# Knowledge utilisation in the South African wine industry

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# DECLARATION

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## ABSTRACT

The use of knowledge that is based on scientific research plays an important role in the development and international competitiveness of a country's wine industry. In order for South Africa to effectively compete with other wine industries in the global market, and to ensure that it produces quality wines that can satisfy consumer demands and expectations, it needs to use the best of current research knowledge available. However, it is unknown to what extent South African winemakers are using knowledge based on scientific research, as well as where and how winemakers obtain knowledge, and how new knowledge is treated against the backdrop of a winemaker's own experience and existing practice knowledge.

The study, which addressed these broad questions, included a literature overview as well as a web-based survey of 210 winemakers in South Africa. Interviews were also conducted with six winemakers and three wine consultants. On the basis of the literature the key notions of "knowledge" and "utilisation" were unpacked. Knowledge was interpreted as either factual (know-that) or practical (know-how), and utilisation as a typology consisting of instrumental, conceptual, symbolic and persuasive utilisation. Insights from a body of literature not typically associated with winemaking, namely evidence-based medicine (EBM) and knowledge translation (KT), were also incorporated in the study.

The study not only examined the *frequency* of using knowledge sources but also the *relative importance* of the different knowledge sources and the underlying structure of the sources (i.e. which sources group together). The results unequivocally showed that practical knowledge (i.e. knowledge that is exhibited in practice and which finds expression as moments of "common sense", intuition, gut feeling etc.) is considered by many winemakers as extremely important for their winemaking. Opinions of fellow-winemakers also appeared to be an important knowledge source as about 46% of winemakers said that they seek advice from colleagues at least once a month and 57% rated these as of extreme importance for winemaking. Knowledge sources that are codified and publicly available, such as *Wynboer* in the industry-based WineLand magazine as well as the internet and winemaking textbooks and manuals, have grouped together and were considered as relatively important by winemakers.

Overall the study produced evidence of the widespread use of scientific research findings, particularly conceptual use of research. The latter refers to a better understanding of certain aspects of winemaking that is based on scientific research. In addition, the elements of practical knowledge have also been explored within the context of winemaking. Additional

insights were provided with regard to the relationship between practical and factual knowledge as well as the relationship between different conceptions of knowledge use, and how knowledge sources relate to knowledge use. The findings and subsequent insights generated undoubtedly apply beyond studies of the knowledge use of winemakers.

Lastly, a key output of the study was to develop a normative model of knowledge uptake for winemakers. The proposed model combines practical knowledge and research-based factual knowledge in a single knowledge product destined for uptake by winemakers, in order to close the knowledge-to-practice gap.

## OPSOMMING

Die gebruik van kennis wat op wetenskaplike navorsing gebaseer is, speel ’n belangrike rol in die ontwikkeling en internasionale mededingendheid van ’n land se wynbedryf. Ten einde vir Suid-Afrika om doeltreffend mee te ding met ander wynbedrywe in die globale mark, moet die beste van beskikbare navorsingskennis gebruik word aangesien dit sal help om kwaliteitwyn te lewer wat aan verbruikers se eise en verwagtinge voldoen. Dit is egter onbekend tot watter mate Suid-Afrikaanse wynmakers kennis gebruik wat gebaseer is op wetenskaplike navorsing, asook waar en hoe wynmakers kennis verkry, en hoe nuwe kennis beoordeel word in die lig van ’n wynmaker se ervaring en bestaande praktykkennis.

Die studie poog om hierdie breë vrae te beantwoord en behels ’n literatuuroorsig sowel as ’n web-gebaseerde opname van 210 wynmakers in Suid-Afrika. Onderhoude is ook gevoer met ses wynmakers en drie wynkonsultante. Die literatuur bied ’n bespreking van die twee kernbegrippe, naamlik "kennis" en "benutting/gebruik". Kennis is vertolk as óf feitelike (“weet-dat”) of praktiese (“weet-hoe”) kennis, en benutting as 'n tipologie van instrumentele, konseptuele, simboliese en oorredende gebruik. Insigte is ook verkry uit ’n stel literatuur wat nie normaalweg geassosieer word met wynmaak nie, naamlik bewys-gebaseerde medisyne (*evidence-based medicine* – EBM) en kennisvertaling (*knowledge translation* – KT).

Die studie het nie net die frekwensie van die gebruik van kennisbronne ondersoek nie, maar ook die relatiewe belangrikheid van die verskillende kennisbronne sowel as die onderliggende struktuur van die bronne (bv. watter bronne groepeer saam). Die resultate het onomwonde getoon dat praktiese kennis – dws kennis wat in die praktyk vertoon word en uitdrukking vind as oomblikke van “gesonde verstand” (*common sense*), intuïsie, gevoel (*gut feeling*), ens – deur baie wynmakers beskou word as uiters belangrik vir hul wynmaak. Menings van mede-wynmakers is ook ’n belangrike bron van kennis. Ongeveer 46% van die wynmakers het gesê dat hulle advies van kollegas ten minste een keer per maand soek en 57% het dit beskou as van die uiterste belang vir wynmaak. Kennisbronne wat reeds gekodifiseer en in die openbaar beskikbaar is, soos *Wynboer* in die bedryfgebaseerde *WineLands*-tydskrif asook die internet en wynmaakhandboeke en -handleidings, het saamgegroepeer in die ondersoek en is ook deur wynmakers as relatief belangrik beskou.

Die studie het ook bewys gelewer van die wydverspreide gebruik van wetenskaplike bevindings onder wynmakers, veral die konseptuele gebruik van navorsing. Laasgenoemde verwys na die ontwikkeling van ’n beter begrip van sekere aspekte van wynmaak op grond van wetenskaplike navorsing. Daarbenewens het die ondersoek ook die elemente van

praktiese kennis binne die konteks van wynmaak verken. Addisionele insigte is verkry met betrekking tot die verhouding tussen praktiese en feitelike kennis asook die verband tussen die verskillende konsepsies van kennisgebruik, en die verband tussen kennisbronne en kennisgebruik. Die bevindings en die gevolglike insigte wat gegenereer is, strek ongetwyfeld wyer as slegs die studie van die kennisgebruik van wynmakers.

Laastens, ’n belangrike uitset van die studie was die ontwikkeling van ’n normatiewe model van kennisoordrag vir wynmakers. Die voorgestelde model kombineer praktiese kennis en navorsing-gebaseerde feitelike kennis in ’n enkele kennisproduk wat bestem is vir gebruik deur wynmakers, ten einde die kennis-tot-praktyk-gaping te oorbrug.

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# INTRODUCTION

## 1.1 BACKGROUND

Wine is seldom thought of as a knowledge product but in many ways it is. In the established wine producing countries of Europe, where the practice of winemaking literally spans millenniums, wine quality is an expression of a producer's intimate knowledge of nature, a form of knowing that is passed on by tradition. The attraction of European wines, produced in a region where "wine is made in the same place, in the same way and style as in the past" (Swart & Smit, 2009:13), is best captured by the French notion of *terroir*, which points to a unique configuration of climate, landscape and soil.

In the much "newer" wine producing countries of the world, including Argentina, Australia, Chile, South Africa and the USA, the focus is more on progress and innovation. Often interpreted as non-traditionalist, the wine industries of these countries are defined in terms of market-oriented objectives, such as producing consumer-responsive wine styles. It is within this context of innovation that additional sources of knowledge, other than tradition, have become accentuated. The revitalising of scientific institutions and transfer structures in these countries, also in South Africa, has led to more wine research being initiated and disseminated. The latter implies larger volumes of scientific knowledge at the disposal of the average wine producer which, in turn, increases the probability of scientific knowledge infiltrating the practice of winemaking. The influence can be as subtle as providing scientific explanations for activities previously accepted as a given and performed without questioning. Moreover, the relatively greater orientation towards new knowledge and technologies has set "newer" wine producing countries apart from their "older" counterparts:

> The preparedness and ability of many new world producers to trial the latest oenological techniques and equipment and combine such technologies with the best soil, vine and disease management practices is providing them with significant advantage over their less adventurous "old world" competitors. This is in spite of the fact that knowledge generated in these fields is generally available to major wine producers world-wide. (Aylward & Turpin, 2003:508)

One reason why these "newer" producers of wine display a greater sensitivity for scientific progress is because wine production has developed into a highly competitive global enterprise. Wine producing countries outside Europe export a significant share of their product, even as high as 80% in the case of Chile (Castaldi, Silverman & Sengupta, 2004). Scientific research is seen as an integral factor that can provide a competitive edge as far as

global participation is concerned. In South Africa, which exported about 49% of its wine in 2010 (SAWIS, 2011), scientific research together with the best technology available and adequate structures for information flows (transfer), are listed among the fifteen major enhancements to the competitiveness of the country's wine industry (Table 1.1). The finding is based on a survey of executive decision makers in the wine industry, reported by Esterhuizen and Van Rooyen (2006).

**Table 1.1: Factors enhancing the competitiveness success of the South African wine industry**

| Factor | Average rating |
|---|---|
| 1. Intense competition in the local and international market | 1.76 |
| 2. Availability of unskilled labour (seasonal and contractual) | 2.05 |
| 3. Entry of new competitors | 2.15 |
| 4. Production of affordable high quality products | 2.26 |
| 5. Environmental sensitive production practises | 2.42 |
| 6. International market large enough to obtain economies of scale | 2.46 |
| 7. Product support, services and processes | 2.58 |
| 8. Ethics and trust in business | 2.60 |
| 9. Continuous innovation | 2.63 |
| 10. Competitive local suppliers of materials, components, equipment and services | 2.84 |
| 11. Investment in human resources to attract, train and retain staff | 2.92 |
| 12. Among the world's most stringent regulatory standards in the industry | 2.94 |
| 13. Best and efficient technology in the production process | 2.97 |
| 14. Technical information flow | 3.16 |
| 15. Availability of scientific research | 3.26 |

Source: Calculations by Esterhuizen and Van Rooyen (2006:480, Table 5), based on the 2005 Wine Executive Survey.

Note: An average rating that is smaller than 4 can be interpreted as "above average enhancement" because 1 = "major enhancement" and 7 = "major constraint".

In the case of the South African wine industry it can therefore be argued that, in order for the industry to effectively compete in the global market, its winemakers need to be aware of and utilise the best possible knowledge available. Any study of knowledge utilisation, however – irrespective of the study domain – is important in itself because of a perceived closeness, at least politically, to the application of knowledge and the broad ideals of innovation and economic development. Such a politically-inspired perception is especially justified for the South African wine industry, given that the industry accounts for R26 223 million, or 2.2%, of the total South African GDP, based on a macro-economic impact study by Conningarth Economists (2009).

The study by Conningarth Economists (2009) also shows that R14 214 million, or 54%, of the total (national) GDP contribution of R26 223 million remains in the Western Cape where the larger share of the industry is located. The R14 214 million comprises 7.3% of provincial

GDP in the Western Cape. In terms of job creation more than 275 thousand opportunities are supported by the wine industry (WineLand, 2010). This clearly shows the importance of the wine industry in the national economy.

Having presented a case for a study of the wine industry of South Africa, and particularly knowledge utilisation within that industry, I now discuss and elaborate on the two central components of the study. First it needs to be clarified though that the use of the term “wine industry” in this study is restrictive, as it includes only winemaking/vinification practices, which are largely cellar based, and not vineyard practices. Thus, the two central study components are, on the one hand, the wine, winemaking and winemaker cluster and, on the other hand, knowledge utilisation. These are highlighted in Sections 1.2 and 1.3 respectively. Thereafter, in Section 1.4, the broad objectives and research questions of the study are specified, followed by a general indication of the study methodology (Section 1.5). Finally, Section 1.6 presents a chapter outline of the remainder of the thesis.

## 1.2 STUDY COMPONENT 1: WINE, WINEMAKING AND WINEMAKER

### 1.2.1 The Concept of Wine

Wine is “the beverage obtained solely by the alcoholic fermentation of the juice of fresh grapes” (Wissing, 1969:18) and is considered both an agricultural and a biological product. It is an agricultural product because:

> Natural factors such as soil, location, climate, varieties of grapes as well as the methods of viticulture and vinification exercise a determining influence on the yield per production unit and the wine's nature, character, quality and marketability … Wine is furthermore a biological product subject to judgement, in the final instance, by organoleptic and other subjective criteria. Widely differing judgements of a particular wine are thus possible. This subjective process which reaches from the producer to the consumer has a profound influence on the price which a wine can ultimately command. (Wissing, 1969:18)

Wine falls within two broad classes, namely good wine and distilling wine. Good wine is considered suitable for human consumption whereas distilling wine is not (Wissing, 1969).

- Good wine refers to either natural wine or fortified wine. Natural wine is known as such because of the fact that no spirits are added. It sometimes also goes by the name of table wine. Fortified wines, on the other hand, do contain a certain amount of wine spirits. Typical examples of fortified wines (liqueurs) are sherry and dessert wines such as port and muscadel.

- Distilling wine can also be divided into two kinds, namely rebate wine (or wine for brandy) and ordinary distilling wine. Rebate wine is the base wine that is used for distillation into pot still brandy. Ordinary distilling wine is used for distillation into portable spirits, which, in turn, is used for blending with pot still brandy to produce spirituous liqueurs (e.g. gin and vodka) and for the fortification of wine.

According to the above classification by Wissing, which was produced in the late 1960s, natural wine could be still or sparkling, as well as white, red, rose, semi-sweet or dry. The latest classification by SAWIS (2011), however, separates sparkling wine from natural wine. On the basis of this, there are three kinds of good wine (simply called "wine" in the current classification), namely natural, fortified and sparkling, as well as two kinds of wine for distillation. The official SAWIS definitions for these are as follows:

- *Natural wine* is non-fortified and non-sparkling wine, including perlé wine which is wine carbonated to the extent that the pressure in the container in which it is sold is between 75 and 300 kPa. It also includes any grape juice or must and grape juice or must concentrate used in the sweetening of such natural wine.
- *Fortified wine* is non-sparkling wine which has been fortified with wine spirit. It includes the volume of wine spirit used in the fortification process.
- *Sparkling wine* is wine carbonated (either by fermentation or by impregnation with carbon dioxide) to the extent that the pressure in the container in which it is sold is more than 300kPa. It includes any grape juice or must and grape juice or must concentrate used in the sweetening of such sparkling wine.
- *Wine for brandy* is wine specially prepared for double distillation in a pot still and then, as distillate, matured for a period of at least three years in oak casks with a capacity of not more than 340 litres.
- *Distilling wine* is wine specially prepared for distillation to spirits intended for use in brandy or other spirits, for fortification of wines or for industrial purposes.

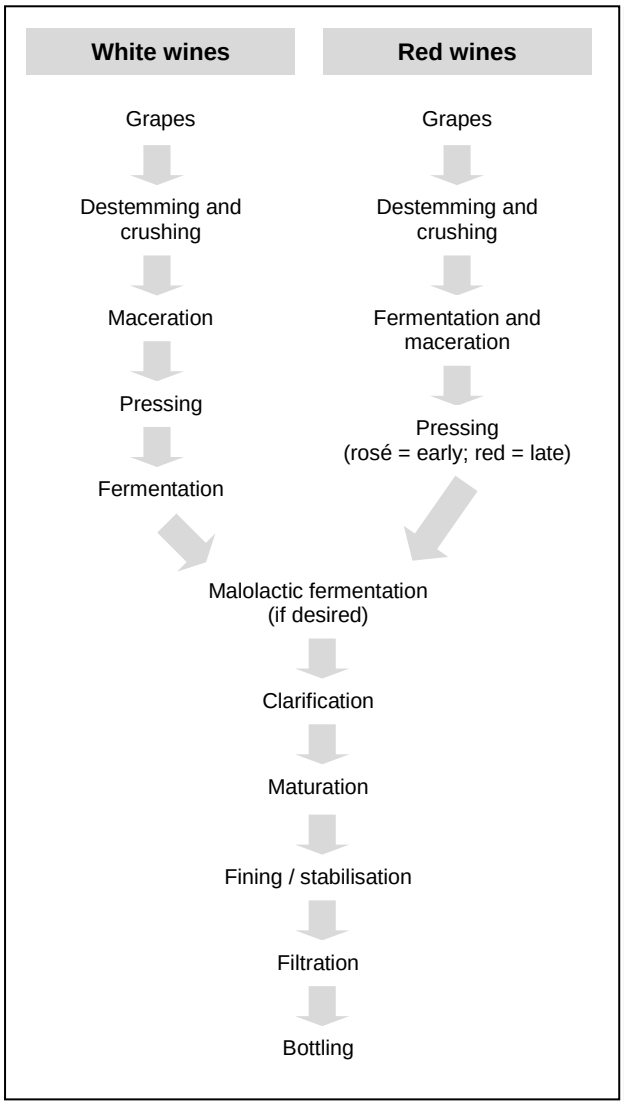
### 1.2.2 The Scientification of Winemaking

Grapes are the raw materials for wine and vinification is the process of converting grapes into wine. The process varies according to the kind and style of wine to be achieved, with the difference between white and red wine an obvious point of variation, as is simplistically illustrated in Figure 1.1. Although winemaking is a process with ancient roots its scientific basis only became clearer around 1863, with Pasteur's groundbreaking work into microbial

activity, which showed yeast to be the primary catalyst in wine fermentation (Pretorius, 2000).

Giuliani (2007) portrays the history of winemaking as consisting of two phases. On the one hand, there is the old quantity-orientated phase, mainly concerned with the production of standard wine that was often sold as bulk wine. On the other hand, the last two decades resemble a quality-orientated phase, where the move is away from standard wine to include medium- to high-range wines that incorporate scientific and research advances in winemaking practice.

**Figure 1.1: The main steps in winemaking**




*Destemming and crushing*: Process of removing the stems and breaking open the grapes.

*Maceration*: The soaking of grape solids in juice. This can take the form of cold soaking pre-fermentation or, in the case of red wines, post-fermentation. Maceration will help extract flavours and, for red wines, colour and tannins. (Tannins are extracts from red grape skins and oak which give red wine structure.)

*Fermentation*: The conversion of sugars into alcohol through the action of yeasts.

*Pressing*: Process in which the juice is pressed from the skins and other solid matter of the grapes.

*Malolactic fermentation*: A fermentation that may take place after the alcoholic fermentation, in which bacteria convert harsh malic acid into soft lactic acid. Almost without exception, it is desirable in red wines.

*Clarification / maturation / fining / stabilisation*: Fining is a procedure for clarifying and purifying liquids, which requires the addition of either natural or synthetic materials to clarify and stabilise the wine. If wine is stored for long enough (maturation) it will eventually become stable to precipitation and further change. However, more rapid stabilisation is required than what is attained naturally, which calls for formal stabilisation processes.

*Filtration*: Pressing the wine through a medium to remove bacteria and solids. Flavours can also be removed.

*Bottling*: The process of transferring the wine to the bottle, protected from exposure to oxygen.

Source: Flow diagram (on the left) is adapted from G.M. Walker by Pretorius (2000). The explanations (on the right) are taken from Grainger and Tattersall (2005) and Rankine (1989).

In the quality-orientated phase there is a large emphasis on codified knowledge (meaning knowledge that can be written up or communicated to others, and which can also find expression as inputs in new technologies). The focus on codification, according to Giuliani (2007), signals three developments occurring in winemaking as a result of increased scientification. The first is the emergence of scientific explanations, through systematic research, that demystified various aspects of fermentation. Secondly, the emergence of recipes for winemaking, serving as appropriate codes of conduct to achieve particular results and, thirdly, the introduction of devices and machinery that automated a number of winemaking practices. Table 1.2 provides a comparison of the quantity- and quality-orientated phases.

**Table 1.2: Scientific and technological changes in winemaking**

| Winemaking stage | Quantity-orientated phase | Quality-orientated phase |
|---|---|---|
| Harvesting decision | Based on farmer experience (colour and taste of grapes) and on basic sugar maturity test | Technological maturity test |
| | | Phenolic maturity test (for red wines) |
| Vinification process | Grape skin, pulp and stem together in fermentation (no use of grape-crusher) | Introduction of sophisticated machines to separate grapes from stems and squeeze the grapes (crush-machines) |
| | No temperature control over the process | Adoption of fermentation tanks that control for temperature and automatic pumping over |
| | No control on yeast | Use of selected yeast and adoption of enzymes to regulate fermentation |
| | Natural process occurring with limited control and analysis | Recurrent analysis during fermentation process |
| | Cement or plastic tanks | Innovation in materials: use of steel tanks |
| Malolactic fermentation | Spontaneous/undesirable process | Controlled and induced in red wines |
| Clarification | -- | Evolution of materials |
| Tartrates removal | No intervention | Cold stabilisation practices |
| Filtration | Rudimentary tools | More sophisticated tools |
| Aging and bottling | Use of big barrels | Innovation of aging procedures (use of barriques) |
| | Corks in bottling | Cork, silicone and polymers for white wines (innovation in materials) |

Source: Adapted from Giuliani (2007:146, Table 1)

However, the increased codification that is part of the quality-orientated phase does not mean that tacit knowledge, which involves intuitive knowing and the immediate recognition of the state of affairs, has now become obsolete. In fact, Giuliani (2007) reports that there is still a strong reliance on the senses, which often characterises tacit knowing in winemaking. In the fermentation phase of winemaking, for instance, it is sometimes essential for wine to breathe through the oxygenation of yeasts. A typical smell normally indicates the need for oxygenation. Similarly, fermenting wine also has to be tasted in the making of red wine in order to determine how long the wine has to be kept fermenting on the grapes' skin. The

tacit knowledge of the winemaker, therefore, supplements the operational procedures and new technologies.

