
TIME2							1.09	7.04			0.10	4.34
R^2	0.94		0.66		0.43		0.97		0.79		0.63	
Adj R^2	0.92		0.63		0.38		0.96		0.77		0.59	
F	44.64		21.9		8.31		86.27		41.38		18.81	
d	2.58		3.00		3.59		2.32		1.19		2.56	

The coefficient signs for the variables are also according to the expectations except for real prices of apricots for ANPCAB, Sauvignon Blanc for AUCHA, Shiraz and price of inputs for ANPCHE, Shiraz for ANPCOL, Chardonnay, apricots and price of inputs for AUSAU, Chardonnay for ANPMER and apricots for ANPSHI. The same reason as given in Section 5.4.1 may be pointed out.

The Durbin-Watson statistics for AUCHA, ANPCHE and ANPCOL equations in Table 5.16 (a) and that for ANPMER, AUMER, AUPIN and ANPSHI equations in Table 5.16 (b) do not allow a decision to be made on the presence of autocorrelation. When using the modified *d* test, the results however show that there is statistically significant evidence of negative autocorrelation implying that the results for these equations may not be reliable for forecasting. It can therefore be held that the factors that determine the producers' choice of wine grape cultivars in Paarl region are as summarized in Table 5.17.

Table 5.17: Determinants of producers' choice of wine grape cultivars, Paarl

Cultivar	Determinants
Cabernet Sauvignon	Lagged price of apricots
Chardonnay	Lagged prices of Sauvignon Blanc and Shiraz
Chenin Blanc	Lagged prices of Shiraz, Pinotage, Chenin Blanc, apricots and price of inputs
Colombar	Lagged prices of Shiraz, plums, apricots, peaches and technology (TIME2)
Merlot	Lagged prices of Chardonnay, Merlot, plums and price of inputs
Pinotage	Lagged price of inputs
Sauvignon Blanc	Lagged prices of Chardonnay, apricots, price of inputs and technology (TIME2)
Shiraz	Lagged price of apricots and technology (TIME2)

5.5.6 Robertson

The results of Robertson region as presented in Table 5.18 indicate that the dummy variable D11 explains the area newly planted for Cabernet Sauvignon (ANPCAB), Chardonnay (ANPCHA), Colombar (ANPCOL), and Shiraz (ANPSHI). This dummy variable was defined as 1 for the period 1998-2001 and zero otherwise. This implies that the conversion of KWV from a co-operative to a company in 1997 and weakening of rand in 2000/01 explains the increase in ANPCAB and ANPSHI and decrease in ANPCHA and ANPCOL.

One of the important findings is that the increase was for red wine grape cultivars with Shiraz having the largest increase while the decrease was for white wine grape cultivars with Chardonnay having the largest decrease in area newly planted. Similarly the dummy variable D12 had an influence on the AUCHA and AUCHE. The dummy was defined as 1 for the period 2000-2001 suggesting that the weakening of rand in 2000/01 explains the increase in AUCHA and AUCHE with Chenin Blanc having the largest area uprooted.

Table 5.18: Results of Area Newly Planted and Area Uprooted for various wine grape cultivars, Robertson

Dependent variables	**ANPCAB**		**ANPCHA**		**AUCHA**		**AUCHE**		**ANPCOL**		**AUCOL**		**ANPSAU**		**AU**
Predictors	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff
Intercept	12.17	0.81	138.8	5.79	5.89	2.59	113.8	9.57	120.9	11.29	19.73	1.22	-2.21	-0.14	-6.53
$RPSAU_{t-1}$	0.05	3.48													
D11	105.7	5.34	-94.61	-2.11					-38.5	-2.29					
D12					16.64	2.77	134.0	4.26							
$RPCAB_{t-1}$									-0.01	-3.68					
$RPPLU_{t-1}$											0.01	3.88			
$PIFR_{t-1}$													0.72	3.90	
$RPCHE_{t-1}$															0.06
TIME2															0.14
$RPSAU_{t-1}$															-0.03
$APSHI_{t-1}$															
R^2	0.89		0.27		0.39		0.60		0.78		0.58		0.58		
Adj R^2	0.87		0.21		0.34		0.57		0.73		0.54		0.54		
F	42.21		4.45		7.65		18.14		17.35		15.04		15.23		3
d	2.8		0.83		2.1		1.56		1.51		2.94		1.89		

The ANPCOL is also explained by lagged real price of Cabernet Sauvignon and the AUCOL is explained by lagged price of plums. The lagged price of inputs seems to be the variable explaining the ANPSAU while AUSAU is explained by lagged real prices of Chenin Blanc, Sauvignon Blanc and TIME2. The coefficient of TIME2 variable implies that the AUSAU is decreasing at a rate of 0.03 per annum. ANPSHI is further explained by area planted with Shiraz in the previous year while the lagged price of plums explains the AUSHI. There were no variables that were statistically significant at five percent significant level for the AUCAB and ANPCHE

It is expected from theory that an increase in the area planted with Shiraz in the previous year would have a negative effect in ANPSHI in the current year. However, this is not the case as can be seen in the results on the equation for ANPSHI. Similarly, the coefficient sign for the lagged real price for Sauvignon Blanc in ANPCAB and price of inputs in ANPSAU are not consistent with *a priori* expectations. Similar suggestions as pointed in Section 5.4.1 may be given.

Durbin-Watson statistic for ANPCAB, ANPCHA, ANPCOL, AUCOL and ANPSHI equations do not allow a decision to be made on the presence of autocorrelation among residuals. Conversely, when using the modified *d* test, the result shows that there is statistically significant evidence of negative autocorrelation. However, from the results it can be held that the factors determining the producers' choice of wine grape cultivars in Robertson region are as summarized in Table 5.19.

Table 5.19: Determinants of producers' choice of wine grape cultivars, Robertson

Cultivar	Determinants
Cabernet Sauvignon	Lagged price of Sauvignon Blanc
Colombar	Lagged prices of Cabernet Sauvignon and plums
Sauvignon Blanc	Lagged prices of Chenin Blanc, Sauvignon Blanc, price of inputs and technology (TIME2)
Shiraz	Lagged price of plums and area planted with Shiraz

5.5.7 Stellenbosch

The regression results for the Stellenbosch region are presented in Table 5.20 (a) and Table 5.20 (b). It is evident from Table 5.20 (a) that the ANPCAB is explained by lagged real price of Cabernet Sauvignon and TIME2. This implies that the ANPCAB is decreasing at a rate of 8.17 per annum. Lagged real price of plums explains the AUCAB.