### 1.2.3 The Winemaker

The winemaker's role extends into the vineyard (i.e. prior to vinification) as co-operation with the vineyard manager/viticulturist is essential to monitor grape maturity for quality, and to decide on the most appropriate time for harvest. Apart from pre-vinification activities the winemaker is responsible for crushing and pressing grapes, monitoring the settling of juice and the fermentation of grape material, filtering the wine to remove remaining solids, testing the quality of wine by tasting, placing filtered wine in casks or tanks for storage and maturation, preparing plans for bottling wine once it has matured, and ensuring that quality is maintained when the wine is bottled (http://en.wikipedia.org/wiki/Winemaker). Laboratory testing and/or the ability to correctly interpret the results of laboratory tests (for microbial activity etc.), and intelligibly acting upon it, has increasingly become part of the winemaker's portfolio and for that reason requires a certain degree of formal scientific knowledge. However, it is not uncommon for successful winemakers to have no formal qualifications, which is also true of some winemakers in South Africa.

That being said, many South African winemakers have completed higher degrees at universities, particularly at Stellenbosch University in South Africa, and hence qualify to be called oenologists. An oenologist, according to Rankine (1989:14) is someone who has "knowledge of the science and principles and practices of wine and winemaking". A number of additional requirements apply for a winemaker to be labelled as an oenologist:

> As an oenologist you should be technically and academically competent. Have a discriminating and trained palate, an appreciation of wine types and quality, be able to manage staff, and have some knowledge of management, costing and marketing. Technical competence needs to extend beyond the field of winemaking, maturing and bottling. The wines you make must be of a style and quality which will sell, and in a large company you are guided by the marketing department which should anticipate trends in market demand … Besides this, the oenologist should have the basis of a sound, broad professional education and keep abreast of current technical developments. (Rankine, 1989:15)

Winemakers are employed at cellars. In 2010, according to SAWIS (2011), the cellar component consisted of 54 producer cellars (i.e. cellars that do not grow their own grapes but process their members' grapes and grapes that they may have bought from other producers), 493 private cellars (i.e. cellars belonging to an individual or group, including estate cellars) and 26 producing wholesalers (i.e. wholesale companies that process grapes but mainly buy wine in bulk from producer or private cellars). The cellars are distributed

across the wine regions and significantly differ in terms of size and access to available resources. Most producer cellars focus on the production of ordinary distilling wine, rebate wine, grape juice for the production of grape concentrates, and bulk drinking wine. The private cellars and producing wholesalers, on the other hand, add value to their wines and have incorporated packaging as part of their operations. Producing wholesalers and larger private cellars therefore have better infrastructure and more resources which place them in a relatively better position to access new technology (Theron, 2008).

Lastly, the private cellar category also includes a few Garagiste winemakers. The latter are individuals who buy grapes from producers and then make the wine themselves, often in garages or backyard structures or spaces rented from established cellars. Obviously these wines are produced in very limited volumes but can be of exceptional quality. Many Garagiste producers make their wine after hours as they are full-time employed elsewhere (Swart & Smit, 2009).

## 1.3 STUDY COMPONENT 2: KNOWLEDGE UTILISATION

Concerns about knowledge utilisation originally gained prominence in discourses about the relevance of social research for state-funded public policies and programmes (public health policy, school programmes etc.). Thus, it is a topic that mainly concerned social scientists and policy makers, and academically found expression in studies pertaining to the relationship between knowledge and policy (Larsen, 1980).

On the other hand, knowledge utilisation has also become an umbrella term for studies referring to the use of knowledge – specifically scientific knowledge including research – for the betterment of society (Backer, 1991; Estabrooks et al., 2008). As such, it has absorbed related scholarly contributions from various disciplinary and cross-disciplinary environments. These include the use of evaluation studies (e.g. Weiss, 1978, 1979, 1980), technology transfer (e.g. Bozeman, 2000; Cooney & Allen, 1974; Mansfield, 1961), research utilisation in nursing (e.g. Champion & Leach, 1989; Stetler & Marram, 1976), evidence-based practice in medicine (e.g. Grol, 2001; Sackett et al., 1996; Straus & Sackett, 1998), the diffusion of innovations (e.g. Rogers, 2003; Valente, 1996) and knowledge translation in health (e.g. Davis et al., 2003; Logan & Graham, 1998; NCDDR, 2005), to mention only a few. Since the body of work pertaining to the overarching notion of knowledge utilisation developed within distinct disciplinary environments, insights are not always shared and different terminologies are used in reference to similar concepts and processes. Ottoson (2009:9) remarks that although many of the disciplinary contributions “acknowledge roots in knowledge utilization,

it is not clear that knowledge utilization reciprocates awareness of its extended family". It is therefore not surprising that the need for standard terminology and a common set of definitions has been repeated at different times, and actual attempts conducted to make sense of the confusion (e.g. Graham et al, 2006).

An example of a *broad conception of knowledge utilisation* is provided by Greenhalgh et al. (2005:422), according to which knowledge utilisation is "the process by which individuals and teams acquire, construct, synthesise, share and apply knowledge". I interpret it as "broad" because, given the scope of the definition it can include any or all of the following:

- Research utilisation: A complex process that can and does occur at the level of the individual knowledge producer and user. It can result in conceptual, behavioural, and social outcomes and may be influenced, scientifically or unscientifically, by the environment, as well as by various characteristics and cognitive processes of the user (Stetler, 1994).
- Knowledge diffusion: The process by which an innovation – i.e. a product, practice, programme, policy, idea or research finding – is communicated through certain channels over time among members of a social system. The focus is on the spread and adoption (or rejection) of the innovation (Ashley, 2009; Rogers, 2003).
- Knowledge dissemination: Ashley (2009) refers to a number of finer (but conflicting) distinctions between diffusion and dissemination. Firstly, dissemination can be interpreted as meaning the same as diffusion, with dissemination being the appropriate descriptor in cases where the innovation involves knowledge or research. Secondly, diffusion can be interpreted as passive spread whereas dissemination involves a more targeted effort. Thirdly, dissemination can mean the sending out of innovations whereas diffusion concerns more than just sending out innovations as it also involves the spread and adoption thereof.
- Knowledge transfer: The process of getting knowledge used by stakeholders. It is conceptualised in terms of a starting point, an understanding of what is being transferred, the medium or mechanism of transfer, the concomitant agents, the purpose, and the ending point (Graham et al., 2006; Oliver, 2009).
- Knowledge translation: The process of exchanging, synthesising and applying knowledge within a complex system of interactions among researchers and users. Knowledge translation is related to knowledge dissemination but is a much broader concept that places a significant emphasis on the quality of the research to be

disseminated and the implementation of research evidence within a system (NCDDR, 2006).

- Knowledge exchange: The process by which researchers and decision makers are brought together and their interaction facilitated. It normally starts with collaboration to determine the research question. On-going exchanges ensure that the knowledge generated is relevant to the stakeholders as well as useful to the researchers (Graham et al., 2006).

On the basis of the above, I would argue that a broad conception of knowledge utilisation can be interpreted as meaning "knowledge utilisation plus", as it is not only concerned with how knowledge is being used (a focus typically associated with the research utilisation tradition) but also with diffusion/transfer/translation/exchange processes and mechanisms by which knowledge comes to be utilised.

A broad conception of knowledge utilisation also implies the co-existence of a *narrow conception*. In such a narrow conception, I would argue, interpretations of the two central elements – knowledge and utilisation – are prioritised. In other words, the focus shifts to what constitutes knowledge and what counts as utilisation. In fact, it appears that the knowledge part of knowledge utilisation has consistently been ignored and even neglected. Jacobson (2007) captures it best when stating that:

> research in knowledge transfer and exchange has generally been more focused on using theory to explain, plan, or research transfer and exchange processes than on using it to understand knowledge and the relationships between knowledge and these processes. (Jacobson, 2007:120)

Apart from covering broader processes of knowledge transfer and utilisation, this study also includes a specific focus on both knowledge (factual versus practical, and codified versus tacit – Section 3.4) and utilisation (the different meanings thereof – Section 3.3).

## 1.4 AIM AND METHODOLOGY OF THE STUDY

As argued above, scientific knowledge is an important factor in the development and international competitiveness of a country's wine industry, and even more so for countries in the newer wine regions of the world. In order for South Africa to effectively compete with other wine industries in the global market it needs to use the best of current knowledge available, to ensure that it produces quality wines that can satisfy consumer demands and expectations. However, it is unknown to what extent South African winemakers are using

knowledge based on science and research, where and how they obtain their knowledge, and how new knowledge is treated against a winemaker's experience and existing practice knowledge. These are broad questions to be answered through the study. The specific research questions are the following:

- What are the sources of knowledge of South African winemakers? What sources do they regularly engage in and which do they regard as most important to their practice? Are there any natural groupings of knowledge sources?
- Can the sources easily be separated into, for instance, factual and practical knowledge? What types of knowledge characterise the knowledge sources of winemakers?
- What routes of knowledge transfer can be observed in the case of winemakers?
- What forms of utilisation or uptake are associated with scientific research findings as a representation of factual knowledge? What is the inter-relation between the different forms of utilisation of scientific research findings in winemaking?
- What cellar based and winemaker specific factors are associated with the different knowledge sources and utilisation types?
- What are the elements of practical knowledge in winemaking?
- What is the relation between the different knowledge sources in winemaking? What sources are first consulted and why?
- What other insights emerged with regard to the different sources of knowledge and their use?
- What recommendations can be provided with regard to the development of a model of knowledge utilisation for the winemaking industry, based on current international developments in the broad field of knowledge uptake?

The research questions are answered through data collected as part of a mixed-methods design. The latter involves both a web-based survey of about 200 winemakers and individual interviewing of six winemakers and three wine consultants. In addition, a literature study is provided, which presents insights from the diverse literature on knowledge utilisation, indicating how a selection of elements from the different perspectives can guide a study of the knowledge utilisation of winemakers

## 1.5 OUTLINE OF THESIS

The thesis is structured as follows:

Chapter 2 ("The wine industry in South Africa") discusses different conventions of wine quality and provides a brief history of the South African wine industry, and its struggle to produce quality wine. The current size, structure and product flow of the South African wine industry is also highlighted. Additional attention is devoted to the role of scientific knowledge in the wine industry, with specific reference to quality, followed by a discussion of local organisations and initiatives that facilitate knowledge creation and transfer in the industry.

Chapter 3 ("Perspectives on knowledge utilisation") highlights the relevant literature that can provide a background to a study of knowledge utilisation by practitioners. This includes a broad historical overview of knowledge utilisation as an area of study and generic models of knowledge utilisation that evolved over time. The meaning of both knowledge and utilisation is also explained, in line with the narrow conception of knowledge utilisation. The chapter has a special focus on evidence-based medicine (EBM), as it is also practitioner based, given its aim to base clinical practice and decision-making on the best available research evidence. Increasingly, however, EBM has become absorbed by the broader knowledge translation (KT) movement, and insights from the KT movement are also highlighted.

Chapter 4 ("Research design and methodology") is faithful to its title and discusses the execution of the survey and interviews, which includes instrument design, selection and general procedures.

Chapter 5 ("Sources of knowledge of winemakers") presents the results of the web-based survey. This includes the demographics of the winemaker respondents, as well as the extent to which they use a variety of knowledge sources, the relative importance of the different sources and the underlying structure of the sources (i.e. which sources group together). The groupings of knowledge sources (refer to as knowledge source components) are related to selected demographical variables.

Chapter 6 ("Aspects of knowledge use of winemakers") highlights different styles of knowledge application in winemaking, followed by a comprehensive analysis of the forms of utilisation associated with the uptake of scientific research findings. A discussion is devoted to intuition, sense-impressions and experience as elements of practical knowledge. The chapter also explores winemakers' preference for and order of use of knowledge sources,

together with a profile of the knowledge sources of winemakers who are most frequently contacted by their peers for advice.

Chapter 7 ("Towards a model of knowledge translation for winemakers") concludes the study by proposing a model of knowledge translation for the local wine industry, and also summarises the contribution of the study.

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# Chapter 2

# THE WINE INDUSTRY IN SOUTH AFRICA

## 2.1 INTRODUCTION

International convention classifies South Africa as a new world producer of wine, a label that the country shares with four other wine producing countries in the southern hemisphere, namely Argentina, Australia, Chile and New Zealand, as well as with the USA in the northern hemisphere. The opposite of "new world", of course, is "old world", a label used to refer to traditional wine producing countries in Europe, specifically France, Germany, Italy, Portugal and Spain but also Bulgaria, Greece, Hungary and Romania.

Until the late 1980s new world wine producers presented no real threat to their old world counterparts, as the first-mentioned mainly produced low quality bulk wine and, in the case of South Africa, also distilled a significant portion of each vintage in an attempt to remove market surpluses. Since the 1990s, however, new world producers have increasingly entered the medium and higher quality levels of the international wine market. According to Cusmano, Morrison and Rabellotti (2009) a number of supply and demand factors account for the emergence of new world wines in the international market:

> On the supply side, a process of technological modernization and pervasive organizational change has been spurred by consistent investment and research effort in the new producing countries and supported by the establishment of specialized research institutions. The demand side has also been important in the wine industry's evolutionary trajectory, with New World players being particularly responsive to changes in wine consumption habits across the world, and aligning emerging scientific approaches and institutional building efforts with their branding and marketing strategies. (Cusmano, Morrison & Rabellotti, 2009:4)

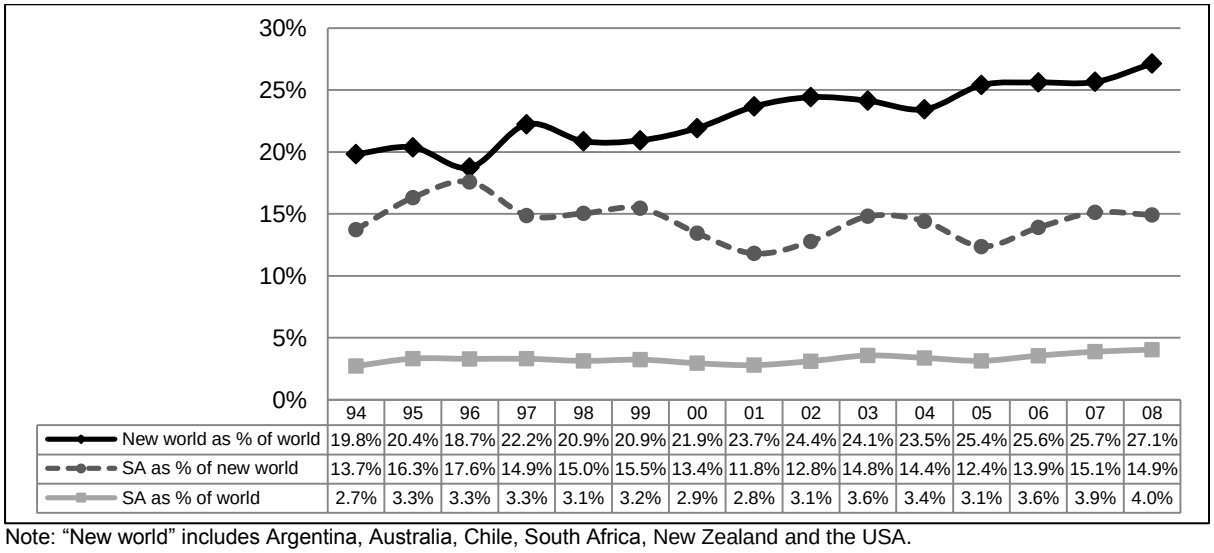
Global customer markets increasingly prefer new world wines, based on the "perception that it offers uniqueness, value for money, quality and innovative blending" (Aylward, 2003:33). It is therefore not surprising that the share of wine produced by new world countries has been growing since the mid-1990s, from just below 20% in 1994 to 27% in 2008 (Figure 2.1).[1] South Africa's share of wine among new world producers, however, has been fluctuating. After peaking at about 18% in1996, the figure systematically declined to 12% in 2001 before climbing to almost 15% in 2003, whereafter it was followed by another decline and

[1] Although new world wine producers increased their share of global wine production and exports during the 1990s their share of global scientific output in wine research over the same period was below the average of all wine producing countries. The number of scientific publications by new world countries nevertheless increased in absolute terms. In the case of South Africa, for instance, the number of publications increased from 29 to 38 between 1991-1995 and 1997-2001, representing a growth of 31%. The latter is significantly below the global average growth of 74% (Glänzel & Veugelers, 2006).

eventually reaching the 15% mark again in 2007/08. Overall, South Africa's share of all wines produced globally is 3.7%, according to figures for 2010 (SAWIS, 2011).

Moreover, as shown in Figure 2.2, South Africa produced about 1.1 billion litres of wine in 2008, which represents a significant increase over the 720 million litres produced in 1994. Around 2003/04 South Africa overtook Germany in terms of total volumes of wine produced while South Africa, in turn, was surpassed by Australia in 2001. South Africa is currently the seventh largest wine producing country in the world. Total wine production by the two major players in the world, namely Italy and France (which both represent old world countries), appear to be on a downward trend. The USA is leading the group of new world wine producers, with 2.5 billion litres of wine in 2008, followed by Argentina which produced about 1.5 billion litres in that same year. Although South Africa is currently ranked fourth among new world producing countries its overall position is nevertheless remarkable as the country was a late (re-)entrant to the international wine market, in the light of its decades of international isolation under the previous political dispensation.