Table 5.20 (a): Results of Area Newly Planted and Area Uprooted for various wine grape cultivars, Stellenbosch

Dependent variables	ANPCAB		AUCAB		ANPCHA		AUCHA		AUCHE		ANPCIN		AUCIN	
Predictors	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value
Intercept	125.2	3.68	37.68	2.76	215.9	7.29	2.28	0.84	-875.7	-2.23	12.48	5.14	60.79	8.58
$RPCAB_{t-1}$	0.24	5.26												
TIME2	-8.17	-4.37												
$RPPLU_{t-1}$			0.008	2.89					0.11	3.65				
$APCHA_{t-1}$					-0.16	-5.12								
$RPCHA_{t-1}$							-0.007	-2.79			-0.004	-3.36		
$RPSHI_{t-1}$							0.01	10.16						
$APCHE_{t-1}$									0.16	2.53				
$RPSAU_{t-1}$														
$RPCHE_{t-1}$													-0.04	-3.97
$APMER_{t-1}$														
TIME														
R^2	0.79		0.43		0.72		0.95		0.62		0.51		0.58	
Adj R^2	0.76		0.38		0.69		0.94		0.54		0.46		0.55	
F	19.99		8.35		30.44		98.87		8.14		11.31		15.76	
d	1.59		2.05		1.65		2.73		2.43		2.84		1.87	

It is also evident that an increase in the area planted with Chardonnay in the previous year by one hectare has a negative effect on ANPCHA. Lagged real prices of Chardonnay and Shiraz are the variables explaining the AUCHA while the AUCHE is explained by lagged real price of plums and area planted with Chenin Blanc. Lagged Real prices of Chardonnay and Chenin Blanc explain the ANPCIN and AUCIN respectively. Area planted with Merlot in the previous year explains both the ANPMER and AUMER. Lagged real prices of Shiraz and Merlot are also variables explaining ANPMER. However, the lagged price of Shiraz is not consistent with *a priori* expectations. There were no variables that were statistically significant at five percent significant level for ANPCHE.

It can be seen from Table 5.20 (b) that ANPPIN is explained by lagged real prices of Chenin Blanc, Cinsaut, Merlot and Colombar and apricots. The lagged prices of Cinsaut and Merlot have the same effect on the ANPPIN. AUPIN on the other hand is influenced by lagged real prices of Merlot and peaches. The variable explaining ANPSAU is lagged real price of plums while AUSAU is explained by lagged prices of Chenin Blanc, Chardonnay and Cinsaut. The price of inputs has a negative effect on the ANPSHI.

Table 5.20 (b): Results of Area Newly Planted and Area Uprooted for various wine grape cultivars, Stellenbosch

Dependent variables	ANPPIN		AUPIN		ANPSAU		AUSAU		ANPSHI		AUSHI	
Predictors	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value
Intercept	-49.7	-3.01	-23.92	-3.98	62.62	4.61	14.84	2.95	229.7	4.07	-13.3	2.42
$RPCHE_{t-1}$	0.32	9.64					-0.07	-5.79				
$RPCIN_{t-1}$	-0.03	-2.43										
$RPMER_{t-1}$	-0.03	-3.91	-0.009	-2.89								
$RPAPR_{t-1}$	0.01	3.02										
$RPPEC_{t-1}$			0.01	6.2								
$RPAPP_{t-1}$					0.009	2.33					0.009	3.57
$RPCHA_{t-1}$							0.01	3.69				
$RPCIN_{t-1}$							0.04	12.92				
$RPPIN_{t-1}$									0.1	7.63		
$PIFR_{t-1}$									-4.6	-4.28		
$APSHI_{t-1}$											0.02	3.62
R^2	0.93		0.92		0.33		0.97		0.90		0.96	
Adj R^2	0.89		0.91		0.27		0.96		0.88		0.95	
F	26.19		58.37		5.43		98.38		43.89		134.89	
d	1.79		2.16		2.18		2.09		1.74		1.74	

Lagged real price of Pinotage also explains the ANPSHI. Finally, the AUSHI is explained by lagged real price of apples and area planted with Shiraz in the previous year. The coefficient sign for the variables that are not consistent as predicted by theory in Table 5.20 (b) includes lagged real prices of Chenin Blanc and apricot in ANPPIN, Merlot in AUPIN, apples in ANPSAU, Chenin Blanc in AUSAU and Pinotage in ANPSHI equations.

It is only the Durbin-Watson statistic for AUCHA, ANPPIN and ANPMER equations which do not allow a decision to be made on the presence of autocorrelation among the residuals. However, when using the modified *d* test, the results show that there is statistically significant evidence of negative autocorrelation implying that the results may not be reliable for forecasting. The factors determining the producers' choice of wine grape cultivars in Stellenbosch region are summarized in Table 5.21.

Table 5.21: Determinants of producers' choice of wine grape cultivars, Stellenbosch

Cultivar	Determinants
Cabernet Sauvignon	Lagged prices of Cabernet Sauvignon, plums, and technology (TIME2)
Chardonnay	Lagged prices of Chardonnay, Shiraz and area planted with Chardonnay
Chenin Blanc	Lagged price of plums and area planted with Chenin Blanc
Cinsaut	Lagged prices of Chardonnay and Chenin Blanc
Merlot	Lagged prices of Shiraz, Sauvignon Blanc, technology (TIME) and area planted with Merlot
Pinotage	Lagged prices of Chenin Blanc, Cinsaut, Merlot, apricots and peaches
Sauvignon Blanc	Lagged prices of Chardonnay, Cinsaut and apples
Shiraz	Lagged prices of Pinotage, apples, price of inputs and area planted with Shiraz

5.5.8 Worcester

The results from regression for Worcester region are presented in Table 5.22 (a) and Table 5.22 (b). It can be seen that the dummy variable D16 influenced the ANPCHA in Table 5.22 (a) and ANPMER, ANPPIN and ANPSHI in Table 5.22 (b) respectively. The dummy was defined as 1 for the period 1998-2001 and zero otherwise. This implies that the conversion of KWV to a company and weakening of rand in 2000/01 had a negative effect on the ANPCHA and a positive effect on the ANPMER, ANPPIN and ANPSHI. Shiraz had the largest increase of 187.9 hectares. The reason for the dummy variable effect on many wine grape cultivars in Worcester region is probably the fact that the region is the largest and one of the most important wine-making areas in the country, producing close on 25 percent of South Africa's total volume of wine and spirits. Similarly it is the home of the world's largest brandy cellar, KWV, and Olof Berg Solera Cellar (Amazingwe, 2004).