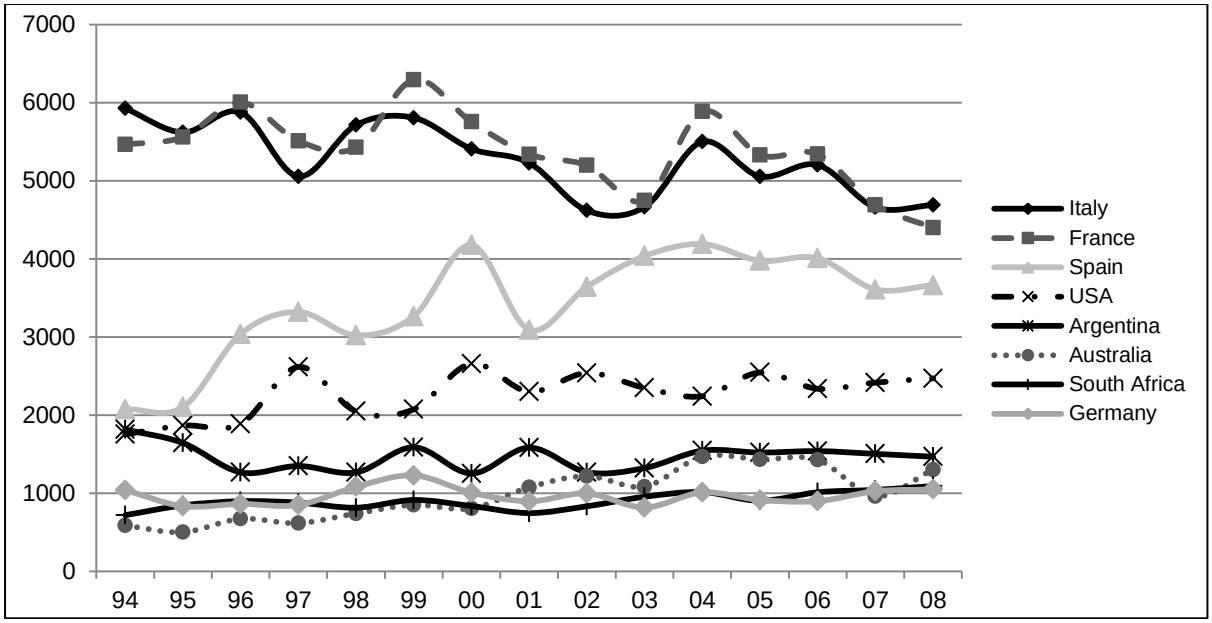
**Figure 2.1: International wine production with specific reference to the shares of wine produced by South Africa and new world wine producers, 1994 to 2008**




| | 94 | 95 | 96 | 97 | 98 | 99 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| New world as % of world | 19.8% | 20.4% | 18.7% | 22.2% | 20.9% | 20.9% | 21.9% | 23.7% | 24.4% | 24.1% | 23.5% | 25.4% | 25.6% | 25.7% | 27.1% |
| SA as % of new world | 13.7% | 16.3% | 17.6% | 14.9% | 15.0% | 15.5% | 13.4% | 11.8% | 12.8% | 14.8% | 14.4% | 12.4% | 13.9% | 15.1% | 14.9% |
| SA as % of world | 2.7% | 3.3% | 3.3% | 3.3% | 3.1% | 3.2% | 2.9% | 2.8% | 3.1% | 3.6% | 3.4% | 3.1% | 3.6% | 3.9% | 4.0% |

Note: "New world" includes Argentina, Australia, Chile, South Africa, New Zealand and the USA.
Source: Calculated from data table in AWBC (2009:5)

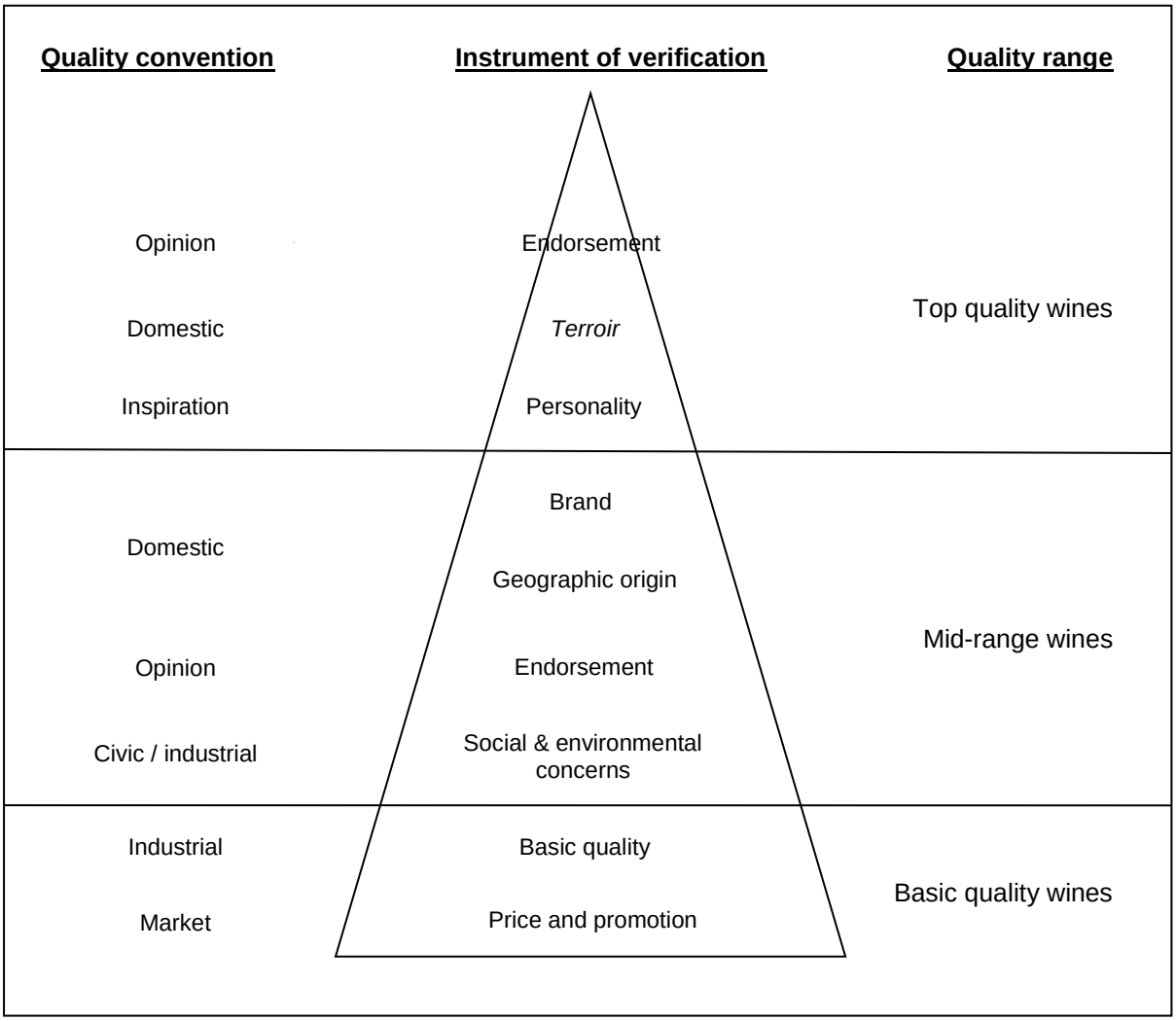
**Figure 2.2: Volumes of wine produced (million litres) by the eight largest wine producing countries in the world, 1994 to 2008**




Source: Calculated from data table in AWBC (2009:5)

The joint reading of Figures 2.1 and 2.2 also implies that the South Africa's wine industry is too small to dominate the global wine business. Still, the country's wine industry has the potential to make significant inroads into select niche markets. Globally, consumers are trading up from ordinary table wines to quality wines (SAWB, 2003a). It is in these upper quality segments that the South African wine industry ultimately hopes to favourably compete, as these segments are also the most lucrative in terms of economic returns. Although better quality wine tends to be associated with higher price points, price alone is not the only indicator of wine quality. The notion of quality in wine is not straightforward but multi-layered. Ponte (2007) uses a three-tier pyramid to capture perceptions as far as wine quality is concerned, which is shown in Figure 2.3 below.

**Figure 2.3: End-market quality convention in relation to the quality pyramid of wine**




Source: Ponte (2007:18, Figure 2)

Ponte's pyramid broadly distinguishes between top quality wines, mid-range wines and basic quality wines. For each of the three segments there are certain "instruments" to verify quality.

- Top quality wines, for instance, are perceived as such because of endorsements by renowned wine judges or critics, or listing in highly acclaimed publications. Another factor in the perception of top quality is *terroir*, which relates to the uniqueness of soil and micro-climate in a particular vineyard, and its systematic cultivation and refinement to render consistency. The unique "personality" of a wine or actor or activity involved in the making of the wine (e.g. winemaker, vineyard, cellar, label, history) is also an important factor in the perception of high quality.
- Mid-range wines are characterised by a complex interaction between a number of factors, particularly brand recognition and geographic origin. Brand names and

specifications of the place of origin (which is broader and more diverse than *terroir*) together with indications of a single variety are often the means by which information about quality is signaled to consumers. Endorsements by wine critics are still relevant but not as important as in the case of top quality wine. Social and environmental considerations, such as "organic" also play a role in the evaluation of quality in this segment (Ponte, 2007).

- Basic quality wines are about price (less than £5 in Europe or €7 in other parts of Europe) and promotion, meaning that the quality agenda is set by retailers. However, the core determinant of quality in this range is the meeting of basic quality elements, and here retailers specify a number of specifications, including chemical tests and basic tasting procedures (Ponte, 2007). Often these basic intrinsic quality elements are defined in fairly simple and straightforward terms, namely "clean wine, with no faults, and with homogeneous characteristics" (Ponte & Ewert, 2007:57).

In the past, the production of even basic quality wines at times had been a major challenge in the South African wine industry, as to be seen in the next section (2.2), which sketches a brief history of the industry. The historical overview is followed by a short summary of the current size, structure and product flow of the South African wine industry (2.3). The last section (2.4) looks at the role of scientific knowledge in the wine industry, with specific reference to quality, and also refers to local organisations and initiatives that facilitate knowledge creation and transfer in the industry.

## 2.2 BRIEF HISTORY OF THE SOUTH AFRICAN WINE INDUSTRY

The first vines on South African soil were planted around 1655-56 by Governor Jan van Riebeeck and three years later, in 1659, the first wine was produced from Cape grapes. Two subsequent events in those early years established the Cape Colony's potential as a future wine producing region: firstly, the planting of some 100 thousand vines by Governor Simon van der Stel in 1680 in the Constantia valley and, secondly, the emigration of a large number of French Huguenots to the Cape Colony in 1688, who settled mainly in the Franschhoek valley and brought with them some specialised winemaking skills (www.wosa.co.za).

The industry however only reached maturity between 1810 and 1820, when wine became the most important export commodity of the Colony, which at that time was under British rule (Vink, Williams & Kirsten, 2004). Wine accounted for about 90% of the Colony's export. Britain was the largest export market, mainly because of imperial preference policies that

significantly reduced the duties payable on Cape wines. These policies were abolished in 1825. As a result, exports to Britain dropped to 75%, thereby plunging the industry into depression. Although there were a few periods of recovery, more challenges followed which include the 1860 treaty between Britain and France that favoured French wines for British import.

All in all it meant that local demand alone could not absorb the surplus supply of wine. Moreover, with few exceptions, the wine produced was of doubtful quality. Wine farmers, in an attempt to rectify matters, organised themselves into co-operative structures, such as the South African Winemakers' Association (*De Zuid-Afrikaanschse Wijnbouwersvereeniging*) in 1877, and the Paarlberg Wine and Brandy Co. Ltd (*Paarlberg Wyn- en Brandewynmaatskappy*) in 1885. Both of these collapsed within a period of years. During this period wine farmers, together with wheat farmers, also politically campaigned for the abolishment of excise taxes. A subsequent Committee of Inquiry into matters, in 1905, expressed concerns about the quality of wine. Government provided some support in the form of loans to create nine co-operative cellars to improve the quality of the produce. Another development was the formation of the Cape Wine Farmers and Wine Merchants Association (CWFWMA) in 1907. Still, surplus production continued and even expanded as lucerne farmers from the inlands also started to plant vines, as the need for lucerne was significantly reduced with the collapse of the ostrich industry (Vink, Williams & Kirsten, 2004).

Moreover, wine farmers felt that they had to protect their interests and negotiate their price for distilling wine, as it was believed that wholesalers were about to exploit farmers (Garrett, 1995). The president of the CWFWMA, Charles Kohler, therefore initiated the establishment of a co-operative of wine and brandy producers, that "would regulate the prices at which vine products were sold to the trade … by controlling the supply of grapes and wine" (Vink, Williams & Kirsten, 2004:230). This initiative materialized in 1916, with the creation of the Co-operative Winemakers Association of South Africa (KWV – *Ko-operatiewe Wijnmakersvereeniging van Zuid-Afrika*). The latter was formally registered as a company in 1918 and later, in 1923, as a co-operative (Vink, Williams & Kirsten, 2004). Specifically, KWV members

> … had to sell all their wine through KWV and contribute a levy of 10 per cent on their sales. KWV would declare an annual 'surplus', which it would remove from the market. Some 90 per cent of the wine farmers in the Cape signed the constitution of KWV by the end of 1917. They insisted that they should not be prevented from planting more vines … A few Stellenbosch farmers and most of the Constantia farmers refused to join. They argued that they had no need for such an institution, as they were producing a superior

> quality wine. Distillers and merchants and so on were opposed to the scheme from the outset. (Vink, Williams & Kirsten, 2004:230)

Eventually an agreement was struck between the KWV and the trade (i.e. merchants and manufacturers), whereby the merchants agreed that they would buy only from the KWV and the manufacturing wholesalers that they would distil and store the surplus declared by the KWV. In return, the KWV would not participate in any trade in Africa south of the equator. However, after battles in court with the Constantia farmers and with merchants withdrawing from the agreement, the KWV turned to Government to request a scheme of compulsory co-operation. The latter was granted in the form of the Wine and Spirits Control Act 5 of 1924, whereby the KWV was given powers to fix the minimum price of any wine for distilling, and also to oversee and approve such sales (Vink, Williams & Kirsten, 2004).

In essence, the KWV became a semi-government body through ratification of the abovementioned act, which allowed the KWV to annually determine a minimum amount to be paid to its farmer constituencies for their distilling wine. The farmer members received the monetary amount irrespective of the quality of their produce. At that stage “good” wine (i.e. wine not used for distilling) was no significant factor because the South African alcoholic market was largely about distilled spirits (mainly brandy) and beer. Since the KWV had the power to fix the price of distilling wine it was believed that the price of good wine would automatically stabilize as well. However, this did not happen as the prices of good wine fluctuated significantly (Garrett, 1995).

Within this context, the demand for good wine remained far below the level of production, resulting in increasing shares of the vintage being earmarked as “surplus” wine for distilling. Moreover, wine producers had little incentive to increase the quality of their wines. It made more sense to them, from an economic point of view, to increase their yields with standard and trusted varietals, as the KWV was under obligation to pay them the fixed amount for their produce, irrespective of quality. Production of quality wine was restricted mainly to the Contantia, Stellenbosch and Paarl regions. Thus, the policy and mechanisms of the KWV facilitated over-production and minimalized quality, a fact that was also recognized by the Wine Commission that was appointed in 1935 by the Minister of Agriculture to investigate objections against the KWV’s power over the industry. As it turned out, the Commission ended up strengthening the monopoly of the KWV rather than reducing it. According to Vink, Williams and Kirsten:

> The Commission agreed that the buying of the surplus by KWV encouraged expansion of production and that a producer cooperative should not exercise statutory control over an

> industry. It decided that the only solution to the failure of partial control was to apply a comprehensive system of statutory control. This would have to fall under KWV, who had invested in the necessary cellar and distilling capacity. (Vink, Williams & Kirsten, 2004:233)

A direct outcome of the Commission was the introduction of the Wine and Spirits Control Act 23 of 1940, which, in effect:

> … empowered KWV to set an annual minimum price for 'good wine', and for 'quality wine' of which wholesalers had to buy a minimum percentage … Thus, KWV had maintained and extended its control of the industry, acquired the powers to set prices for distilling good and quality wine, protected its effective monopoly of the export market and secured, in principle, powers to limit production. (Vink, Williams & Kirsten, 2004:233)

Thus, the KWV was granted power to also fix the price of good wine to control production and marketing thereof. Moreover:

> All transactions between merchants and producers had to be KWV approved, with payments for wine to be paid through the latter. No person was allowed to produce wine except by KWV permit which necessitated that the producer should have approved cellar equipment, tanks and vats. Also KWV was empowered annually to recommend fixing the percentage of each farmer's vintage not to be sold on the local market. Thus, by processing this supply itself, KWV was taking control over production. (Garrett, 1995:48)

It was during the time of World War II that the demand for brandy increased, and since rebate wine[2] and distilling wine are the building blocks of brandy, increased brandy production assisted in the removal of market surpluses. Also, since the price of natural good wine started to increase farmers started to produce more thereof, which meant that they had to pool their resources as they did not have access to cellars. As a result, the number of co-operative cellars significantly increased, from six in 1939 to 46 in 1955. Moreover, with the advance of new cellar technologies, such as cold fermentation which was first introduced in South Africa in 1959, even more co-operatives were created as farmers had to find methods to share technology costs (Vink, Williams & Kirsten, 2004).

Over the next decades the KWV would continue to unilaterally determine the prices for distilling and good wines. Every year the KWV set a minimum price for good wine, which was then submitted to the Minister of Agriculture for approval. In the case of distilling wine, the KWV estimated at the start of every year what portion of the crop would be declared as surplus. If, for instance, the surplus was declared at 24%, then the producer had to provide 24% of the entire crop to the KWV without any compensation. The remainder of the crop the

[2] Rebate wine is the base wine from which brandy is made and therefore also referred to as "wine for brandy". It is wine specifically prepared for double distillation in a pot still and then, as distillate, matured for a period of at least three years in oak casks with a capacity of not more than 340 litres (WineLand, 2010:484).

producer could sell to merchants but for no less than the minimum price for distilling wine, which was also fixed by the KWV (Wissing, 1969).

In 1950, further regulation introduced planting quotas, thereby specifying legal limits to the number of vines a farmer might grow. More provisions for planting quotas were introduced in 1960 as part of Act 47 of 1957, which encouraged even higher levels of production as the quotas exceeded existing output and were expanded ahead of supply (Garrett, 1995; Vink, Williams & Kirsten, 2004).

The planting quotas and fixed prices protected the income of farmers but essentially removed competition among buyers as buyers had no bargaining power to negotiate for the best possible price. The wholesalers' dilemma was that only high and medium priced natural wines were profitable but the crops to produce these were restricted under the KWV's monopoly, with crops for low priced wines being in the vast majority. To address these issues the wholesalers would have had to intervene in production which was impossible as it was monopolized by the KWV. Moreover, the wholesalers turned to retailers as an outlet for their wines because they could not sell directly to the public. The Cape Wine and Spirits Institute (CWSI) was formed in 1967, in opposition to the KWV, to defend the interest of the trade. The state of affairs also left the about 40 wholesalers with little choice but to join forces to eventually become four organisations of wholesalers: Stellenbosch Farmers' Winery (SFW)[3], Distillers Corporation, Gilbeys Distillers & Vintners, and Douglas Green Bellingham. Two of these, SFW and Distillers, controlled the market for wines and spirits, respectively. Over time the latter two organisations would also be involved in a number of heavy disputes[4], often requiring political intervention (Garrett, 1995; Vink, Williams & Kirsten, 2004).

[3] Stellenbosch Farmers' Winery was established in 1935 by Williams Charles Winshaw, the pioneer of natural wine in South Africa. He arrived in the country in 1899 from America. Having a medical background, he strongly believed in the beneficial aspects of natural health for human health and concentrated his effort on the making of natural wine at his co-owned far, Oude Libertas (Garrett, 1995).

[4] It started in 1960, when South African Breweries (SAB), the leading brewery in South Africa, indirectly gained control of SFW by taking over the Stellenbosch Wine Trust, which at that stage controlled SFW. In 1973, Anton Rupert's Rembrandt, in an attempt to challenge SAB's control of the beer market, acquired control of the Inter-Continental Breweries (ICB). SAB, however, in 1975, received permission from government to acquire full control of SFW. Rembrandt responded in 1978 by acquiring all the shares in both ICB and Distillers Corporation (then called Oude Meester). The so-called "beer war" was resolved in 1979, when the beer interests were removed from both SFW (on the SAB side) and Oude Meester (on the Rembrandt side). It was then proposed that SFW and Oude Meester would be amalgamated into Cape Wine & Distillers (CWD), and that Rembrandt, SAB and the KWV would each hold 30% of shares in CWD. However, Rembrandt sided with the KWV and the two parties formed a joint holding company, thereby becoming majority shareholders in CWD and thus controlling it. Most of these developments were declared unlawful by the Competition Board in 1982. However, a cabinet committee chaired by the Prime Minister and with representatives from KWV and Rembrandt as consultants, rejected the decisions of the Competition Board (Vink, Williams & Kirsten, 2004:235-236). Only in 1988 would government announce the separation of CWD back into SFW and Oude Meester, with no change in ownership. In 2000, however, SFW and Oude Meester (then Distillers Corporation) amalgamated again to form the current Distell, without any objection from the Competition Commission (Vink, Williams & Kirsten, 2004).

Informal actions, in 1963, by the international community against South Africa's policy of racial segregation, started to reduce international export markets, particularly markets for fortified wines and brandy. This was exacerbated by the entry of Great Britain (South Africa's greatest export market) into the European Community in 1973 and the onset of formal sanctions in 1985. Significant declines in international exports then became evident. Against this, wine production in South Africa still continued to increase even though domestic demand also stagnated (Vink, Williams & Kirsten, 2004). Surplus production were thus at the order of the day.

When political changes dawned on South Africa in the early 1990's, the wine industry was highly regulated and characterized by planting quotas; vineyards of co-operative cellars largely relying on trusted, high-yielding cultivars; guaranteed minimum prices for grapes delivered; mass production of low quality (cheap) wine for the domestic market; surplus removal through distillation and other methods (e.g. grape concentrate and juice production); and isolation from global wine trade and international export markets. However, it was also during the 1990s that the monopoly and regulatory authority of the KWV became eroded. In 1991 a group of estate producers formed an action group to challenge the system of planting quotas and the fines associated with it, resulting in the KWV eventually suspending quotas. Co-operatives were most affected by the suspension as they suddenly had to regulate production. Whereas they previously paid their members for their produce in terms of fixed rates and planting quotas, they now had to carefully discriminate in terms of the prices paid for produce according to cultivar and quality (Vink, Williams & Kirsten, 2004). The minimum price for good wine was also suspended in 1995, shortly after South Africa's first democratic election in 1994 and re-entering into international markets.