Table 5.22 (a): Results of Area Newly Planted and Area Uprooted for various wine grape cultivars, Worcester

Dependent variables	**ANPCHA**		**AUCHA**		**ANPCHE**		**AUCHE**		**ANPCIN**		**AUCIN**		**ANPCOL**		**A**
Predictors	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff
Intercept	114.1	6.59	6.24	3.91	-417	-4.79	-359	1.65	8.58	0.67	3.79	0.14	181.00	7.64	14.08
D15	-68.3	-2.11													
$RPHAN_{t-1}$			-0.01	-3.19					0.04	2.23					
$RPPIN_{t-1}$			0.008	4.03											
$RPSHI_{t-1}$			-0.005	-2.71											
$PIFR_{t-1}$					11.44	6.57									
TIME2					-5.76	-6.93									
$RPPLU_{t-1}$							0.03	4.93							0.01
$APCHE_{t-1}$							0.09	2.33							
$APCIN_{t-1}$											0.06	2.35			
$RPAPR_{t-1}$													-0.01	-3.62	
R^2	0.27		0.81		0.83		0.76		0.31		0.33		0.54		
Adj R^2	0.21		0.75		0.8		0.71		0.25		0.27		0.5		
F	4.46		12.69		25.29		15.79		4.99		5.53		13.14		
d	1.28		2.13		2.01		2.76		2.17		1.92		1.80		

Table 5.22 (b): Results of Area Newly Planted and Area Uprooted for various wine grape cultivars, Worcester

Dependent variables	ANPHAN		AUHAN		ANPMER		AUMER		ANPPIN		AUPIN		ANPSHI		A
Predictors	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff	t-value	Coeff
Intercept	81.61	8.14	74.06	15.73	31.21	3.32	-2.09	-2.03	61.90	4.56	-4.76	-1.89	24.93	1.61	-5.09
TIME	-7.21	-5.49							19.87	5.59					
D2			46.34	4.56											
$RPCHA_{t-1}$					0.13	5.09									
$RPCOL_{t-1}$					-0.27	-4.18									
D1					109.5	12.54			139.9	9.08			187.9	6.49	
$RPPLU_{t-1}$							0.001	5.56	-0.04	-7.26	0.003	5.26			0.002
R^2	0.72		0.63		0.97		0.74		0.93		0.72		0.79		[illegible]
Adj R^2	0.69		0.6		0.96		0.71		0.91		0.69		0.76		[illegible]
F	30.18		20.77		101.50		30.90		39.99		27.65		42.22		[illegible]
d	1.57		1.53		2.43		2.82		2.49		2.69		2.63		[illegible]

The AUCHA is explained by lagged real prices of Hanepoot, Pinotage and Shiraz. The ANPCHE is decreasing at a rate of 5.76 per annum as indicated in the variable TIME2. Price of inputs also influences the ANPCHE. Lagged real price of plums influences the AUCHE and AUCOL in Table 5.22 (a) and AUMER, ANPPIN, AUPIN and AUSHI in Table 5.22 (b). Plums therefore seem to be the main competitive product influencing the producers' choice of the various cultivars. However, its influence is much more on the AUCHE. An increase in the area planted with Chenin Blanc in the previous year by one year leads to an increase in AUCHE by 0.09 hectares. Lagged price of Hanepoot, apricot and area planted with Cinsaut in the previous year explains the ANPCIN, ANPCOL and AUCIN respectively.

The TIME variable in ANPHAN and ANPPIN in Table 5.22 (b) indicates that with improvement in technology, the ANPHAN is decreasing by 7.21 hectares per annum while ANPPIN is increasing by 19.87 hectares per annum. The dummy variable D16 had an influence on ANPHAN. This was defined as 1 for the period 1998-2000 which could probably imply that the conversion of KWV to company explains an increase in AUHAN by 46.34 hectares. Lagged real prices of Chardonnay and Colombar are also variables explaining ANPMER.

The variables whose coefficient sign are not as predicted by theory in Table 5.22 (a) includes real price of Hanepoot and Shiraz in AUCHA, price of inputs in ANPCHE and real price of Hanepoot in ANPCIN equations and in Table 5.22 (b) it is the lagged real price of Chardonnay in ANPMER equation. Durbin-Watson statistic for ANPCHA and AUCHE equations in Table 5.22 (a) and that of AUMER, ANPIN, AUPIN and AUSHI equations in Table 5.22 (b) do not allow a decision to be made regarding the presence of autocorrelation among the residuals. However, when using the modified *d* test, the result shows that there is statistically significant evidence of negative autocorrelation. The determinants of producers' choice of wine grape cultivars are summarized in Table 5.23.

Table 5.23: Determinants of producers' choice of wine grape cultivars, Worcester

Cultivar	Determinants
Chardonnay	Lagged prices of Hanepoot, Pinotage and Shiraz
Chenin Blanc	Lagged price of plums, price of inputs, technology (TIME2) and area planted with Chenin Blanc
Cinsaut	Lagged price of Hanepoot and area planted with Cinsaut
Colombar	Lagged prices of plums and apricots
Hanepoot	Technology (TIME)
Merlot	Lagged prices of Chardonnay, Colombar and plums
Pinotage	Lagged price of plums and technology (TIME)
Shiraz	Lagged price plums

5.6 SUMMARY

Chapter 5 describes the results of both the questionnaire administered to co-operatives and of the analysis for determining the variables explaining the area newly planted and area uprooted for each wine grape cultivar in each wine region. Results of the questionnaire are comprehensively presented and are summarised as research findings. Statistical results have also been presented in the preceding tables and a discussion on each result for each region was provided. A summary of the determinants of producers' choice of wine grape cultivars for each cultivar in each region was also provided.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The study reported in this thesis attempted to identify the factors determining the producers' choice of wine grape cultivars in the South African wine producing regions by explaining the factors affecting area newly planted and area uprooted for each wine grape cultivar in each wine region.

In the case where the objective was to describe the structure of South African wine industry, it was observed that the wine industry has undergone significant changes. These changes occurred due to deregulation of the industry and lifting of sanctions thus exposing the industry to a new set of global demands. The structure of production has been changing rapidly at the same time as the area under vines has been increasing. By comparison with other New World producers, South Africa is still lagging behind. Growth in export value has been less impressive as South African producers have had a limited success in the export of quality wines.

The South African supply and value chain structure is highly fragmented. This fragmentation of the value chain, the set ideas of some of the role-players and the international image of the industry demand strong leadership and focused actions if the industry is to become more internationally competitive. Growth in export volumes depends on the degree to which the international image of the industry can be improved, supported by a stable political and economic environment locally. Not only should every link in the value chain be client-driven, but the value chain should be structured to allow information from the market to reach the producer timeously – from a product-driven to a market-driven chain.

The deregulation of the industry also meant that wine grape producers were now able to plant cultivars that best suited their micro-climates best. This also enabled South African producers to take full advantage of the biodiversity that is a natural competitive advantage of the country. The international demand for red wines further necessitated a change in focus from producing low quality high yielding white grape cultivars to high quality red cultivars. Chenin Blanc is still the cultivar occupying the largest area planted in all the wine regions. However, its status is declining each year and is being replaced by noble cultivars such as Cabernet Sauvignon, Merlot, Shiraz, Pinotage, Chardonnay and Sauvignon Blanc.

The price forming mechanism of co-operatives was investigated in depth due to little information on the subject matter. It was found that the co-operatives are involved in the price formation and they communicate the wine grape price they would offer to producers each year. The most important factors considered by co-operatives in their price formation are the demand for wine grape cultivars, quantity supplied, production cost and present price of a specific wine grape cultivar. It was also noted that different co-operatives in the same region offer different price for the same wine grape cultivar.

The first point of concern in the analysis of data to determine the factors affecting area newly planted and area uprooted was the stationarity of variables. This is because many economic variables of time series data are non-stationary in their raw form. An effort was made to make the variables stationary but it was in vain and thus the raw data was used. However, to counter this, a dummy variable for each region was used for the time period in which there was an abrupt change.

The second issue of concern was the limited amount of data and a large amount of independent variables available. This raised the question of loss of the degrees of freedom with the increase in the number of the independent variables. Nevertheless, through the measures of determining the best subset and use of forward stepwise regression, variables which were significant at five percent level of significance were included and hence the problem of loss of degrees of freedom reduced. An attempt was also made to make use of price ratios rather than real prices which would have reduced the number of independent variables available for analysis. However, the results were no better than the analysis using the real prices.

The result that emerged with regular frequency is that the dummy variable which was used as a variable to counter non-stationarity of data does not appear in the best subset obtained for most of the equations. This poses the possibility of autocorrelation and may explain why in some results autocorrelation was detected. According to Gujarati (2003:448) non-stationarity in time series data is one of the causes of autocorrelation. However, since the purpose of the study was to identify factors affecting the choice of wine grape cultivars and not forecasting, the results obtained may possibly be appropriate. The wine grape cultivars that seemed to be explained by the dummy variables were Chardonnay, Chenin Blanc, Colombar, Cabernet Sauvignon, Merlot, Pinotage and Shiraz. One interesting finding was that the dummy variables had a positive (negative) effect on the area newly planted (area uprooted) with red wine grape cultivars and a negative (positive) effect on the area newly planted (area uprooted) in white wine grape cultivars, respectively. The area newly planted with Pinotage and area uprooted with Pinotage in Malmesbury region was the exception.

It was realised that each wine grape cultivar in each wine region has its own factors influencing the producers' choice of that specific wine grape cultivar. The same wine grape cultivar in different wine regions similarly has its own factors determining the wine grape producers' choice. The implication of this finding is that there are differences in terms of the requirements and types of crops and wine grape cultivars grown in each wine region. However, the most important result that emerged with regular frequency was that the factors determining the producers'choice of a specific wine grape cultivar for each wine region was price of other wine grape cultivars and competitive products in that wine region. The price of the specific wine grape cultivars only had an influence on a few wine grape cultivars. The implication is that the wine grape producers in South Africa appears to consider the prices of other wine grape cultivars and competitive products before making a choice of whether to plant or uproot a specific wine grape cultivar more than the price of the specific wine grape cultivar. This supports the theory that farm prices play a key role in allocating resources and in rewarding efficient producers.

The effect of the cost of inputs for some of the wine grape cultivars was not as expected in theory. Similarly, the coefficient sign for some prices of wine grape cultivars were not as predicted by theory and a suggestion given was based on the finding from the results in the questionnaire that co-operatives in the same region offer different prices for the same wine grape cultivar. However, some results from the regression analyses were consistent with the historical patterns and co-operatives data. Historically, it has also been observed that wine grape producers 'planted after price' (Vink *et al*, 2004). The results from the regression analysis has indicated that the producers appears to consider the price of other wine grape cultivars in their decisions on whether to plant or uproot a specific wine grape cultivar. From the results of the questionnaire, the price forming mechanism of co-operatives entails establishing price brackets for each of the wine grape cultivars based on the supply and demand of each wine grape cultivar. Wine grape prices for the next season are mostly communicated after harvesting. This is the price which would likely influence the producers' choice of wine grape cultivars. However the price communicated is a preliminary one. This implies that the producers would be interested in knowing the price brackets for other wine grape cultivars in their decisions of whether to plant or uproot a specific wine grape cultivar in the next season. The regression results further show that producers also consider the prices of other competitive products.