The lifting of sanctions by the international community presented challenges that the South African wine industry was not quite prepared for. The industry immediately had to compete with the industries of other new world wine producing countries and these were predominantly market-driven and innovation-orientated, everything that the typical South African wine producer was not. In fact, the other new world producers were increasingly gaining new global market share with new grape varieties and new wine blends, which meant that they were non-traditionalist with a continued focus on quality combined with brand building and customer-responsive wine styles (SAWB, 2003b).

That being said, in South Africa, estate farmers and winemakers generally were considered more innovative than co-operative producers and winemakers, even during the period of international sanctions. A prominent example is Danie de Wet, from De Wetshof estate in

Robertson, who, through own efforts, played a leading role in the importation of Chardonnay clones into South Africa in the 1980s. The latter clones were unavailable to South African farmers due to international boycotting (Garrett, 1996). Estates were traditionally also the high-priced producers of natural wines. During the heydays of international boycotting and sanctions, roughly from 1978 to 1992, these producers were better off as they did not have any international competition in the South African market. This means that they could get the price that they want, especially if they did their own marketing. They were therefore in a financial position to experiment with the latest technology and methods (Garrett, 1995). Nevertheless, following the lifting of sanctions, wine producers in South Africa were presented with a number of opportunities and challenges:

> After sanctions, some farmer's early action included exporting almost all their product. Importers were prepared to try anything new, as this was to them. It was not a concerted effort by SA's whole wine trade – far from it – but it was distinctly noticeable. Some farmers made mistakes because they had little knowledge of marketing, and of export requirements elsewhere in the world. Some bulk exports did not help South Africa's quality name … The huge change brought about by lifting of sanctions caused others to feel it was time to get out of the wine business because they could sell their farms profitably. In other cases, fathers who had held on during the restricted years handed over to their sons, who had in many cases trained abroad. (Garrett, 2002:65)

The aftermath of South Africa's re-entering into the international market (1994-1997) was characterised by a "honeymoon" period, where the novelty of South African wine allowed it to flourish on the international market, irrespective of poor intrinsics of some of the wines exported. This period did not last long and quality issues had to be attended to (Ponte & Ewert, 2007). The global market demanded medium-priced wines of good quality that set itself apart through branding and indication of region (no longer cheap bulk wine of low quality). Many co-operative cellars shifted to bottled production, meaning bottling were also included as part of their operations, in addition to producing bulk wine for wholesalers for distribution. Marketing divisions have also been added and direct sales introduced. On the other hand, the lifting of trade sanctions together with the deregulation of the local industry resulted in cheaper imports of particularly distilling wine, which historically has been an important product and source of income of co-operative cellars. These developments, according to Ewert (2003), resulted in a situation of winners and losers during the early 2000s:

> Less than a decade after the industry entered the international market, the majority of South African cellars – especially the private ones – have a stake in the exporting and are benefitting from it, either because they were well positioned when sanctions fell away, or because of successful adaptation to international price regimes. They are not only benefitting from revenues in hard currencies, but also from the exposure to new ideas, innovative practices and marketing networks … At the same time, they have little

> sympathy for the co-operatives which find themselves unable to adjust. (Ewert, 2003:167)

Some co-operatives applied for a change in business registration status, namely from co-operative to company. The KWV also announced in 1996 its intention to convert from a co-operative to a company. The conversion was delayed by the Minister of Agriculture who first appointed a committee to determine the implications thereof on the future regulatory framework of the industry and whether any of the assets related to KWV's past regulatory position would need to be redistributed to benefit the whole industry. In early 1997 the commission reported that it supports deregulation and that a representative industrial body be created to take control of remaining statutory powers. After an investigation that established that the KWV had benefitted substantially from the pooling mechanism, the KWV was allowed in 1997 to convert to a company (operating as a producing wholesaler)[5]. After further negotiations the KWV:

> … agreed to contribute R200 million over ten years and to provide services, valued at R227 million for five years, to the South African Wine Industry Trust (SAWIT), directed by nominees of the Minister and KWV. SAWIT established a Business Committee (Busco) and a Development Committee (Devco). The main function of the former is to provide funding for groups such as Wines of South Africa (the exporters' association), Winetech (the research funding arm of the industry), SAWIS (providers of information and systems services) and Vinpro (the industry extension service). Devco, on the other hand, is charged with responsibility for promoting 'development', including land reform and facilitating entry of new farmers who had been racially excluded in the past. (Vink, Williams & Kirsten, 2004:237)

The South African Wine Industry Trust (SAWIT) was therefore established in 1999, with a board of trustees appointed by the Minister of Agriculture and the KWV. The board oversaw the funds paid by the KWV. The dual responsibilities of the board, namely research, technology and innovation development, and community development, were eventually institutionalised in the form of two non-profit companies, the Wine Industry Business Support Company (Busco) and Wine Industry Development Company (Devco). As said above, Busco assumed responsibility for financing the Wine Industry Network of Expertise and Technology (called Winetech – see Section 2.4.1) which, in 1999, initiated the Vision 2020 agenda. The latter outlines futuristic designs for prosperity and global competitiveness of the wine industry, based on industry-wide consultations (SAWB, 2003b:i). The agenda also signaled the first indication that the industry was about to shift from being production-orientated to becoming more market-directed (Ponte & Ewert, 2007). In essence, the Vision 2020 agenda

[5] In 2002, the KWV split into two separate entities: a commercial company, KWV Limited, and Wijngaard Co-operative, which provides services to and looks after the interests of producers. A few years later, in 2009, KWV Ltd unbundled its indirect shareholding in Distell from its own operations and assets to become KWV Holdings (www.wosa.co.za)

for the South African wine industry can be summarised in the following credo (SAWB, 2003b):

- Be internationally competitive
- Change from being production and commodity driven to market-driven
- Develop “Brand South Africa”
- Handle wine, brandy, distillate and grape juice concentrate as specialised production entities and end all forms of cross-subsidisation
- Exploit South Africa’s wine ecology by developing *terroir*-based wine production
- Develop total value chain management
- Integrate total logistics and total quality management systems into industry practices
- Develop world-best business intelligence systems for the industry
- Invest in market-focused innovation, and link innovation with programmes of human development in the wine industry
- Institute ethical trade practices and meaningful social responsibility programmes throughout the industry
- Be a “good citizen” and support the development of a prosperous and fair South Africa by implementing strategies for affirmative action

Vision 2020’s aim was to design specific strategies for each of three sub-industries, namely drinking wine (good wine), wine distillates and brandy, and grape juice products (SAWB, 2003b). The implementation of Vision 2020, however, required an integrative structure that provides leadership to the industry and represents all stakeholders; a structure that was lacking at that time. Hence, the two main producing wholesalers, KWV and Distell, facilitated the formation of a South African Wine and Brandy Company (SAWB) to represent the total industry (Ponte & Ewert, 2007).

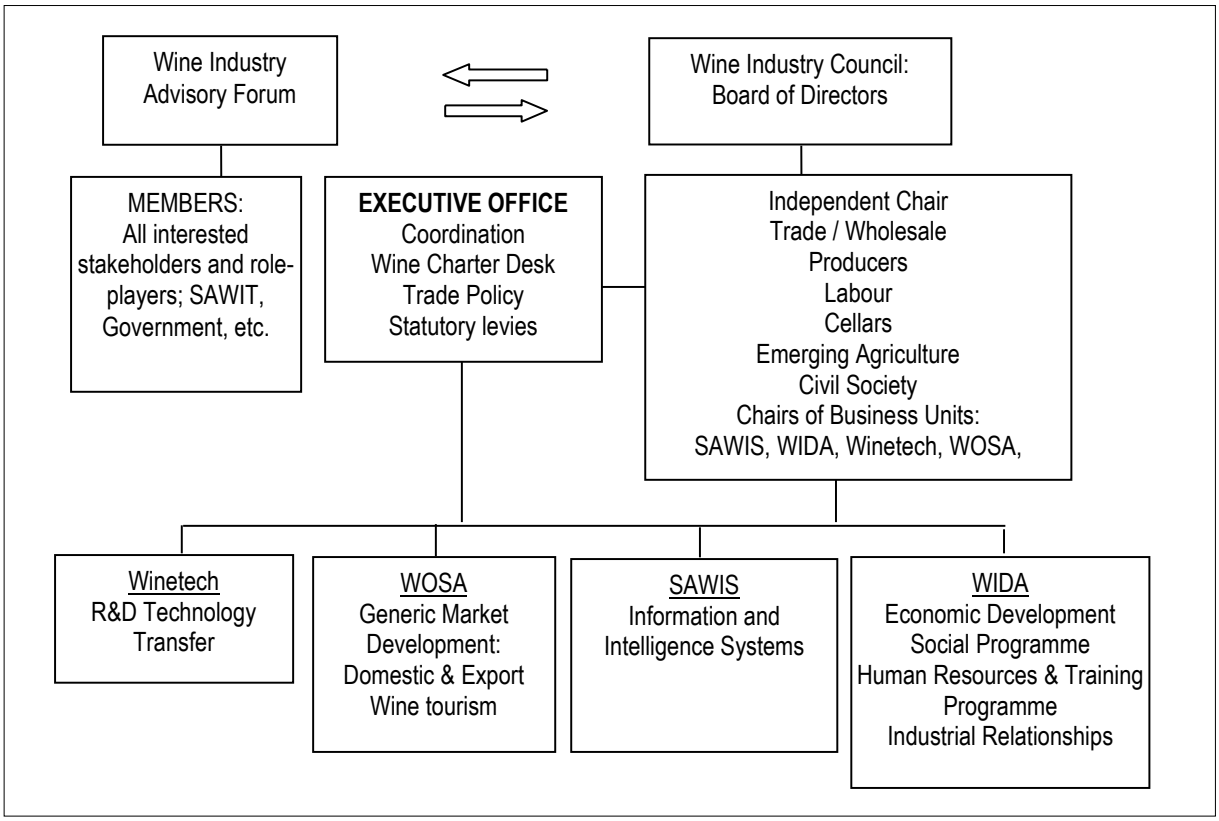
In 2002, the SAWB was registered as a non-profit company and became the representative and overarching body in the wine industry. Its board consisted of four stakeholder groupings or chambers, namely wine farmers, labour, cellars and trade (SAWB 2003b). The SAWB also prepared a strategic plan to achieve a “vibrant, united, non-racial and prosperous” wine industry (SAWB 2003a). The resultant Wine Industry Plan (WIP) consists of six strategic thrusts, each with its own industry programme. These are:

- Economic development and empowerment
- Social development and upliftment
- Human resources development and training
- Market development and promotion

- Knowledge and information development, and
- Technology innovation and transfer.

The SAWB was tasked to drive and manage the WIP, which essentially aligns the Vision 2020 agenda of the wine industry with the government's broader strategic plan for agriculture (SAWB, 2003a). In 2003, the WIP was accepted by the Minister of Agriculture as the strategic framework for co-operation and action in the South African wine industry (www.wosa.co.za). Three years later, in 2006, the SAWB was restructured into the South African Wine Industry Council (SAWIC) in an attempt to become "more representative". SAWIC thus became the new umbrella body in the wine industry, incorporating all industry stakeholders as its constituency members (see Figure 2.4 below).

**Figure 2.4: Organisational structure of the South African Wine Industry Council**




Source: Agri-Africa (2008:15), Figure 1

SAWIC's constituency included emerging agriculture, wine producers, labour, cellars, traders and wholesalers, and civil society. Representatives of the constituency, together with the chairs of the four SAWIC business units, formed the SAWIC board under the chairmanship of Professor Kader Asmal, a former Minister of Education. The business units comprised Winetech, Wines of South Africa (WOSA), South African Wine Information and Systems (SAWIS) and the Wine Industry Development Association (WIDA). Together these business

units accounted for five core functions, namely R&D and technology transfer (Winetech), market development and exports (WOSA), business intelligence (SAWIS), human resources development (WIDA) as well as socio-economic empowerment (WIDA). Lastly, the SAWIC organs also included an advisory body, the Wine Industry Advisory Forum. The latter involved a representative forum open to all wine interest groups, which regularly met to engage role players on policy and strategy matters (Agri-Africa, 2008).

The reason for referring to the organs and activities of SAWIC in the past tense is because the organisation was abruptly disbanded in 2008. The general perception is that this "well-intentioned project failed due to unnecessary politicisation of the process and through the unfortunate triumph of vested interest over best practice" (Ratcliffe, 2011). As a result, the wine industry is currently experiencing a leadership vacuum, without any clear indication as to who should be guiding the industry and in what direction. However, for those in the wine value chain – i.e. grape farmers, grape crushing cellars as well as wine merchants and wholesalers – it remains business as usual.

## 2.3 SIZE, STRUCTURE AND PRODUCT FLOW OF THE SOUTH AFRICAN WINE INDUSTRY

In 2010, there were 3,596 grape farmers in South Africa (primary grape producers in Table 2.1), who cultivated a national vineyard composed of 125,033 hectares, and delivered a total of 1.26 million tons of grapes to be crushed (SAWIS, 2011). As Table 2.1 also shows, not many of these grape farmers are large scale producers, given that 43% of them produce less than 100 tons of grapes. Moreover, not even 1% of grape farmers produce more than 5,000 tons of grapes.

Of the 1.26 million tons of grapes crushed in 2010, a wine/juice component of almost 985 million litres was produced, of which about 79% consisted of drinking wine (i.e. natural, fortified and sparkling), followed by 12% distilling wine, 4% rebate wine and 5% non-alcoholic grape juice and grape juice concentrate (SAWIS, 2011). These grapes were crushed by 573 cellars, the majority of them (86%) being private cellars (which include cellars on wine estates), followed by 9% of producer cellars (i.e. co-operative cellars).

As can be seen, private wine cellars are the largest category in terms of numbers. However, in terms of crushing activity the producer cellars are the most prominent. In 2010 the latter pressed almost 77% of the country's total wine harvest, and 32 of the 35 cellars (in Table 2.1) that pressed more than 10,000 tons of grapes in 2010 are producer cellars. On the other

hand, in terms of certified wine production, the producing wholesalers are more prominent as they were responsible for 59% of all certified wine[6] produced in 2010 (SAWIS, 2011).

**Table 2.1: South African wine industry structure, 2010**

| **Number of primary grape producers = 3596** | | |
|---|---|---|
| ***Breakdown of primary grape producers in terms of tons of grapes produced*** | | |
| **Tons** | **Count** | **Percentage** |
| 1-100 | 1542 | 43% |
| >100-500 | 1304 | 36% |
| >500-1000 | 415 | 12% |
| >1000-5000 | 329 | 9% |
| >5000-10000 | 6 | <1% |
| Total | 3596 | 100% |
| **Number of wine cellars which crush grapes = 573** | | |
| ***Breakdown of wine cellars in terms of cellar type*** | | |
| **Cellar type** | **Count** | **Percentage** |
| Producer cellars | 54 | 9% |
| Private wine cellars | 493 | 86% |
| Producing wholesalers | 26 | 5% |
| Total | 573 | 100% |
| ***Breakdown of wine cellars in terms of tons of grapes crushed*** | | |
| **Tons** | **Count** | **Percentage** |
| 1-100 | 265 | 46% |
| >100-500 | 151 | 26% |
| >500-1000 | 45 | 8% |
| >1000-5000 | 57 | 10% |
| >5000-10000 | 20 | 3% |
| >10000 | 35 | 6% |
| Total | 573 | 100% |
| **Number of bulk wine buyers = 100** | | |
| ***Breakdown of bulk buyers in terms of type of buyer*** | | |
| **Type of buyer** | **Count** | **Percentage** |
| Wholesalers (Incl. producing wholesalers) | 60 | 60% |
| Exporters (Buy wine for export only) | 40 | 40% |
| Total | 100 | 100% |

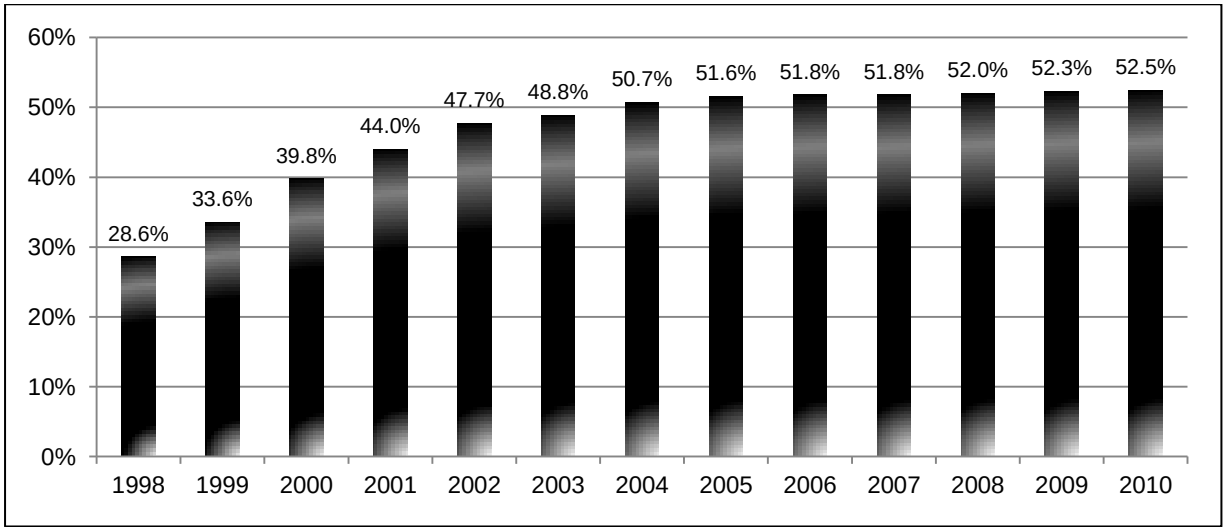
Source: SAWIS (2011)

In addition to local changes and developments, both grape and wine production in South Africa have also been shaped and influenced by various global trends[7]. This is reflected in

[6] Certified wine refers to wine that complies with requirements of the Wine of Origin Scheme. A certification seals on the bottle confirms that at the time of its assessment by the Wine and Spirit Board, the wine conformed to the prescribed standards and confirms claims with regard to origin, variety and vintage as indicated on the label (WineLand, 2010:485).

the shift away from standard high-yielding cultivars to a number of premium cultivars, which include Sauvignon Blanc, Chardonnay, Cabernet Sauvignon, Shiraz, Merlot and Pinotage. As the global demand for higher quality wines increased, South African wine producers expanded and replanted their existing vineyards with these six noble cultivars in order to render better quality products. According to Vink, Williams and Kirsten (2004), the six cultivars, in 1980, constituted only 6.5% of the national vineyard, compared to 12.5% of acreage in 1990. Subsequent figures for the period 1998 to 2010 are provided in Figure 2.5. By 1998, the six noble cultivars accounted for 28.6% of the total area under wine grape vineyards, which continued to increase to about 52% in 2005, whereafter it seems to have been stagnating. However, replanting with noble cultivars can lead to an initial reduction in quality (Brown-Luthango, 2007), with quality crops being produced only from five years onwards in the life of a vineyard. In South Africa, in 2010, only about 31% of all vines were older than 15 years. The proportion is even more drastic if red varieties are singled out: only 15% of all vines in this category were older than 15 years in 2010. The corresponding figure for white varieties in the same year was 42% (SAWIS, 2011).

**Figure 2.5: Combined share of six noble wine grape varieties as percentage of national vineyard, 1998 to 2010**




Source: SAWIS (2011); WineLand (2006, 2009, 2010)

Note: The six noble wine grape varieties consist of two white (Savignaun Blanc and Chardonnay) and four red (Cabernet Sauvignon, Shiraz, Merlot and Pinotage).

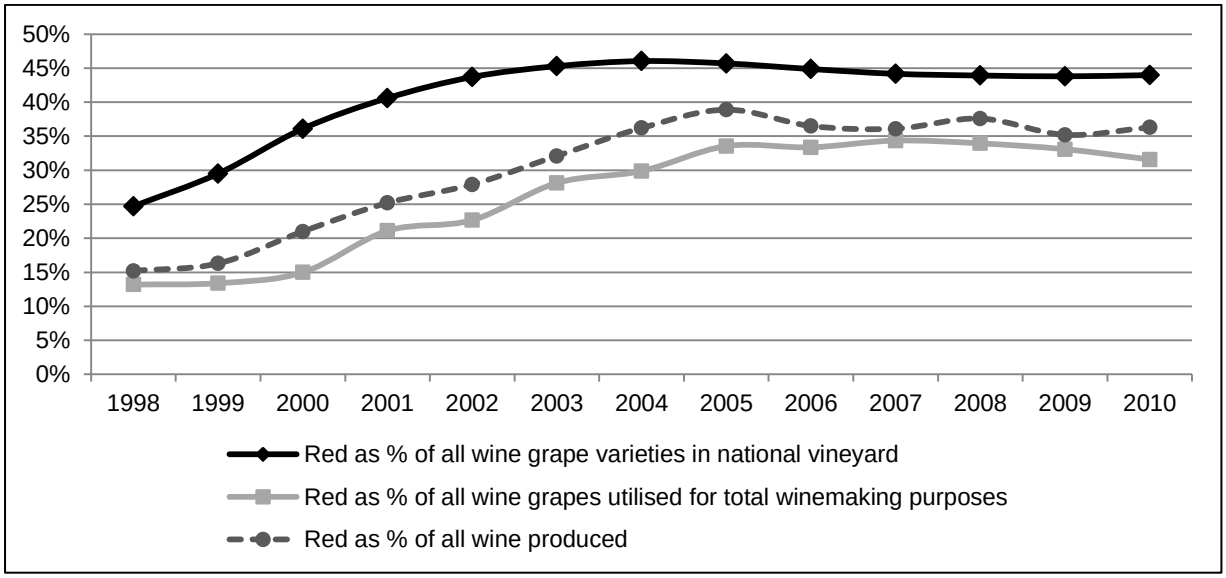
Another prominent feature of the South African wine industry is the significant shift towards red wine grape varieties and red wine production since the re-acceptance of South African wine in international markets. This is in response to shifting global consumer preferences, as red wine is believed to reduce the risk of cardiovascular disease and is also associated with

[7] The globalisation of winemaking can also be seen in the emergence of "flying winemakers". The latter are expert oenologists who hire there services to wineries around the world to provide quick solution to problems experienced as well as to assist with vineyard and winery development (Lagendijk, 2004).

a healthier lifestyle. Figure 2.6 shows three indicators of the growing importance of red grapes and wine in the South African industry. In 1998, red grape varieties constituted 24.7% of the national vineyard and systematically increased to 46% in 2005 whereafter it marginally declined to about 44% between 2007-2010. A figure of 18% for 1996 has been reported elsewhere (Conningarth Economists, 2009), which means that in the course of only two years (between 1996 and 1998) the planting of red grape varieties increased by almost 7%. Similarly, red wine as a percetage of all wine produced increased from 15% in 1998 to a maximum of 39% in 2005 whereafter it seems to be fluctuating between 35% and 38%. Although South Africa has increased its percentage of red grape varieties significantly, the current share of red wine grape varirities (44%) still does not compare favourably with other new world wine countries such as Australia, Chile and the USA (Figure 2.7), whose shares are markedly above 50%.

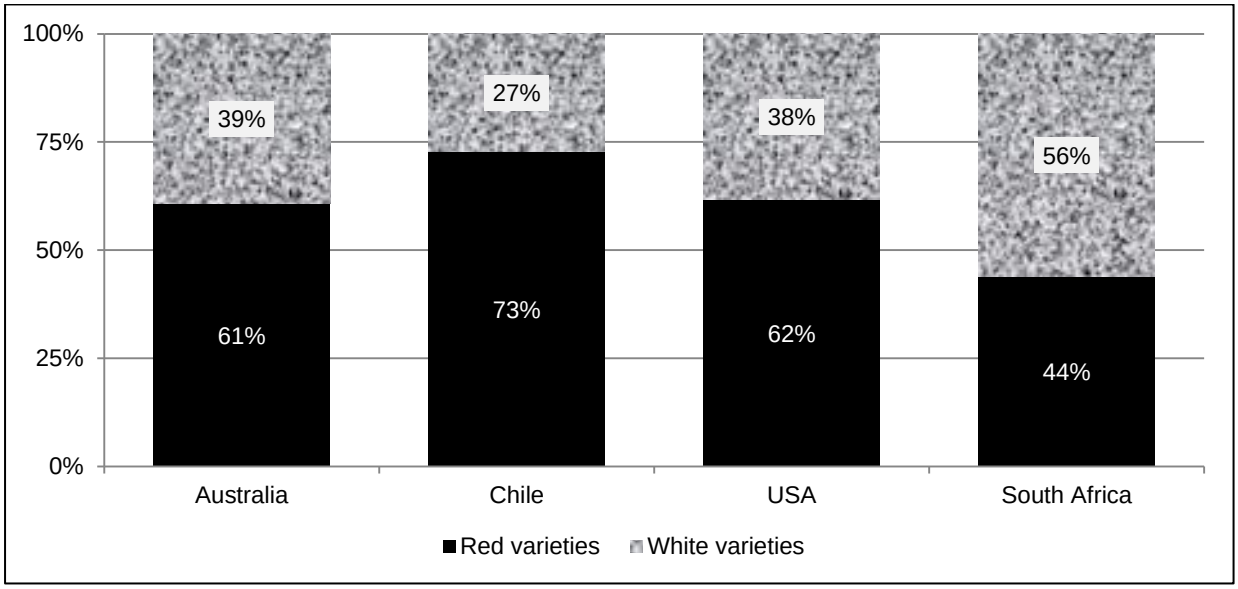
In 2004/5 a global red wine glut occurred, which means that South Africa's failure to produce sufficient reds actually became a blessing in disguise (Ponte & Ewert, 2007). A surplus production of red wine also occurred in recent years as the local demand was insufficient to meet the increased supply, which put downward pressure on producers' prices. As a result, South Africa had to intensify its international exports (Conningarth Economists, 2009).

**Figure 2.6: Three indicators illustrating the share of red wine grape varieties and red wine production in South Africa, 1998 to 2010**




Source: SAWIS (2011); WineLand (2006, 2009, 2010)

**Figure 2.7: Red wine grape varieties as percentage of all wine grape varieties in national vineyard, 2010 – South Africa versus three other new world wine producing countries**

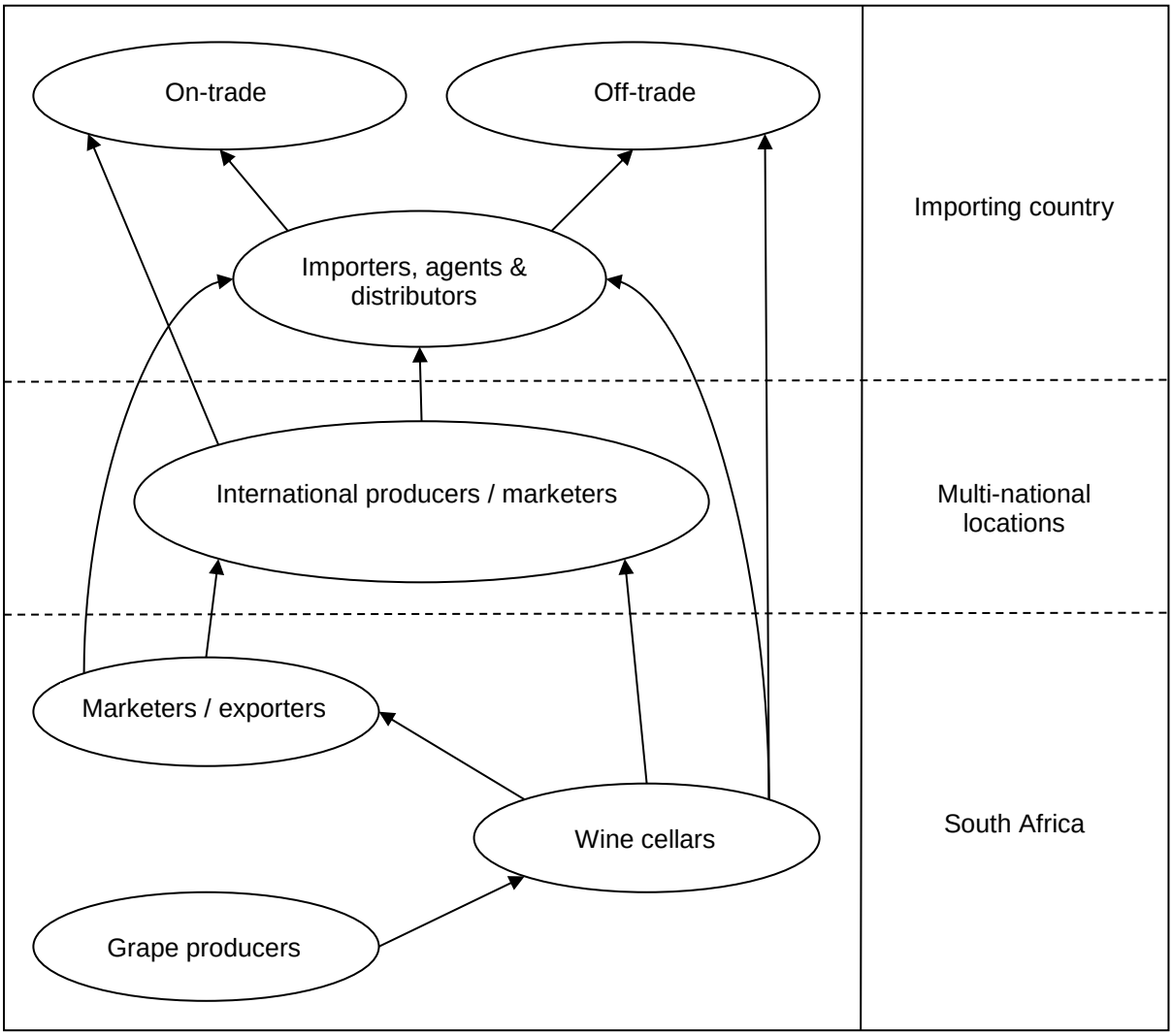



Source: SAWIS (2011)
Notes: Figures for Chile are for 2009

Returning to Table 2.1, there are 100 buyers of bulk wine in the country (2010 data), the majority of them are wholesalers, i.e. entities that sell wine in large quantities to retailers for resale to the public. The 100 wholesalers also include the 26 producing wholesalers that, apart from processing grapes, also buy wine in bulk from producer and private cellars.

Figure 2.8 provides an overview of the product flow of South African wine and the entities involved. A wine cellar (private or producer cellar) can use South African marketers and exporters as intermediaries who, in turn, take responsibility for international distribution in a number of ways, including selling of wine products to international producers, to international marketers or to country-specific importers and agents. The objective is to enter the on-trade international market (e.g. restaurants and bars) and/or off-trade international market (supermarkets, other shops and internet/mail orders). The on-trade market is more orientated towards higher quality wines and the off-trade market to lower quality wines although there are exceptions. South African cellars do not always operate via local marketers and exporters but may also be involved in direct sales of wine products to international producers, marketers and distributors. Wine cellars may also directly interact in off-trade activities (Ponte, 2007).

**Figure 2.8: Product flow of South African wine**




Source: Ponte (2007:15, Figure 1)

Lastly, South Africa currently exports about 49% of its wine (2010 figure), with Europe being the most dominant importer. Within Europe the United Kingdom (UK) is by far the most important recipient of South Africa's wine export. In terms of natural wine exports (i.e. drinking wine excluding fortified and sparkling wine), the UK accounted for 28.3% of the total litres of wine exported in 2010. Although the 2010 figure for exports to the UK is significantly less than the 40.2% recorded earlier in 2004, it is nevertheless well above the 19.5% of exports to Germany, the second largest importer of South African wine in 2010. Together with Sweden, the Netherlands and Denmark, these two countries (the UK and Germany), provided destinations for 70% of all South Africa's exported wine in 2010 (SAWIS, 2011).

## 2.4 SCIENTIFIC KNOWLEDGE AND KNOWLEDGE TRANSFER IN THE SOUTH AFRICAN WINE INDUSTRY

Innovation provides the leading edge in wine production, which includes the combination of the best oenological processes and equipment available with the best approaches to vine, soil and disease management, together with innovative product branding and marketing strategies (Aylward & Turbin, 2003). Ever-changing and more refined consumer preferences are creating a demand for multi-faceted innovation, of which scientific research is one facet together with product development, logistics and marketing strategies.

Knowledge generated through scientific research can assist both viticulture and oenological practices. In viticulture, for instance, scientific knowledge of vine canopy management techniques and fruit maturation development processes can be of value in the achievement of desired wine styles and so directly affect quality (Rotter, 2009). Similarly, in oenological or winemaking practice, which is the domain of this study, science provides the necessary knowledge to clarify the processes and factors that affect wine quality, resulting in the implementation of practices that can eliminate wine faults. Rotter uses the example of acetic acid bacteria. If the conditions in which these bacteria thrive are scientifically understood, they can be attenuated to reduce the impact of the bacteria and enhance wine quality. Moreover:

> Winemakers who are not aware of the mechanics of processes occurring in wine are at a disadvantage because they possess less control over the winemaking process. Knowing where potential faults lie and how to correct them, how to obtain specific stylistic goals, and how to produce quality wine consistently given certain changes in environmental factors, cannot successfully be accomplished without some understanding of the theory behind them. (Rotter, 2009)

It is therefore not surprising that the South African wine industry, immediately following its re-entering in the global market in the early 1990s, also started to invest in research and technology and technology transfer; specifically in creating an integrated R&D funding structure that is both sensitive and responsive to industry challenges and, through the co-operation of scientific experts, also ensures that the research agenda keeps pace with global scientific developments. This structure is the Wine Industry Network for Expertise and Technology, known as Winetech.

Winetech will be discussed in the next section (2.4.1). Before doing so it is worthwhile to mention a small survey that was conducted around 2000-2001 among wine firms in four new world countries (Aylward, 2003). South Africa was one of the countries surveyed, and the

results compare the perceptions of firms in the South African wine industry with the perceptions of firms in the other three countries. Findings with regard to three perceptions of R&D performance are reported in Table 2.2.

**Table 2.2: R&D perceptions of wine firms in four New World wine producing countries**

| Industry | Response | | |
|---|---|---|---|
| *Perception of overall R&D in local wine industry* | *Low* | *Average* | *High* |
| South Africa (n=16) | 12.5% | 62.5% | 25.0% |
| Australia (n=47) | 19.1% | 23.4% | 57.4% |
| California, USA (n=22) | 36.3% | 54.2% | 9.0% |
| New Zealand (n=29) | 37.9% | 51.7% | 10.3% |
| *Perceived effectiveness of R&D co-ordination in local wine industry* | *Poorly* | *Moderately* | *Very* |
| South Africa (n=16) | 25.0% | 68.8% | 6.2% |
| Australia (n=47) | 2.1% | 65.9% | 31.9% |
| California, USA (n=20) | 40.0% | 50.0% | 10.0% |
| New Zealand (n=27) | 42.4% | 57.6% | 0.0% |
| *Consistency and relevance of information flows concerning R&D developments in local wine industry* | *Non-existent* | *Irregular* | *Regular & relevant* |
| South Africa (n=16) | 0.0% | 62.5% | 37.5% |
| Australia (n=47) | 2.1% | 23.4% | 74.5% |
| California, USA (n=20) | 5.0% | 55.0% | 40.0% |
| New Zealand (n=28) | 3.6% | 53.6% | 42.6% |

Source: Compiled from Tables 2, 3 and 4 in Aylward (2003)

The table above shows that R&D efforts in the South African wine industry, at least during the late 1990s/early 2000s, were mainly regarded as average, moderately effective and irregular. Although the pool of respondents is small and without any indication of representativeness, the study nevertheless gives an indication of the context within which Winetech had to operate and establish momentum during the early years of its existence.

### 2.4.1 Wine Industry Network for Expertise and Technology (Winetech)

In the early to mid-90s the South African wine industry was fragmented and characterised by internal politics and rivalry. This is the time when Professor Sakkie Pretorius, a leading microbiologist, was approached by Stellenbosch University to revive oenology and viticulture at that institution. Pretorius, very much aware of the fact that research quality and the building of a research reputation require a focused, long-term programme, agreed to become the director of a new university research institute, the Institute for Wine Biotechnology (IWBT – see Section 2.4.2), on condition that a shared vision for the industry be formulated. Without mutual goals, Pretorius realised that the priorities for the wine industry would fluctuate each year, resulting in a fragmented research programme. From the

start he emphasised that the IWBT would not conduct research on an *ad hoc* trouble-shooting basis. There had to be a research programme that is based on common growth objectives, where the latter had been defined and agreed upon by all industry stakeholders. Once a shared vision for the wine industry had been formulated, Pretorius recommended that a united body be created within which the wine industry could materialise the R&D growth objectives. This resulted in the creation of Winetech in 1996 (Boshoff, 2005).

Winetech is a generic structure with no personnel, apart from an executive manager and two assistant managers although initially the executive manager was assisted by only a technical assistant. It is a virtual association that consists of business people and scholars who sit on committees, all with a strong interest in improving the competitive position of the industry. As stated elsewhere, in 2003 Winetech was incorporated into the structure of SAWIC as a business unit, but resigned from SAWIC in 2008 when the latter was disbanded. Since then the Winetech Advisory Council became responsible for the management and operational functioning of Winetech (Boshoff, 2005; Winetech, 2010).

The objectives of Winetech, according to its constitution (Winetech, 2009), are as follows:

- To assist the industry with expertise so that it will be able to deliver the best quality wines and vineyard products with the aid of environmentally friendly technology in the most cost effective manner.
- To assist the industry in training sufficient people at all levels in respect of the appropriate knowledge, skills and insight in order to develop forefront expertise and technology and to integrate this with business strategy.
- To establish a culture of innovation and utilisation of the best technologies by effectively transferring technology to all sectors of the wine industry.
- To support the access and development of producers with limited resources by the provision
- To establish the network as the world leader in respect of scientific knowledge and technological skill on selected niche fields in the wine industry.
- To commission relevant and thoroughly planned research, technology development and technology transfer in the promotion of the industry's technological capabilities and in the attainment of the other objectives.

Winetech's primary source of income is a statutory R&D levy that amounted in 2010 to R18.4 million and comprises about 96% of the association's total income.[8] The levy is composed of four price components (Winetech, 2010):

- Grapes intended for the production of wine: R14,33/ton
- Grape juice concentrate for the production of wine: 2,05c/litre
- Wine: 2,05c/litre
- Distilling wine and wine spirits 1,77c/litre@10%A/V

The statutory R&D levy, combined with a small stream of additional income, enables Winetech to fund projects within four specialist committees, namely viticulture, oenology, training, and technology transfer. Each of the viticulture and oenology committees is sub-divided in five sub-committees. In the case of viticulture these are soil science; plant protection; plant improvement; plant biotechnology; and cultivation. The oenology committee is divided in microbiology; brandy and distilling; production technology; bottling, packaging and distribution; and environmental impact (Winetech, 2010). These sub-committees are responsible for the funding decisions of projects classifiable within seven research programmes (Winetech, 2008b):

- Vine virus research that focuses on limitation and extermination, etiology, virus resistance and support studies
- Optimal grape composition to reach specific wine objectives
- Terroir identification and utilisation
- Grapevine and wine biotechnology: improvement of viticulture, wine yeasts and bacteria for a quality focused, market directed wine industry
- Research projects not included in the programmes
- Technology transfer
- Training

The actual research performers and contractors include the research institutes of the Agricultural Research Council (ARC), among which ARC Infruitec-Nietvoorbij in Stellenbosch (see Section 2.4.3), as well as the Universities of Stellenbosch, Cape Town and Pretoria. Most prominent at Stellenbosch University is the Department of Viticulture and Oenology as well as the IWBT, which is housed within that department. According to its own mission, Winetech strives to commission research only to the most competent persons and institutions (Winetech, 2010).