6.2 RECOMMENDATIONS

- One essential element to note is that prices are increasingly influenced by macroeconomic and global factors that lie outside the agricultural system as well as farm supply, consumer demand and marketing agencies. Although the co-operatives indicated that they consider the supply and demand factors in their price formation, a possible recommendation that follows is that co-operatives in each region should take into consideration of the factors identified above in advising the producers on what wine grape cultivars to plant or uproot. Further it is also recommended that co-operatives in the same region should try to offer a relatively same price for similar wine grape cultivars to avoid the mixed responses from producers in the same region on which cultivar to plant based on the wine grape prices.

- Some data, for instance, the net change in area under wine grape cultivars for each region, could not be gathered accurately. This was due to unavailability of data for each region on the corrections resulting from recounting of vines as well as plantings and uprooting of the previous years not taken into account. It is therefore recommended that SAWIS should provide data on these corrections for each region.

- Based on economic theory, an increase in the price of wine grape cultivars would have a positive effect on the area newly planted and a negative effect on the area uprooted. However, in some of the equations, this was not the case. Although a suggestion of this result was given, more valuable information can be obtained from producers by investigating on these reactions.

- There are other factors that might influence the producers' choice of wine grape cultivars which were not accounted for in this study. These may include, *inter alia* a particular orientation of a winemaker, the strategic orientation of wholesale buyers, historical and sentimental considerations of co-operative boards. A study that takes account of these factors would be a valuable contribution to the existing literature on the subject.

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APPENDICES

Appendix 1: QUESTIONNAIRE

QUESTIONNAIRE ON THE PRICE FORMING MECHANISM OF

CO-OPERATIVES/COMPANIES IN THE SOUTH AFRICAN WINE REGIONS

You are kindly requested to fill in this questionnaire by answering the questions that follow. Responses will be treated in the strictest confidence. The names of the specific co-operatives/companies will not be mentioned in the results since aggregate data will be presented.

SECTION A: CO-OPERATIVES/COMPANIES DETAILS

1. Name of the co-operative/company ---

2. In which magisterial district is your co-operative/company situated------------------

3. In which SAWIS region is your co-operative/company situated-----------------------

4. Since when (years) has the co-operative/company been operating?

(a) As a co-operative ----------------------------

(b) As a company --------------------------------

5. Is the co-operative/company registered in the 'Wine of Origin' system?

☐ YES ☐ NO

5.2 If YES, in which year was the co-operative/company registered -----------------

6. Is the present co-operative/company an amalgamation of two or more companies/co-operatives?

YES ☐ NO ☐

6.2 If YES, name the previous co-operatives/company

Name of co-operative/company	**Magisterial District**

SECTION B: PRICE FORMING MECHANISM

7. Which of the following grape cultivars are delivered to you co-operative/company and what was the final price paid for each cultivar for the production year 2003/04?

Cultivar	**Tick where applicable**	**Price per ton 2003 (R/ton)**
Chenin Blanc		
Colombar		
Chardonnay		
Sauvignon Blanc		
Hanepoot		
Cabernet Sauvignon		
Pinotage		
Merlot		
Shiraz		
Cinsaut		
Other(specify)		

8. What is the total tonnage of wine grapes that your co-operative/company (cellar) received and processed during the past 3 years?

2004/05 ………………………….. tons

2003/04……………………………tons

2002/03……………………………tons

9. Please indicate what percentage of each of the following grape cultivars was received and processed during the past year (2004/05) originated within your magisterial district

Cultivar	**Percentage**
Chenin Blanc	
Colombar	
Chardonnay	
Sauvignon Blanc	
Hanepoot	
Cabernet Sauvignon	
Pinotage	
Merlot	
Shiraz	
Cinsaut	
Other (specify)	

10. Which of the following factors do you consider to determine the price for the next season for each of the grape cultivars delivered to your cooperative/company?

	FACTORS (Tick where applicable)					
Cultivar (please specify)	Production cost	Present price of specific grape cultivar	present price of other grape cultivar(s)	Predictable demand for that grape cultivar	Present quantity for that specific cultivar	Others (please specify)

11. When do you communicate the next season grape prices to farmers? Please also indicate whether the price is final (F) or preliminary (P) by marking a block with a F or P.

Cultivar	**Before harvesting**	**During harvesting**	**After harvesting**	**Final price (F) or preliminary (P)?**
Chenin Blanc				
Colombar				
Chardonnay				
Sauvignon Blanc				
Hanepoot				
Cabernet Sauvignon				
Pinotage				
Merlot				
Shiraz				
Cinsaut				
Other (specify)				

12. How does the co-operative/company communicate the grape prices to farmers?

Appendix 2: GUIDELINES FOR FORMULATING SUPPLY EQUATIONS

Independent Variable	**Formulation**
Expected	
Price of product	
Price of substitutes	Values in previous period, distributed lags
Price of compliments	futures, rational expectations
Price of major inputs	
Technical conversion rates	Serial time, exponential smoothing
Risk	Measure of variability
Structural changes – gradual	Serial time
Structural changes – abrupt	Dummy variable
Government policy variables	
Non-recursive loan	Value
Direct payments	Value
Area set asides	Value
Irreversibility	Dummy
Weather	Rainfall, temperature at planting time,degree days, days of sunlight
Anomalies, pest	Dummy variable

Source: Ferris, 1998

Appendix 3: PRODUCTION AND UTILIZATION OF CROP

$$\text{Average for 1990-1992} = \frac{852\,049\,981 + 857\,388\,720 + 883\,864\,951}{3} \approx 864 \text{ million}$$

$$\text{Average for 2002-2004} = \frac{834\,156\,194 + 956\,015\,511 + 1\,015\,696\,991}{3} \approx 935 \text{ million}$$

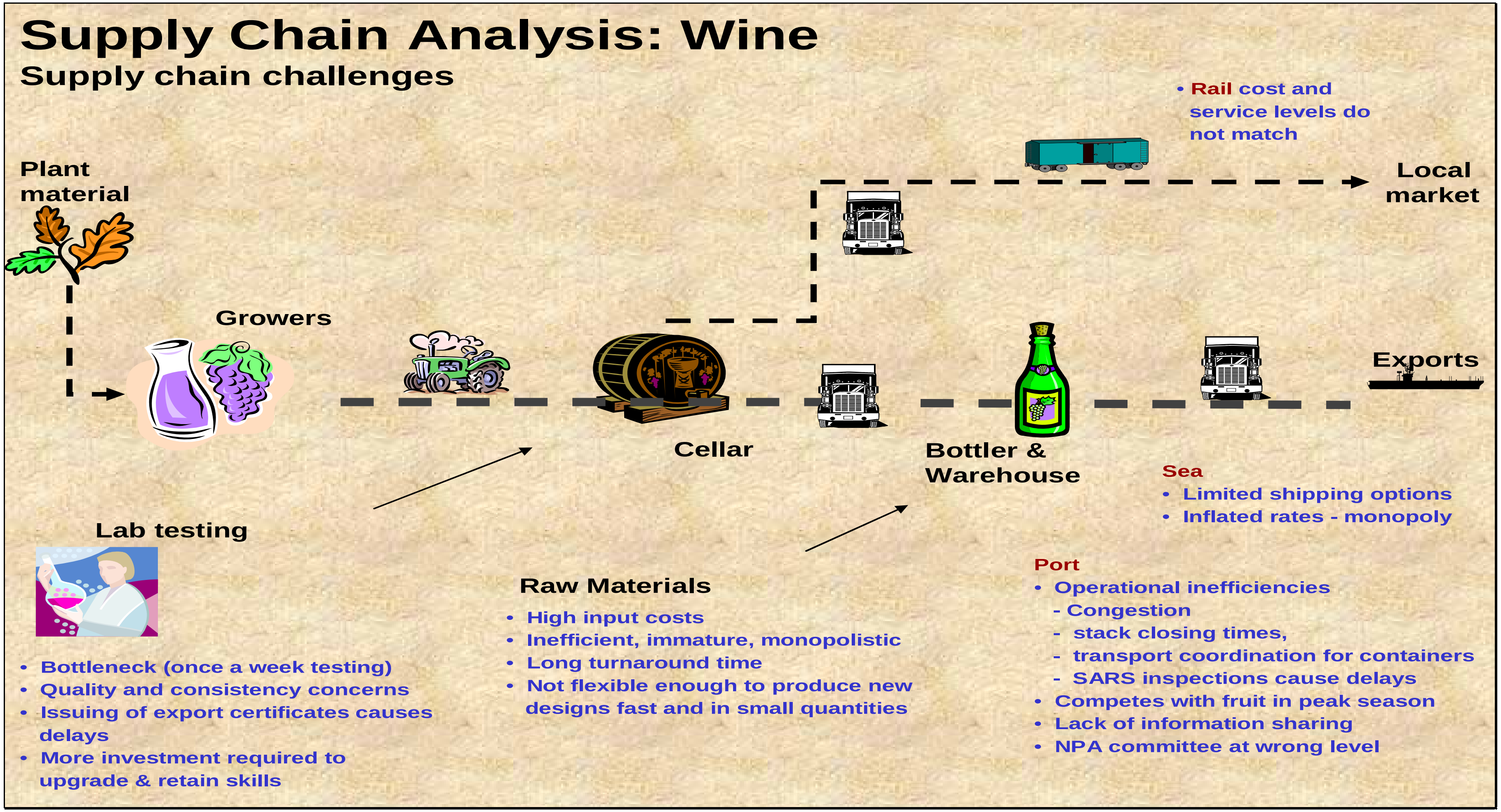
$$\frac{935 - 864}{864} * 100 \approx 8.2 \text{ percent}$$

Appendix 4: TOTAL PACKAGED (PERCENTAGE) EXPORT MARKET LOCATION

Bottled	2002	2003	2004
UK	53	50	46
Netherlands	19	19	17
Sweden	3	7	8
Germany	6	7	8
Japan	1	1	1
Canada	2	2	3
Belgium	2	2	2
USA	3	3	4
Finland	2	2	2
All others	7	7	9

Source: SAWIS, 2005

Appendix 5: **SUPPLY CHAIN ANALYSIS AND CHALLENGES**



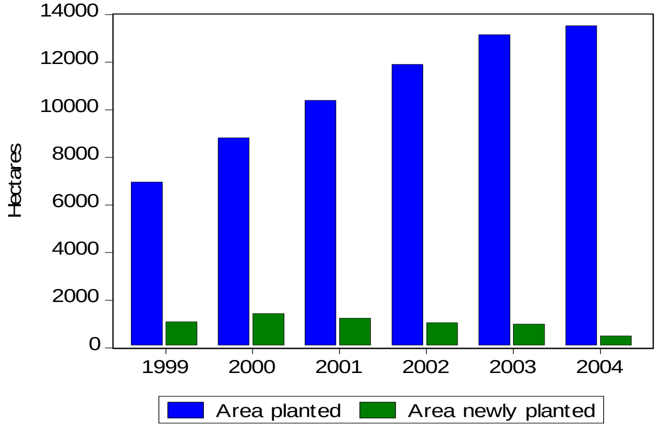
Source: Van Rooyen, 2004

Appendix 6: ANALYSIS OF WINE GRAPE CULTIVARS PLANTED IN VARIOUS DISTRICTS

Cultivar	LITTLE KAROO		MALME-BURY		OLIFANTS RIVER		ORANGE RIVER		PAARL		ROBERT-SON		STELLEN-BOSCH		WORCE-STER	
	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%
Cab. Sauv	4	8.9	2	22.6	4	8.6	5	1.6	4	13.9	7	6.7	3	14.0	5	7.4
Chardonnay	2	18.7	4	7.7	6	4.1	4	7.4	3	14.5	1	27.9	5	8.1	2	17.7
Chenin Blanc	3	12.2	3	21.2	2	21.5	2	18.9	2	15.6	3	12.5	6	5.2	1	19.9
Colombar	1	28.5	-	-	1	37.3	1	61.5	9	0.7	4	11.5	-	-	3	13.7
Cinsaut	8	0.8	8	0.9	-	-	-	-	6	5.1	9	1.53	8	0.81	6	6.2
Hanepoot	8	0.8	11	0.2	-	-	-	-	-	-	11	0.28	-	-	12	0.9
Merlot	5	8.1	7	2.3	9	0.9	-	-	5	6.6	9	1.53	4	8.3	11	1.1
Pinotage	8	0.8	10	0.3	8	1.2	-	-	11	0.3	11	0.28	9	0.6	13	0.2
Sauv. Blanc	6	5.7	5	5.8	3	11.9	6	0.8	8	2.0	2	12.9	1	29.2	4	12.3
Shiraz	7	4.1	1	22.8	5	6.2	3	8.2	1	25.5	6	6.8	2	18.9	7	5.3
Total		**88.7**		**83.8**		**91.9**		**98.4**		**84.2**		**86.9**		**85.2**		**84.6**