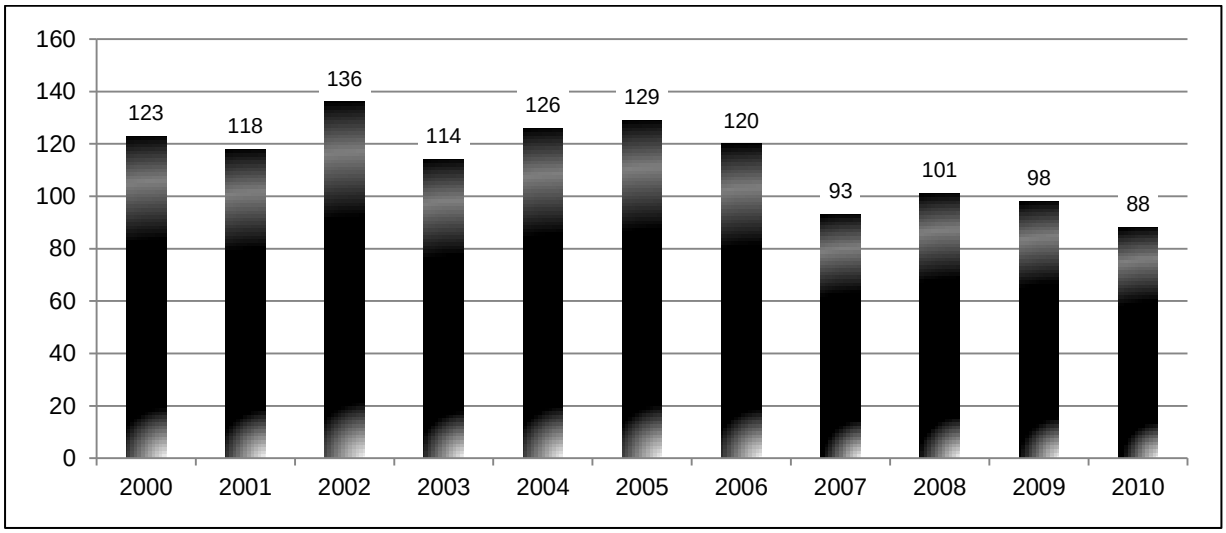
[8] Between 1999 and 2004 Winetech also received annual contributions from Busco under the SAWIT agreement. The actual Busco contribution amounted to R37.9 million in total (Winetech, 2010).

Research performers and contractors can submit project proposals but relevant research needs are also identified at producer level. As part of the technology transfer programme Winetech, together with VinPro, hold regular feedback and prioritising meetings with wine grape and wine producers in the various districts. The purpose is to identify industry-specific needs and suggestions for further research. The needs and suggestions, once categorized and prioritised, are forwarded to the research institutions in order for them to propose research projects based on the identified needs (Winetech, 2010).

The evaluation, selection and monitoring of research projects occur at the level of the technical committee. Generally a researcher submits a concept project proposal, which is evaluated by the technical committee concerned. A meeting with the researcher to clarify the details of the proposal follows this. If approved, the researcher is asked to submit a formal application for project funding. Once granted, a researcher must submit progress reports on an annual basis. A final report is submitted when the project is completed. There are prescribed templates for applications and reports. There are also face-to-face meetings with researchers where feedback is provided. These meetings occur during the second half of the year, and per institution. For instance, the IWBT will be visited and all the researchers with Winetech funding will give their project feedback at that meeting. Market-driven considerations, with a focus on innovation, play a strong role in the selection of funding applications (Boshoff, 2005).

There has been a significant decline in the number of projects funded by Winetech, especially since 2007 when it first dropped to below the 100 mark (Figure 2.9). This is a reflection of the fact that Winetech's income has been stagnating since 2004. The stable income, combined with general inflationary increases in the cost per project, resulted in fewer new projects funded (Winetech, 2010).

**Figure 2.9: Number of projects funded by Winetech, 2000 to 2010**




Source: Winetech (2003, 2006, 2008a, 2010)

Winetech provides a detailed set of guidelines for its funding applications and one of these actively encourages the dissemination of research findings. It states that:

> The results of all WINETECH funded research projects must, if possible, be presented to the end-users in the industry, be published in at least one scientific and one popular magazine (www.winetech.co.za).

Winetech appears to be actively involved in the facilitation and encouragement of research dissemination. The organisation provides its funded researchers with a number of ready-made platforms for dissemination and potential utilisation of their research as well as opportunities for grape and wine producers to obtain relevant knowledge. These include the following:

- Winetech sponsors a section in *WineLand*, a popular wine magazine that is published by VinPro (see Section 2.4.4). The section sponsored is known as *Wynboer Technical*, a technical guide for South African wine producers. According to a survey that *WineLand* conducted among its readers in 2003, *Wynboer Technical* was considered to be the second most important section in the magazine, attracting 74% of votes (Winetech, 2003). This implies that almost three-quarters of the readership of *WineLand* value the contributions in *Wynboer Technical*. Moreover, Theron (2008) surveyed 13 producer cellars and 80% of winemakers and assistant winemakers at the cellars indicated that they have access to articles in *WineLand* and *Wynboer Technical* and also utilise its content (Theron, 2008:15). Thus, the technical section is an important channel for technology and knowledge transfer of Winetech funded research projects. Every year VinPro publishes all articles from the

previous year's editions of *WineLand* in a separate publication called *Wynboer Technical Yearbook*.

- Winetech also sponsors the *South African Journal of Enology and Viticulture* as part of its technology transfer programme. This peer-reviewed, scientific journal is generally known as the SASEV journal, since the South African Society for Enology and Viticulture (SASEV) publishes it. The journal is available as a hard copy as well as online, and recipients of Winetech funding are encouraged to publish in this journal. In 2010, 27 scientific publications resulted from Winetech sponsored research projects. Of these, 10 were published in the SASEV journal. The corresponding figure for 2008 was 8 out of 15 publications (Winetech, 2008a, 2010). This illustrates the importance of the SASEV journal in the dissemination of Winetech funded research findings to local scholarly audiences and winemakers. Moreover, Winetech sponsored research projects are presented at SASEV conferences.

- Winetech, in conjunction with the industry library of SAWIS[9], has also compiled a Winetech research database. The database contains all Winetech funded research projects since 1999. Information about the projects is available at no costs on the SAWIS website and full text final reports can be requested. The database is updated every year (Winetech, 2010).

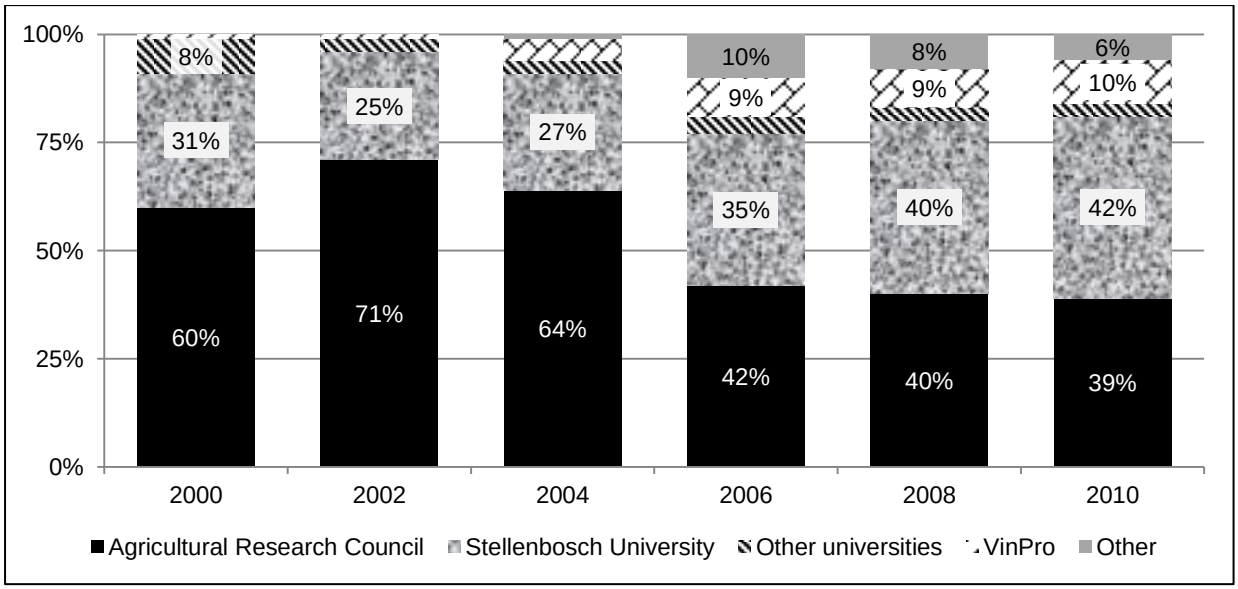
- The Winetech Scan is a monthly electronic newsletter that highlights the following: the latest relevant international research results and news; the latest local Winetech funded research results and other news; and the latest technological advancements in the wine and related agricultural sectors. The idea is to stimulate research as well as to alert industry members to possible developments which could be implemented on the farm, in the cellar or business. The Winetech Scan is emailed to more than 1,600 individuals every month (Winetech, 2010).

- From time to time Winetech also hosts information meetings in co-operation with other bodies, e.g. the SASEV Forum for Viticulturist and Oenology, where project findings are often presented to end-users. Feedback to end-users is important, given that Winetech is funded through a statutory industry levy and therefore accountable to its industry stakeholders.

[9] SAWIS – or the South African Wine Industry Information and Systems – collects, processes and disseminates industry information and statistics.

In the next sub-sections (2.4.2, 2.4.3 and 2.4.4) the discussion will be on the three organisations that received the largest shares of project funding from Winetech in recent years. As can be seen in Figure 2.10, these are Stellenbosch University (the Department of Viticulture and Oenology and IWBT cluster), the Agricultural Research Council's research institutes (particularly Infruitec-Nietvoorbij), and VinPro.

**Figure 2.10: Distribution of funds (%) between the different research institutions for 2000, 2002, 2004, 2006, 2008 and 2010**




Source: Winetech (2003, 2006, 2008a, 2010)

### 2.4.2 Institute for Wine Biotechnology (IWBT) and Department of Viticulture and Oenology at Stellenbosch University

The IWBT was created in 1995 within the Department of Viticulture and Oenology (DVO) at the University of Stellenbosch, under the directorship of Prof Sakkie Pretorius[10]. Since its

[10] The establishment of the IWBT goes back to the crisis in the local wine industry in the early 1990s. Because of over-regulation and the inaccessibility of foreign export markets due to sanctions and economic isolation, the focus of the local wine industry in the 1970s and 1980s was largely on the removal of surplus stock. This impacted negatively upon the research and training of the then Department of Oenology at the University of Stellenbosch – surpluses constrained the introduction of new and desired cultivars to the market, which, in turn, limited research opportunities within the wine industry. Also, research funds were scarce. Thus the department was under no pressure to improve its research performance, nor did large numbers of students want to pursue a career in oenology.

In the early 1990s, when the international community re-opened its doors for South African wine exports, the local industry experienced a major crisis: the demand for quality exports exceeded quality production by far. The crisis was exacerbated by the absence of a research and training infrastructure for the wine industry. While the Nietvoorbij Institute for Viticulture and Oenology in Stellenbosch did provide some research structure, the researchers at Nietvoorbij were expected to come from university. But up to 1995, in the history of the Department of Oenology at the University of Stellenbosch, only one PhD student had graduated. The head of that department was a retired professor who had been reappointed on contract for three years after retirement, as he was the only professor in oenology in the country. It was during this crisis period that the University of Stellenbosch approached Prof Pretorius, a young, leading scientist in microbiology to offer him the professorship in oenology. He however declined the offer because he did not see himself as an oenologist. He nevertheless agreed to table a proposal that would help to kick start viticulture and oenology at both undergraduate and postgraduate levels, in order to meet the demands of the fast-growing wine industry.

inception the IWBT has established itself as a centre of excellence in wine and grapevine biotechnology, nationally as well as internationally. The IWBT is the only research institute in the country that is focused primarily on grapevine and wine biotechnology and it cooperates very closely with the wine and table grape industries of South Africa (www.sun.ac.za/wine_biotechnology). The DVO, on the other hand, is the only academic department in South Africa that offers graduate and postgraduate courses in viticulture and oenology. The department has at its disposal significant research facilities, including experimental and commercial vineyards, a small-scale experimental cellar and an industry-scale research and teaching cellar, as well as well-equipped viticulture, oenology, biotechnology and chemical laboratories. The DVO's research projects are supported by competitive grants awarded to the department by industry (including Winetech) and government institutions. The department has research ties with many national and international universities and research organisations, such as the Australian Wine Research Institute in Adelaide, the German Wine Research Centre in Geisenheim, the universities of Burgundy, Bordeaux and Montpellier in France, and the Centre for Industrial Fermentations in Madrid, Spain (http://academic.sun.ac.za/viti_oenol/).

The main research objective of the DVO is to contribute towards enabling the South African industry to produce wines and vineyard products of a high quality, with the aid of environmentally friendly technology in the most cost-effective manner (http://academic.sun.ac.za/viti_oenol/). The combined research activities of the DVO and the IWBT cover the following specialist areas: (1) Viticulture (grapevine cultivation; grapevine and climate; the concept of terroir; eco-physiology of berry ripening; grapevine physiology; table grape production); (2) grapevine molecular biology and biotechnology; (3) oenology (wine microbiology; wine chemistry; cellar technology); (4) wine biotechnology and (5) advanced chemical-analytical techniques in viticulture, oenology and biotechnology.

The IWBT's overarching research theme is the improvement of grapevine cultivars, wine yeast and wine bacteria to promote sustainable, environmentally friendly and cost-effective production of quality grapes and wine. The research portfolio consists of three programmes. The first focuses on the molecular characterisation of metabolic and signalling pathways in yeasts and the genetic improvement of wine yeast strains. A second programme is concerned with lactic acid and other bacteria, including their impact on wine, metabolic

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Prof Pretorius' proposal, which he did not intend to implement personally at that stage because of promising career prospects in New Zealand, was to merge the Departments of Oenology and Viticulture, and to create a research institute alongside the combined department. Eventually he was persuaded by the University of Stellenbosch and wine industry to take up the position of director of the institute. There was however one major prerequisite: the alignment with the local wine industry, which gave birth to Winetech, as described in Section 2.4.1. Prof Pretorius directed the IWBT for a period of seven years, from 1995 to 2002 (Boshoff, 2005).

characterisation and improvement of malolactic fermentation. The third programme focuses on the molecular biology and genetic improvement of grape cultivars (www.sun.ac.za/wine_biotechnology).

The IWBT also includes a research group, SunBio, which forms a link between the academic research world and the wine industry. Apart from a dedicated R&D programme (with topics such as the evaluation of new and alternative sterilization methods for wine, grape concentrate and cellar equipment; and the breeding and improvement of yeast strains through non-GM technologies, etc.) the group also offers commercial services. These include:

- Knowledge transfer from research to industry through specialized short courses (online or presented at the Institute)
- Specialized analysis, assistance and problem solving for spoiled wine (e.g. microbial analysis of wines and yeast strain identification)
- Analysis of spontaneous fermentations of commercial cellars and custom identification of their unique yeast microflora
- Small-scale wine fermentation trials
- Chemical analysis of health related compounds in wine such as resveratrol and biogenic amines.

Lastly, the DVO offers a BScAgric programme in Viticulture and Oenology and, in collaboration with the IWBT, postgraduate programmes in Viticulture, Oenology and Wine Biotechnology

### 2.4.3 ARC Infruitec-Nietvoorbij

Prior to the establishment of the IWBT and the revival of viticulture and oenology as a department at Stellenbosch University, most research on wine grapes was conducted at the then Nietvoorbij Institute for Viticulture and Oenology of the Agricultural Research Council (Townsend & Van Zyl, 1998). In 1997 Nietvoorbij merged with another institute of the Agricultural Research Council (ARC) in Stellenbosch, namely the Infruitec Institute for Fruit Technology, to become ARC Infruitec-Nietvoorbij. The mandate of the ARC Infruitec-Nietvoorbij is to conduct research, development and technology transfer on the breeding, cultivation and post-harvest technology of a number of crops, which include deciduous fruit, viticulture as well as alternative crops such as berries and olives and indigenous herbal teas (www.arc.agric.za/home.asp?pid=1066).

The institute is structured in terms of six divisions, of which two are most relevant for the wine industry, namely (1) viticulture and (2) post-harvest and wine technology. The post-harvest and wine technology division, in turn, serves two distinct audiences. On the one side the post-harvest technology group focuses on the deciduous fruit and alternative crops and herbal tea industries whereas, on the other side, the wine and fermentation technology group targets the wine and brandy industry. Research conducted by the wine and fermentation technology group is aimed at understanding the chemical and microbiological processes involved in wine production, to identify quality determining factors in grapes and wine. The objective is to create technologies by which the potential quality in the grapes will be transferred to wine and brandy, and to deliver a variety of newly selected yeast strains to enhance wine quality. The wine and fermentation technology group also offers diagnostic services, such as microbial stability testing and assessments of the malolactic status of wines.

### 2.4.4 VinPro

VinPro, as discussed in Section 2.4.1, facilitates technology transfer for Winetech. It was formerly known as the KWV Extension Service but is privatised now, acting as the service organisation for wine producer members (Viljoen, 2000). VinPro's viticulture consultants are present in all the wine regions and convene regularly and for that reason have an established communication structure within VinPro. Their services are however directed at wine grape producers. Oenological technology transfer services, on the other hand, occur on a much smaller scale within VinPro and tend to be sub-contracted. Staff from associations within the district wine route associations, as well voluntary cellar personnel are used as agents in cellar communication networks. Winemaker study groups were established in this way in a number of districts since 2005.

According to the 13 producer cellars surveyed by Theron (2008), about 80% of the managers, cellar masters and winemakers within the cellars indicated that they have access to these winemaker study groups, and 70% reported actually attending those groups. However, according to Theron, these responses contradict available figures, as the attendance registers reveal that, since 2005, only about 9 people, on average, attended each winemaker study group.

The initial purpose of the winemaker study groups was to create a platform where winemakers from a particular region could meet and participate in a knowledge-based presentation by a guest speaker. It was hoped that the presentation and the ensuing discussion would create a dialogue between the wine expert and the winemakers. However,

because of the very poor attendance the winemaker study groups had to be terminated. These have now been replaced with cellar worker study groups, where the target audience is no longer winemakers but cellar workers who lack any tertiary education but nevertheless have a desire to also acquire technological knowledge.

### 2.4.5 Other organisations directly or indirectly involved in scientific knowledge transfer

Apart from the organisations discussed above there are also other entities that can facilitate the dissemination of knowledge within the wine industry, such as wine societies and associations (e.g. Pinotage Association, Pinot Noir interest Group, Shiraz Forum, South African Port Producer's Forum, etcetera) and, of course, training institutions as well as commercial enterprises that render client services. The latter two groups are highlighted below.

- Training institutions are valuable sources of scientific knowledge. Many winemakers received their agricultural training at the then Elsenburg College of Agriculture – renamed to the Cape Institute for Agricultural Training: Elsenburg (CIAT) in 2004. The CIAT is a training institution of the Western Cape Department of Agriculture. Since 1976 CIAT offers a Diploma in cellar technology. In 2004 the CIAT also initiated a new relationship with Stellenbosch University and since then it has been offering a BAgric programme in association with the university's faculty of AgriScience (CIAT, 2011a, 2011b). Apart from the CIAT and Stellenbosch University (discussed in Section 2.4.2) there is also the Wellington campus of the Cape Peninsula University of Technology (CPUT). The latter offers a national diploma in agriculture with viticulture and oenology as electives. On completion of the 3-year diploma a BTech in agriculture can be obtained after completion of a fourth year of study.

- Yeast manufacturing companies can also transfer knowledge through their technical consultants and other activities. An example is Anchor Bio-technologies, which is one of three business units of Anchor Yeast (Pty) Ltd, the leading yeast manufacturer in Africa. The business unit, based in Cape town, services niche markets with "bio-solutions" in the wine, whisky, commercial brewing, and bio-control industries. As such, the unit has a highly qualified team of technical consultants to solve specialist customer needs (www.anchor.co.za). These individuals can be regarded as transfer agents in the sense that they communicate the knowledge to their clientele, which

consists of winemakers. The first is through interaction and consultation with winemakers, and second, through practical articles in an *Outlook* gazette that is distributed to winemakers. The *Outlook* is an A3-size gazette that Anchor Bio-technologies publishes twice a year (Boshoff, 2005).[11] Anchor Wine Yeast, a subdivision within Anchor Bio-technologies, is also responsible for sharing technical news about winemaking developments in new world countries, through a dedicated website at www.newworldwinemaker.com. The latter is a non-commercial website.

## 2.5 CONCLUSION

This chapter aimed to place the South African wine industry in context by referring to global developments as well as domestic conditions that had shaped the industry into its current form. What needs to be stressed is that the modern-day notion of quality in wine, which in one way or the other always finds expression as an objective in the research agendas of wine researchers, is multi-faceted and determined through different conventions. Various factors such as uniqueness, value for money and innovative blending, to mention only a few, can come into play in determining quality based on user perceptions. In order to produce wine that is perceived to be of high quality and in line with consumer expectations, and thus also profitable, winemakers need to understand the science underlying the organisms and processes that they are working with, and keep abreast with new technological developments. From an outsider's perspective a study of the sources of winemakers' knowledge therefore seems important. The chapter has started to identify relevant knowledge sources in the South African wine industry, with particular emphasis on the intermediary role of Winetech and the major (domestic) producers of wine research. The notion of knowledge will be unpacked in the next chapter, together with insights from other disciplines with regard to the uptake of knowledge in practice.

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[11] At the time of writing this PhD the name of the *Outlook* gazette was changed to the *Newworldwinemaker* newsletter as the company wants to present a single brand. To promote this brand ("newworldwinemaker"), Anchor Wine Yeast has also introduced a blog, a newworldwinemaker twitter that distributes technical facts every day, and a Facebook site with more than 5,000 fans worldwide, of which about 130 are South African winemakers.

# Chapter 3

# PERSPECTIVES ON KNOWLEDGE UTILISATION

## 3.1 INTRODUCTION

As stated in Chapter 1, the present study is guided by two conceptions of knowledge utilisation. The broad conception can be formulated as "knowledge utilisation plus" as it is not only concerned with the utilisation of knowledge but also the factors, processes and mechanisms by which knowledge comes to be utilised. Thus, the broad conception corresponds to the process of knowledge transfer. The narrow conception of knowledge utilisation prioritises the two central notions, knowledge and utilisation. It focuses on two types of knowledge exhibited by practitioners (factual and practical) and how new knowledge is utilised within the context of existing factual and practical knowledge.

This chapter highlights the relevant literature that provides a background to and which can inform a study of knowledge utilisation by practitioners. The historical development of knowledge utilisation as a field of study is firmly rooted in the social sciences, particularly in the domain of public sector policy, which explains the references to this set of literature in the chapter. Moreover, perspectives specifically dealing with the knowledge utilisation of practitioners are most prominent in the spheres of health practice and health policy, and mainly concentrated in the literature on evidence-based medicine (EBM). The latter represents a movement geared towards basing clinical practice and decision-making on the best available research evidence. Increasingly, however, EBM has become absorbed by the broader knowledge translation movement. Knowledge translation operates according to the principle of planned knowledge-to-action, which propagates systemic interventions and stakeholder exchange as mechanisms to ensure the smooth integration and sustainable use of knowledge in practice settings.

In light of the above, the structure of this chapter is as follows:

- Firstly, a broad *historical overview of knowledge utilisation* as an area of study is provided, together with a discussion of generic models of knowledge utilisation that evolved over time (Section 3.2).
- Secondly, the *meaning of utilisation* is clarified (Section 3.3), where utilisation is interpreted as either a category (or typology of categories) or a process.
- Thirdly, the *notion of knowledge* is unpacked in terms of two broad types: factual knowledge and practical knowledge (Section 3.4).

- Fourthly, EBM and knowledge translation – as part of the *knowledge-to-action movement in health practice* – is discussed in relative detail in Section 3.5, including a review of a set of models of knowledge translation that highlight various aspects of planned research use.
- Lastly, the *concluding section* (Section 3.6) integrates insights from the rather diverse literature overview, indicating how elements from the different perspectives can inform the current study of the knowledge utilisation of winemakers.

## 3.2 HISTORAL ACCOUNT OF KNOWLEDGE UTILISATION

### 3.2.1 "Waves" of Knowledge Utilisation

Thomas Backer (1991) highlights three historical "waves" of knowledge utilisation that capture the main trends in the American context as far as the study of knowledge utilisation is concerned, and which provides a background for similar developments world-wide.

The *first wave*, based on Backer's (1991) account, started during the 1920s, when scholarly enquiries into knowledge utilisation predominantly focused on the diffusion of agricultural innovations to farmers. These studies laid the foundation for one of the most popular and best researched sub-domains of knowledge utilisation ever, namely the diffusion and adoption of innovations (see Section 3.5.5.2), also known as diffusion research. However, during those earlier years the notion of knowledge utilisation was still unheard of. The buzz word was agricultural extension. The origin of agricultural extension was politically motivated and gained importance due to the establishment of the Co-operation Extension Service by the United States Department of Agriculture in 1914, as a result of increased pressures to raise the level of agricultural productivity in the aftermath of World War I (Rogers, 1988). The subsequent scholarly focus on diffusion research provided insight into the adoption of agricultural innovations by farmers, which was the immediate objective of agricultural extension activities. Typical of this wave is the work by Ryan and Gross (1943) on the diffusion of hybrid seed corn to farmers and particularly the role of social networks in the adoption process. Moreover, as Backer explains, most of the studies of this period concerned the adoption of innovations by individuals, mostly in agriculture but also in education.

The first wave, which ended around 1960, includes World War II. This period was also characterised by important developments pertaining to the relation between science and society at a macro level (Rich, 1979). The Manhattan Project of 1942 to 1945, in which an

international team of scientists developed the atom bomb that ended the War, provided a clear demonstration of the direct value of science for national security and survival. As a result, the USA federal government was one of the first to support science as a relatively autonomous endeavour, believing that scientific endeavours into unexplored areas, as seen fit by scientists themselves, will eventually deliver benefits in terms of security and economic prosperity. An implicit social "contract" between science and society therefore emerged. This contract entailed:

> … a bilateral relationship from which both society *and* the producers of knowledge derive benefits. It emphasizes that knowledge-producing institutions prosper to the extent that their activities are consistent with the goals of society. It also certifies that society recognizes both the right of science and other producers of knowledge to a measure of independence, and the fact that independence is in the long-range interest of society. (Rich, 1979:13)

This "contract" remained largely unquestioned until the early 1960s, when it started to become clear that science was not providing answers to the most critical problems at the order of the day. Eventually, about three decades later, a revised social "contract" would take effect, where science's accountability is more valued than its independency, and science also required to more explicitly addressing the needs of users in the economy and society (Martin, 2003).

During the *second wave* of knowledge utilisation, which more or less corresponds to the period 1960-1980, the focus of utilisation broadened to include innovation adoptions by organisations, as well as by individuals. Knowledge utilisation started to develop into a movement, with increasing pressure on science to demonstrate its relevance to society. This was reflected in various national debates as well as the development of national policies to guide and promote science in the interest of society (Rich, 1979). Backer (1991) highlights three factors that contributed to the notion of knowledge utilisation entering the agenda of the federal government – firstly, the desire to stimulate economic growth through technological innovations; secondly, the desire to transfer technologies that emerged from space and defence research to other sectors of society; and thirdly, the desire to transfer innovations that emerged from research activities funded by federal government agencies. Developments concerning knowledge utilisation during this period laid the foundation for the emergence of technology transfer as a distinct field of study.

The debate concerning knowledge utilisation and science in the interest of society also extended beyond technology transfer, to include the social sciences. In fact, in the social sciences, during this 20 year period, both over-optimism and over-pessimism with regard to

the utility of social sciences research could be observed. The greater part of the 1960s was characterised by an over-optimistic belief in the value and utility of social sciences research for policy. However, against a backdrop of growing evidence of the non-use of the results of social sciences research, a period of over-pessimism followed, where the value of social sciences research for policy making was seriously questioned (Wingens, 1990). The work by Carol Weiss (e.g. Weiss, 1978, 1979, 1980) sheds significant light on the state of knowledge utilisation in the social sciences in those years. At that time the predominant line of thinking was that individual projects, specifically academic projects sponsored by government, should prove their relevance to society to the extent that the findings thereof are incorporated into policy documents and other structures. However, as Weiss (1978:20) points out, the state of policy research in the 1970s in the USA presents a paradox. On the one hand, millions of dollars were invested in applied social science research with government officials reporting high interest in social sciences research. On the other hand, there was general consensus that social policy research had a negligible effect on policy decisions. Rather than climbing on the bandwagon and attributing blame for the paradox at the usual places (policy makers' unwillingness to accept that social policy research is not paying in terms of better decisions, a cultural gap between academics and policy makers, etc.), Weiss argues that the main reason for the paradox lies in the interpretation of the notion of "utilisation" in social policy research (a topic that I will return to in Section 3.3.1). Nevertheless, despite some negativism and even pessimism about the utility of science, the 1970s saw the emergence of an increased focus on accountability as a result of public expenditure on science, pushing research utilisation "into the forefront as a concern for federal program managers" (Larsen, 1989:423).

An example of the growing maturation of this body of scholarship during the relevant period was the establishment of the first journals on knowledge utilisation, namely the *Journal of Technology Transfer* (in 1975) and the journal *Knowledge: Creation, Diffusion, Utilization* (in 1979). The latter was later renamed to *Science Communication*.

The *third wave*, from the 1990's onwards, was preceded by a brief interlude during the 1980s when the Reagan administration in the USA introduced a different science funding approach. The funding preference of the federal government shifted from sponsored research to block grants, which meant a reduced need for the demonstration of the utility of federally sponsored research. During the 1990s, with the change to the Bush administration, there was a renewed interest in policies, programmes and research activities pertaining to knowledge utilisation. Dedicated programmes for the utilisation and uptake of knowledge started to flourish and enjoyed high priority in all spheres of policy and decision making,

including agriculture, defence, education, health, human services, space administration and transportation (Backer, 1991). It is during this wave that the demand for evidence-based medicine (EBM – see Section 3.5.1) intensified, with increasing demands "that clinical practice … be based on systematically reviewed and critically appraised evidence of effectiveness" (Lambert, 2006:2633)

Although Backer's (1991) account ends with this period, he nevertheless highlights a few trends that can be interpreted as indicative of a probable *fourth wave*. He observed, for instance, already in the early 1990s, a closer association between utilisation, quality assurance, ethics and evaluation. This observation by Backer strongly reminds of the current fascination with knowledge translation (see Section 3.5.4) where knowledge is translated to suit a target audience by involving the audience in a lengthy and complex exchange relationship. Knowledge translation is a systems intervention with the aim to facilitate evidence-informed health policy and practice. It follows the logic of planned action, which explains the emphasis on aspects of quality, evaluation and the ethically sound application of knowledge (NCDDR, 2007; Straus, Tetroe & Graham, 2009).

The observation that the further development of knowledge utilisation is currently being shaped by evidence-based medicine (EBM), and knowledge translation as an extension of EBM, is confirmed by other studies. In 2008, Estabrooks et al., for instance, conducted the first comprehensive bibliometric analysis of the field of knowledge utilisation, by using author co-citation analysis. Their dataset comprised more than 5 000 articles that were published between 1945 and 2004 in the Web of Science online database. Their research showed that, until the mid-1980s, three specialised domains could be distinguished: initially, innovation diffusion, followed by technology transfer and knowledge utilisation, with the latter mainly comprises insights pertaining to knowledge uptake in the social sciences. During the mid-1980s a fourth domain started to appear, namely EBM, which rapidly expanded in the 1990s:

> [U]ntil the late 1960s most diffusion research took place in Rural Sociology … In the next decade (1965 to 74), most diffusion publications are located in social science journals, and one library science journal. By 1979, the field of knowledge utilization had become sufficiently cohesive to warrant a specialist journal: Knowledge: Creation, Diffusion, Utilization ... This journal is the core journal in the field for the next two decades. In 1985 to 1994 the Journal of the American Medical Association enters the field of core journals, and in the next decade (1995 to 2004), three of the most prolific journals are health journals. (Estabrooks, 2008:5)

This conclusion serves to validate Backer's periodisation of the field of knowledge utilisation, highlighting shifts that range from innovation diffusion to technology transfer and the utilisation of social sciences research, to EBM and knowledge translation. The study by

Estabrooks et al. (2008) does not explicitly mention knowledge translation but it needs to be remembered that the study's analytical time frame ends with 2004 whereas the bulk of publications in knowledge translation only started to appear immediately thereafter.

### 3.2.2 Linear and Interactive Models of Knowledge Utilisation

Over time different models have emerged from reflections on various studies of knowledge utilisation. One of the more comprehensive typologies was developed by Landry, Amara and Lamari (2001b), where they distinguish between the science-push model, demand-pull model, organisational interest model, dissemination model and interaction model:

- The *science-push model* views scientific research and its associated processes and products as the key determinant of knowledge utilisation. Researchers are considered central in the knowledge utilisation process – topics originate with them, which they then research and consider in terms of available evidence, and report on as a set of findings for potential users. Users are perceived as passive receptors of research. Studies located within this model, for instance, focus on the extent to which knowledge utilisation is determined by research types (basic/applied, quantitative/qualitative, etc.) as well as by the attributes and dimensions of the ensuing results (reliability, importance, etc.). Thus, this model explains utilisation in terms of research types and the researcher's context. The science-push model implies a simple linear model, from researcher to user; one where research advances are assumed to automatically find their way into application. The model has been criticised as it does not make explicit references to linkages between researchers and users; it ignores the fact that research findings require some form of transformation or translation in order to become useable knowledge; and that some entity (individual or organisation) is required to facilitate knowledge transfer.

- According to the *demand-pull model*, knowledge utilisation is increased when the research problems are determined by users and the researchers are contractors who provide the results in return for payment. Knowledge utilisation is thus enhanced when researchers turn their scholarly attention towards investigating topics and needs as identified by users, rather than to the advancement of knowledge alone. Thus, the model explains utilisation in terms of user needs. This model is also linear – it differs from the science-push model in the sense that users are considered central in the knowledge utilisation process. Researchers are merely responding to

the needs of users in order to provide them with the knowledge requested. This model has been criticised for ignoring the organisational interests of users because utilisation can be hampered in cases where the results do not support the objectives or expectations of the contracting organisation.

- The *organisational interest model* is an extended version of the demand-pull model and includes the organisational interest of users and other organisational factors in the explanation of utilisation. The focus is on the ways in which the organisational structures, rules and norms of the user organisation facilitate utilisation. Both the demand-pull and organisational interest models focus too much on the interest of users and, like the science-push model, ignores the interaction between researchers and users as a mode of knowledge transfer.

- According to the *dissemination model* effective utilisation is a function of active dissemination efforts and mechanisms, and specifically the dissemination of research information that is packaged in such a way that it meets the peculiarity of the user milieu. Thus, the model's explanatory power lies in the efforts made at utilisation and the adaption of research products for users. The disseminated information is considered to have reached its intended audience once the audience becomes aware of the information. However, awareness and reception do not necessarily imply actual use of the research results, and the model also does not provide space for the involvement of users in the selection of research information to be transferred or the production of research results.

- The *interaction model* claims that knowledge utilisation "depends on various disorderly interactions occurring between researchers and users" (Landry, Amara & Lamari, 2001b:335). This model is an overarching one as it captures all the explanatory factors of the other models: research types and nature of results, needs and organisational interests of users, dissemination, and linking structures. Particularly important is the interplay of explanatory factors, and the interaction between researchers and users during various stages of knowledge production, dissemination and utilisation. Generally, the more sustained and intense the interactions between the researchers and users are, the greater the likelihood of utilisation. Thus, it is the linkages between researchers and users that are important in this model.

The question to be asked about these models is what they actually represent. Are they heuristic tools to classify different studies of knowledge utilisation? This is not necessarily true as Landry et al. (2001b) cite elements of the same study to illustrate different models. The discussion of the models by Landry et al. also suggests some chronology in their development and use (i.e. that the one preceded the other) as can be inferred from the following quote: "the interaction model has been developed to overcome the criticisms of the previous models" (Landry et al., 2001b:335). Again this is not necessarily the case. Huberman (1990:364), for instance, noted that, during the 50 years prior to his paper, the nature of interactions between researchers and practitioners already had constituted a primary focus within studies of knowledge utilisation. It is therefore best to say that the models as conceptualised by Landry et al. organise different foci and interests in the study of knowledge utilisation but that these are not mutually exclusive. The work by Landry et al. provides a framework of "ideal types" of knowledge utilisation approaches.

Moreover, the models by Landry et al. (2001b) are elaborations of earlier conceptual work by others, such as Weiss (1979) who originally distinguished between linear and interactive models. In Weiss' conception, the models were not presented as frameworks that highlight and organise aspects of various studies of knowledge utilisation, but as models trying to exemplify how (social research) knowledge actually come to being used in the policy domain.

- Weiss' (1979) *problem-solving model*, a linear model, typifies situations where (1) a problem is identified, (2) a solution is not possible on the basis of existing information either because information is lacking or no consensus could be reached among the alternatives given that crucial information is lacking; (3) research provides the missing knowledge; and (4) on the basis of the research findings, the policy-makers can reach a solution. Research, within the problem-solving model, is thus seen as providing solutions to identified problems. The need for a decision to be made in response to a problem is the actual drive behind the research. Weiss mentions two ways by which social science research can enter the policy arena. The first is where the policy makers do not commission new research in response to the policy decision to be made but consult existing research. The second is when new research is commissioned. Yin and Moore (1988) equated the problem-solving model to a demand-pull model, a notion that would later also feature in the classification by Landry et al. (2001b).

- Another linear model discussed by Weiss (1979), the *knowledge-driven model*, is an imaginary of research utilisation in the social sciences, taken directly from the natural sciences. In essence it is a model where basic research provides new insights which are then further refined and tested through applied research to determine their practicality. In turn, new technologies can be developed which, eventually, could also be adopted and applied. This description represented for Yin and Moore (1988) a technology-push or science-push sequence.

- An *interactive model* is present when stakeholders participate in various consortia and other forms of interaction (face-to-face meetings) to pool their knowledge and insights to derive at solutions for decisions or courses of action. Within this model the use of research is not central but "only one part of a complicated process that also uses experience, political insight, pressure, social technologies, and judgment" (Weiss, 1979:428).

In these earlier models by Weiss (1979) the knowledge producers and knowledge users are typically contrasted, with the flow of knowledge either one-directional (from producer to user = knowledge-driven model; or from user to producer = problem-solving model), or facilitated through some sort of interaction between the two parties. It is therefore not surprising that a new perspective emerged whereby researchers and users were conceived of as representing two distinct communities. Caplan (1979) presented this perspective as a two-communities theory. Dunn (1980) doubted whether this represents a theory in the true sense of the word and instead refers to it as a metaphor that allows for analogies.

The two-communities perspective or "metaphor" explains differences in utilisation on the basis of cultural differences between the two domains involved – the science production and policy implementing domains respectively. The different values, language, reward systems, and social and professional affiliations of these two domains result in a so-called cultural gap, and the cultural gap can only be closed by strengthening interaction between the two communities. Wingens (1990), however, objected to the two-communities perspective on the basis that a viable utilisation model should not be built around the notion of two culturally different communities but around the notion of functionally differentiated social systems. A culturalistic conception of the two-communities perspective highlights the orientations and practices of individuals (i.e. scientists and policy makers), whereas, according to a systems conception, the focus is not on individual life forms but on the structural conditions and constrains under which representatives of social systems have to act. The culturalistic conception was formulated in an attempt to account for non-use of social sciences research

by policy makers. Thus, a culturalistic conception of knowledge utilisation stresses the distinctiveness and separateness of the knowledge production and utilisation domains. However, as Wingens (1990) points out, the two domains are not that separate: policy makers hold university degrees and have to assess research as part of their routine work; researchers, on the other hand, are familiar with the public sphere (through consultancy and other forms of engagement, among many things). He therefore proposes a systems approach that focuses on successful interaction between systems as well as successful utilisation, with the gap between the two socially different systems serving as a starting point for explanation, and not as an explanation itself as in the two-communities perspective.

For Dunn (1980), as said, the value of the two-communities perspective lies therein that it acts as a metaphor or constructive analogy by which one can arrive at various contending explanations for the use (or rather non-use) of social science research by policy makers. These competing explanations, according to Dunn, can be grouped into five models. Two of the models (inquiry-contingent model and product-contingent model) cover aspects relating to the scientific community. The next two models cover aspects that relate to the policy making community (problem-contingent model and structure-contingent model), and the last aspects relating to interaction between the two communities (process-contingent model).

- According to the *inquiry-contingent model*, the modes of inquiry by which knowledge is created (quality of research design and strategy, and analytical method) determine the extent of knowledge use by policy makers.
- The *product-contingent model*, on the other hand, claims that the scope of knowledge used by policy makers is a function of the characteristics of the products of social sciences research. In other words, the form, content, language, length, validity and reliability of the knowledge output have a direct bearing on its use or non-use.
- The nature and characteristics of the policy problem(s), according to the *problem-contingent model*, are key factors in determining the extent to which scientific knowledge is used to resolve the problem. For instance, the complexity of the policy problem and the levels of uncertainty and risks involved can play a role in knowledge use.
- The *structure-contingent model* claims that the formal structures, procedures and incentive structures of the organisation responsible for knowledge use determine the actual extent of knowledge use.