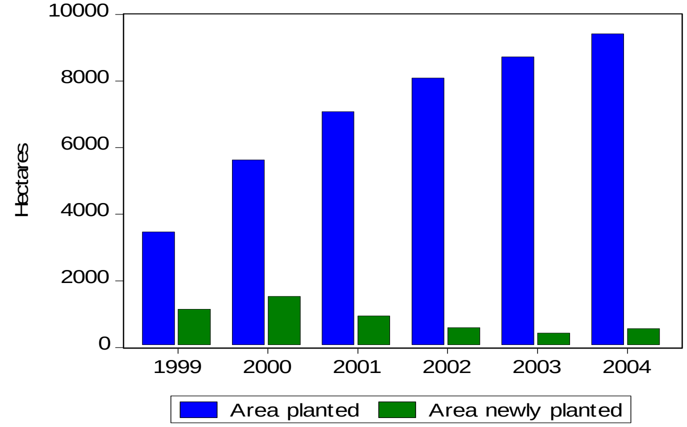
Source: SAWIS, 2005

Appendix 7: TOTAL STATUS OF SELECTED WINE GRAPE CULTIVARS



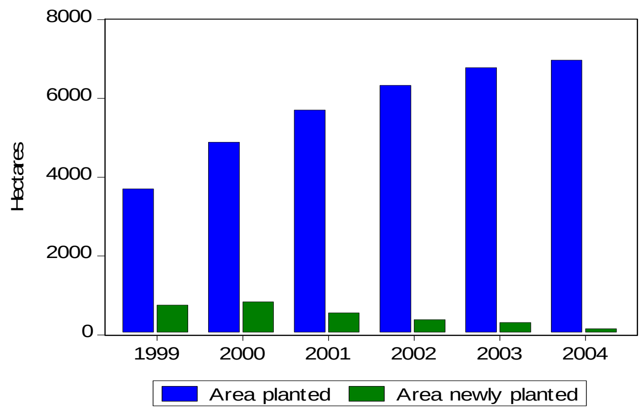
Area planted and area newly planted of Cabernet Sauvignon

Source: SAWIS, 2000 & 2005



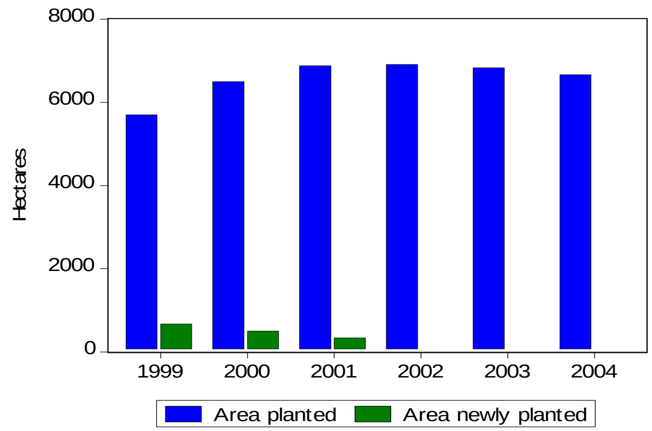
Area planted and area newly planted of Shiraz

Source: SAWIS, 2000 & 2005



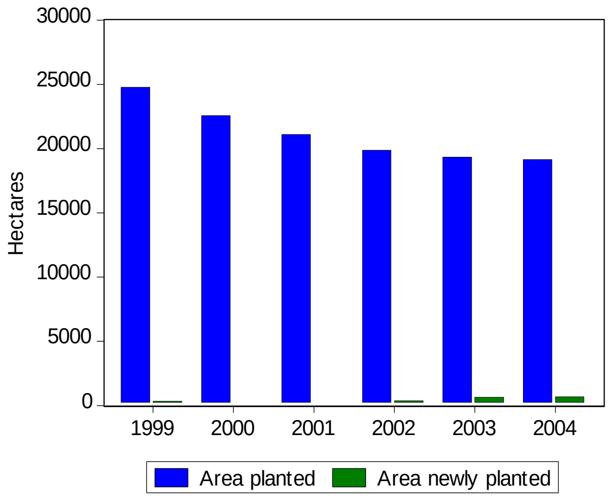
Area planted and area newly planted of Merlot

Source: SAWIS, 2000 & 2005



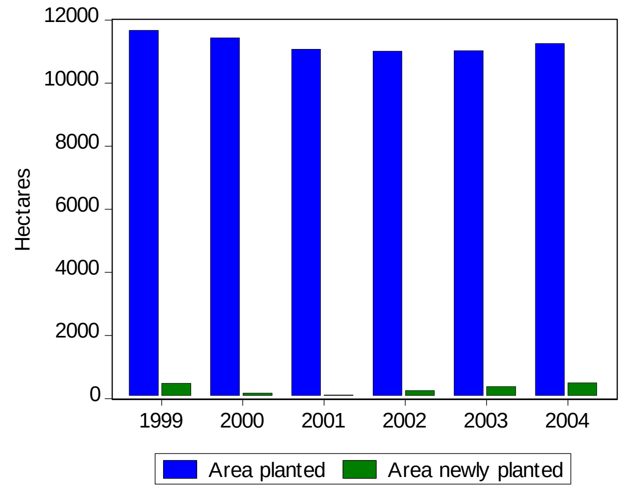
Area planted and area newly planted of Pinotage

Source: SAWIS, 2000 & 2005



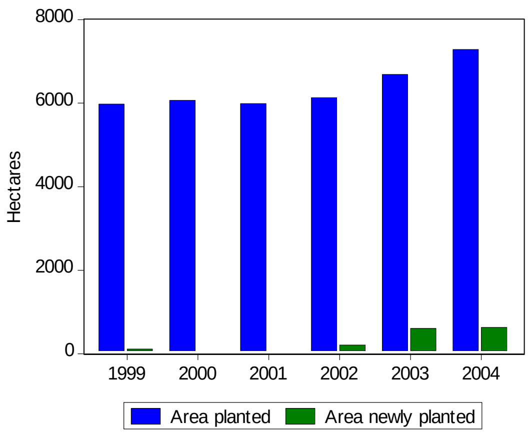
Area planted and area newly planted of Chenin Blanc

Source: SAWIS, 2000 & 2005

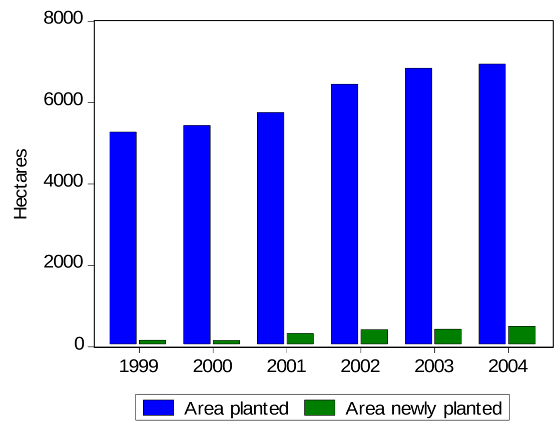


Area planted and area newly planted of Colombar

Source: SAWIS, 2000 & 2005



Area planted and area newly planted of Chardonnay
Source: SAWIS, 2000 & 2005



Area planted and area newly planted of Sauvignon Blanc
Source: SAWIS, 2000 & 2005

Appendix 8: PERCENTAGE COMPOSITION OF CULTIVARS PLANTED IN THE WINE REGIONS FOR THE YEARS 1997 AND 2004

Cultivar	Worcester		Paarl		Stellenbosch		Orange river		Malmesbury		Robertson		Olifants river		Little Karoo	
	1997	2004	1997	2004	1997	2004	1997	2004	1997	2004	1997	2004	1997	2004	1997	2004
Chenin Blanc	31.5	22.8	33.9	20.6	27.1	10.1	3.6	18.4	38.5	25.5	23.3	13.8	27.3	21.9	24.8	21.3
Colombar	14.4	13.5	5.1	3.3	2.1	0.4	1.2	55.0	5.3	2.7	22.0	16.3	19.2	21.2	25.1	26.7
Chardonnay	6.0	8.3	4.9	6.3	6.7	6.4	0.2	1.1	3.5	5.1	10.5	14.3	4.9	5.4	3.8	7.7
Sauvignon Blanc	2.3	5.5	6.0	5.5	11.1	13.2	0.0	0.5	5.1	6.3	5.9	8.6	3.4	4.5	1.0	1.8
Hanepoot	10.8	6.0	2.1	0.9	1.4	0.5	5.3	6.8	1.6	0.6	2.8	1.4	14.1	6.1	13.8	9.3
Cabernet Sauv.	1.3	7.3	8.6	18.3	14.5	23.4	0.1	2.1	4.9	16.3	2.7	10.5	1.1	7.0	0.4	3.9
Pinotage	2.0	4.3	5.5	7.2	7.1	8.4	0.2	2.0	8.5	11.7	1.2	3.6	2.2	6.4	0.7	3.6
Shiraz	0.6	6.1	1.9	11.2	3.7	12.9	0.0	1.2	1.5	11.5	0.8	7.8	0.4	10.4	0.0	4.3
Merlot	1.1	5.4	3.2	7.8	6.4	12.6	0.0	0.9	2.0	6.3	0.6	5.0	0.9	5.9	0.5	4.0
Cinsaut	6.0	4.2	8.9	6.6	3.0	1.7	0.0	0.0	6.7	4.0	1.2	0.7	0.6	0.4	0.7	0.3

Source: SAWIS, 2005

Appendix 9: AGE OF VINES PER REGION EXPRESSED AS PERCENTAGE, 2004

	HECTARES IN WINE REGION AS % OF TOTAL								
Age of vines	**Total hectares**	**Orange River**	**Olifants River**	**Malmes-bury**	**Little Karoo**	**Paarl**	**Robert-son**	**Stellen-Bosch**	**Worce-ster**
< 4 years	6.8	6.9	8.4	5.2	7.5	4.9	9.8	4.0	9.5
4 – 10 years	13.2	48.1	17.2	7.9	20.7	7.1	16.2	6.6	15.5
11 -15 years	9.7	12.8	16.2	5.9	14.8	5.4	14.1	4.7	13.5
16- 20 years	10.9	13.4	11.0	8.6	15.1	9.1	13.0	8.1	14.5
> 20 years	13.3	8.0	11.9	17.1	16.8	16.5	10.8	10.9	12.5
Total White varieties	**54.0**	**89.2**	**64.8**	**44.8**	**74.9**	**43.0**	**63.8**	**34.2**	**65.5**
< 4 years	8.0	1.0	4.6	10.2	4.8	10.9	6.2	10.4	6.6
4-10 years	27.4	8.0	27.7	33.0	15.6	30.6	24.5	33.8	22.3
11-15 years	5.2	1.0	1.5	4.8	1.4	7.2	3.6	10.6	3.3
16-20 years	2.3	0.7	0.6	2.0	0.7	3.6	0.8	5.9	0.6
> 20 years	3.1	0.8	0.8	5.1	2.6	4.6	1.1	5.1	1.7
Total red varieties	**46.0**	**10.8**	**35.2**	**55.2**	**25.1**	**57.0**	**36.2**	**65.8**	**34.5**
< 4 years	14.8	7.9	13.0	15.5	12.3	15.8	16.0	14.4	16.1
4-10 years	40.6	56.1	44.9	40.9	36.3	37.7	40.7	40.3	37.8
11-15 years	14.9	13.8	17.7	10.8	16.2	12.6	17.7	15.3	16.8
16-20 years	13.2	14.1	11.6	10.6	15.8	12.7	13.7	14.0	15.1
> 20 years	16.4	8.2	12.7	22.2	19.3	21.2	11.9	15.9	14.2
Total white and red	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: SAWIS, 2005