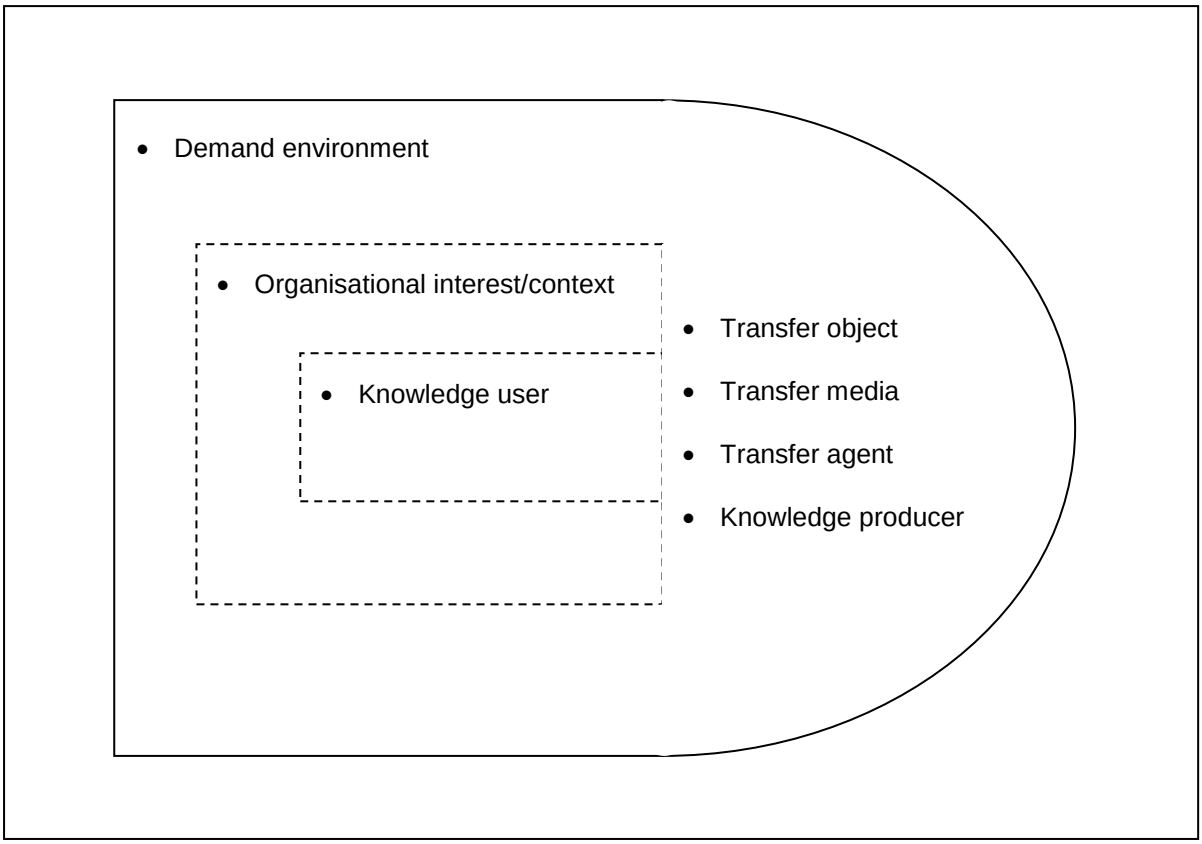
- Lastly, the *process-contingent model* focuses on the interaction between knowledge producers and the potential users thereof; the extent of knowledge use is considered a direct function of the nature of interaction.

What the different models by Dunn (1980), Landry et al. (2001b) and Weiss (1979) reveal, apart from suggesting under what conditions utilisation will be optimal, is the recognition that different elements (actors, actions, structures, conditions, products, etc.) can be discerned in any study of knowledge utilisation. Moreover, although these models are derived from studies of research use by policy makers, the elements equally apply to studies outside the policy domain, such as technology transfer. Bozeman (2000), for instance, who focuses on the determinants of effective domestic technology transfer from universities to government laboratories, describes technology transfer with reference to five elements:

- The first element is the *transfer agent*, which refers to the organisation seeking to transfer the technology.
- The second element refers to the *transfer media*, which are the formal or informal media by which the technology is transferred. Examples include formal literature, person-to-person interaction, forums, consortia, etc.
- The *transfer object* constitutes the third element in Bozeman's study, and refers to the contents and form of that which is transferred. The transfer object can be scientific knowledge, a process, a piece of know-how, etc.
- The fourth element is the *transfer recipient*, or the organisation receiving the transfer object, which can be consumers, a firm, informal group, etc.
- Lastly, the *demand environment* is another element that impacts on technology transfer. It refers to the market and non-market factors that induce or reduce the need for the transferred object.

If one combines the elements listed by Bozeman (2000) with those implied in the other models, there appears to be seven elements that need to be taken into account when studying knowledge utilisation. These are displayed in Figure 3.1.

**Figure 3.1: Elements to consider in a study of knowledge utilisation**




Central is the *knowledge user* (a winemaker in our case), who operates within a particular *organisational context* with its own set of interests, which, in turn, is embedded within a broader *demand environment*. Any new knowledge[12] utilised by the user, within this demand environment, is received through *transfer media*, meaning that the knowledge resembles a *transfer object*. The knowledge user may or may not be aware of the *knowledge producer*, as well as of the *transfer agent*, in instances where the latter applies.

The above provides a description of knowledge utilisation in the broad sense, as it corresponds to the process of knowledge transfer seen from the perspective of the knowledge user (not the knowledge producer) and, from that viewpoint, covers aspects of use, dissemination, knowledge origin and context. On the other hand, the narrow and more literal description of knowledge utilisation highlights only the two central notions (knowledge and utilisation), specifically what counts as knowledge and what counts as utilisation, and, taken together, what knowledge is being utilised and how. This narrow description of knowledge utilisation occupies the space that is demarcated as "knowledge user" in Figure

[12] With "new knowledge" is meant newly generated knowledge as well as existing knowledge that the user has not previously been aware of.

3.1. The notions of utilisation and knowledge will now be dealt with in Sections 3.2 and 3.3 respectively.

## 3.3 UNPACKING UTILISATION

A distinction can be made between knowledge utilisation as a type and knowledge utilisation as a process. The first distinguishes between different types of knowledge use whereas the second highlights distinct stages or hierarchies of knowledge use.

### 3.3.1 Typologies of Knowledge Utilisation

Section 3.2.2 discussed three models by Weiss (1979) that highlight the trajectories by which research findings can enter the social policy domain (i.e. knowledge-driven, policy-driven and interactive models). Weiss also developed three more models that directly speak to the issue of research use, namely the political-driven, tactical and enlightenment models. Insights from these three models, together with insights from the policy-driven model in the first group, provide the necessary input to produce a typology of research use that involves three types: instrumental use, symbolic use and conceptual use.

- The policy-driven model, where policy-makers commission research or seek out existing research evidence in response to a policy issue, provides the best example of the *instrumental use* of research. The findings are of immediate relevance to the policy-makers, thereby finding *direct application* in decision-making and policy interventions.

- The political model of research use refers to instances where social policy research findings are used by policy makers to *strengthen standpoints already taken*. This is an example of *symbolic use* of research. In such cases the policy makers are not influenced by the research findings but use the latter only as ammunition to back particular viewpoints.

- The tactical model of research use is one where research serves as a tactic in bureaucratic politics. It provides another example of *symbolic use*. The nature and content of research findings are not the focus of attention but rather the fact that research has been commissioned or that research findings were considered. By focusing on the aspect of research, government agencies can provide *proof of their responsiveness*.

- In the enlightenment model of research use, policy makers often cannot identify a single piece of research that has shaped their decisions although they are very much attuned to research and have a clear sense that research has provided them with an underlying set of ideas on which they base decisions and actions. The enlightenment model is characterised by *knowledge creep*, or a "diffuse, undirected seepage of social research into the policy sphere" (Weiss, 1978:23). The underlying research type is called *conceptual use*.

In the words of Weiss:

> [P]eople … often do not catalogue research separately in their minds. They interpret it as they read it in light of their other knowledge, and they merge it with all the information and generalizations in their stock. Therefore, they find it difficult, often impossible, to identify the unique contribution that one study, a body of studies, or research in general, has made to their actions. (Weiss, 1980:391)

Another typology is that by Estabrooks (1999) who, in the nursing sciences, distinguishes between direct, indirect and persuasive research utilisation. *Direct utilisation*, like instrumental utilisation, implies the use of research to make specific decisions or to change one's own practice. *Indirect utilisation*, in Estabrooks' study, refers to the use of research findings to change one's own thinking or opinions, which corresponds to the notion of conceptual utilisation. *Persuasive utilisation*, on the other hand, refers to the use of research findings to persuade others to make changes in current conditions, policies and practices. Thus, persuasive utilisation is not exactly the same as symbolic utilisation, as the latter implies the use of research findings to justify a certain position or decision. Estabrooks also explored the conceptual structure of research utilisation through an advanced multivariate data analysis technique, known as structural equation modelling (SEM). The analysis revealed a good fit between the model (consisting of direct, indirect and persuasive utilisation) and the empirical data collected for 600 nurses, which, in turn, provided strong evidence for the existence of the three types of research utilisation.

In summary then, a set of literature exist that distinguishes between different types of utilisation. However, it is a limited set that, conceptually, hasn't really moved beyond the original work by Weiss although some modifications were introduced by those in the field of nursing research. The extent to which the categories are mutually exclusive, or not, are not really addressed although the focus on "knowledge creep" by Weiss (1980) implies that conceptual use could underlie some of the other forms of utilisation. The relation between the different types of utilisation will therefore constitute a focus in the empirical section of this study.

### 3.3.2 Stages of Knowledge Utilisation

Rich (1997) depicts knowledge utilisation as a process that is composed of three central events, with considerable variation within each. The first is *information pick-up*, referring to the process of retrieving and receiving information. Various possibilities for retrieval and reception exist, e.g. information may be accessed from an electronic databank, read in a book on the library shelve, transmitted through a consultant, or through a telephonic conversation with a colleague. The second event, *information processing*, consists of different sub-events, namely understanding the information, using cognitive procedures to assess the value of the information and testing it against one's own assumptions and beliefs, and transforming the information into a form that better suits the needs of the user. The last event is *application*, which involves the decision to either implement or not to implement the information after it has been picked-up and processed.

In an earlier study, Knott and Wildavsky (1980:546) engaged with the question as to when it can be stated that utilisation has actually occurred. In doing so, they highlighted seven standards of utilisation, each determining a different 'cut-off' for evidence of utilisation. Accordingly, utilisation is said to have occurred when the research findings physically have reached the potential user (reception standard); when the potential user has read, understood and 'digested' the research findings (cognition standard); when the research findings have changed the frame of reference – i.e. preference, attitude, understanding – of the potential user (reference standard); when the potential user makes an effort to adopt the research findings even if it may be blocked by other forces (effort standard); when the research findings are formally adopted, such as appearing in a policy or practice protocol (adoption standard); when the policy or practice protocol is formally implemented (implementation criterion); and when tangible benefits are produced based on implementation (impact standard). Landry, Amara and Lamari (2001a) slightly modified Knott and Wildavsky's (1980) conception by combining the adoption and implementation stages into a single stage called application. Their own conception therefore consists of six cumulative stages of knowledge utilisation, namely transmission, cognition, reference, effort, influence and application.

Finally, Glasziou and Haynes (2005) also make reference to a stage model in getting evidence into practice in the context of clinical practice. They distinguish between seven stages that occur between evidence and action, namely (1) an awareness of relevant information, (2) the acceptance of the evidence, (3) a consideration that the evidence is applicable to their situation, (4) access to the specifics of the information and the ability to engage with it, followed by the (5) actual acting upon the information which is the

implementation of change. Patients, as the eventual end users of knowledge in clinical settings, also need to (6) agree to the intervention and (7) their continued adherence to the intervention needs to be ensured.

### 3.3.3 Summary

In conclusion, one could ask how the portrayal of knowledge utilisation as a series of steps or events in a process relates to the previous portrayal of knowledge utilisation as a number of ideal types. Table 3.1 is an attempt to integrate the six cumulative stages of knowledge utilisation by Landry, Amara and Lamari (2001a) with the four primary utilisation types derived from the work by Weiss (1980) and Estabrooks (1999). The stages of knowledge utilisation are seen mainly from the perspective of the knowledge producer whereas the knowledge types can be viewed from the perspective of either the knowledge producer or knowledge user.

**Table 3.1: Stages of knowledge utilisation versus knowledge types**

| Stages of knowledge utilisation | Utilisation types | | | |
|---|---|---|---|---|
| | Indirect , targeting self | | Direct | Indirect, targeting others |
| | Conceptual | Symbolic | Instrumental | Persuasive |
| **1. Transmission**: I transmitted my research results to the practitioners and professionals concerned | -- | -- | -- | -- |
| **2. Cognition**: My research reports were read and understood by the practitioners and professionals concerned | √ | -- | -- | -- |
| **3. Reference**: My work has been cited as a reference in the reports, studies, and strategies of action elaborated by practitioners and professionals | √ | √ | -- | -- |
| **4. Effort**: Efforts were made to adopt the results of my research by practitioners and professionals | √ | √ | √ | -- |
| **5. Influence**: My research results influenced the choice and decision of practitioners and professionals | √ | √ | √ | (√) |
| **6. Application**: My research results gave rise to applications and extension by the practitioners and professionals concerned | √ | √ | √ | √ |

Sources: Estabrooks (1999); Landry, Amara and Lamari (2001a); Weiss (1978, 1979, 1980)

Transmission, the first stage in the knowledge utilisation process, is not related to any of the utilisation types because it only implies reception of knowledge. The potential user's engagement with the knowledge transmitted only starts during the cognition stage. During the latter stage, when the recipient of the knowledge also engages with it, conceptual utilisation becomes applicable as insights and ideas can start to formulate in the head of the recipient. The steps are hierarchical, implying that conceptual utilisation, or the possibility

thereof, also characterises each of the remaining higher-order stages. Only when a user starts to refer to the results, during stage 3, symbolic utilisation becomes a reality because the knowledge can be used to strengthen standpoints already taken. Instrumental utilisation, or the direct application of the knowledge referred to, starts to take shape during stage 4, when efforts are made to adopt the results to one's own setting. A stronger version of instrumental utilisation characterises stage 5 (influence), when the knowledge adopted directly influences one's actions or decisions. It is during this stage that those who adopted the knowledge can also target others to do the same, resulting in persuasive utilisation. During the last stage (application), all four utilisation types can co-exist simultaneously. Table 3.1 also suggests that conceptual utilisation occurs prior to any of the other three types of knowledge utilisation. This suggestion will be further explored in the relevant empirical section of the current study.

## 3.4 UNPACKING KNOWLEDGE

The utilisation of new knowledge is not a straightforward process as incoming information is often assessed and processed in relation to existing knowledge, which can be either other factual knowledge or practical knowledge. The distinction between factual and practical knowledge is important and underscores two main kinds of knowing: knowing *that* something is the case and knowing *how* to do things. Sahdra and Thagard (2003), for instance, explored this distinction among molecular biologists by demonstrating that scientists' knowledge not only consists of facts about cellular molecules or theories of the workings of those molecules, but also of ways to do things practically in the laboratory. As Sahdra and Thagard further make clear, the two kinds of knowledge often go by different names, depending on the discipline from which one is approaching these notions (e.g. philosophy, psychology or artificial intelligence). Factual knowledge is sometimes referred to as *know-that*, propositional knowledge, explicit knowledge or declarative knowledge. Similarly, a number of related terms exist for practical knowledge, among which *know-how*, procedural knowledge, implicit knowledge, experiential knowledge, tacit abilities and skills.

### 3.4.1 Factual Knowledge

The conventional conception of factual knowledge is that it is justified true belief. Three elements – justification, truth and belief – define the core of what constitutes factual knowledge and are standard elements in the traditional tripartite analysis of knowledge

(O'Brien, 2006). According to the tripartite analysis[13], if person X knows that Y is the case, three conditions need to be met:

- It is true that Y is the case (truth);
- X believes that Y is the case (belief); and
- The belief of X is justified (justification).

Factual knowledge is normally expressed as some form of statement (proposition), either simply or complex, or is capable of being expressed as a statement, even if the knowledge is never put into words but only passes through someone's head (Pears, 1971). Consider the following proposition taken from the context of winemaking: *The proneness to oxidation of white table wines is minimized if the pH values (which ensure the quantity of hydrogen ions in the wine) range between 3.1 and 3.4* (Rankine, 1989:189). The tripartite analysis of knowledge would claim that three conditions are individually necessary and jointly sufficient for a winemaker to claim factual knowledge concerning the ideal range of pH values for white table wines:

- It must be the true that the specified range of pH values minimizes the proneness to oxidation of white table wines;
- The winemaker must believe that the specified range of pH values will minimize the proneness to oxidation of white table wines; and
- The winemaker must have very good reason(s) or evidence to believe that the specified range of pH values will minimize the proneness to oxidation of white table wines.

[13] The tripartite analysis of knowledge was first challenged by Gettier (1963) who, through two hypothetical cases, showed that there are some instances where a thinker can have a justified true belief without possessing any knowledge. Gettier's cases are counterexamples to the tripartite analysis because although the three required conditions are individually satisfied they do not jointly present sufficient conditions for a knowledge claim.

One response to the counterexamples of Gettier (1963) has been to argue for a more stringent criterion of justification. For a belief to be justified, it is argued, justification should be extended beyond having "very good reason" to believe that something is the case, to involve conclusive evidence only. In other words, the evidence presented must be infallible. This being said, the notion of infallibility has never been at the centre of justification because, should that happen, much of what is currently regarded as knowledge would then fall outside the boundaries of the significantly narrower definition of knowledge. Differently put, knowledge will become so rare to come by should conclusive evidence be the single most important criterion for justification, that this seems over-stringent. Fallibility rather than infallibility therefore remains central in our prevailing conception of factual knowledge. It is possible to claim to know something even though the evidence relied on is a reflection of the best of current evidence and therefore potentially fallible (O'Brien, 2006).

Williamson (2000) offers a more radical response to Gettier's (1963) attack on the traditional tripartite analysis of knowledge. Instead of specifying a more stringent criterion for one of the defining elements of knowledge (justification), Williamson argues that the tripartite analysis should be abandoned altogether because it is impossible to define a set of conditions that must be satisfied by all instances of knowledge. Williamson does not reduce knowledge to merely a particular kind of true belief, as the tripartite analysis does. In fact, he argues that knowledge is conceptually prior to belief. According to O'Brian's (2006) interpretation of Williamson's thesis, the tripartite analysis is based on a hybrid conception of knowledge, where knowledge consists of both mental states (belief and justification) and non-mental states (truth). This breakdown, according to Williamson, is flawed because knowledge, essentially, is a "basic, indefinable, unanalysable, mental state" (O'Brien, 2006:18).

Factual knowledge is "formal, explicit, derived from research and scholarship and concerned with generalisability" (Rycroft-Malone et al., 2004b:83), meaning that the propositions have been empirically derived through systematic observation and experimentation (O'Brien, 2006). Scientific evidence, therefore, can justify a belief as a factual claim, because the evidence is empirical, replicable and verifiable.

However, science is accumulative, as new knowledge is constantly being generated that supports, contests or even supersedes existing knowledge, and scientific theories also shift within larger paradigms. Scientific evidence, therefore, is always the best of current evidence at a particular point in time and does not provide absolute and unconditional justification. Thus, the degree to which a person X is justified in believing that Y is the case at time Z, depends on how well developed and credible the scientific evidence base for that belief is at time Z. According to Haack (1993:81) "justification comes in degrees". This realisation is often expressed in scientific reports through carefully formulated phrases such as "some justification for", "partial evidence for", "reasonable grounds for", "possible to conclude", etc. In addition, according to Haack, a person could interpret scientific evidence as a relevant source of justification for a belief on the basis of other (background) beliefs which may or may not be true.

### 3.4.2 Practical Knowledge

The distinction between knowledge of how to do things (*know-how*) and knowledge of propositions or facts (*know-that*) was first made by the philosopher Gilbert Ryle in 1949. Ryle (1949, 1971) coined the notion of *know-how* as part of an attempt to debunk the so-called "intellectualist legend" in philosophy. The intellectualist legend postulates that

> practical activities merit their titles 'intelligent', 'clever', and the rest only because they are accompanied by some internal acts of considering propositions. (Ryle, 1971:212)

Thus, according to the intellectualist legend which Ryle fiercely opposed, all *know-how* can somehow be reduced to *know-that* (or propositional knowledge). Ryle, on the other hand, regarded *know-how* as practical knowledge that cannot be constructed through an accumulation of individual pieces of *know-that*.

A number of philosophical studies debated the order or relation between *know-how* and *know-that*, and specifically, which is conceptually prior to which (e.g. Snowdon, 2003; Stanley & Williamson, 2001; Williams, 2008). These studies, however, almost exclusively rely on linguistic analyses of sentences that contain the verbs *know-how* and *know-that*. It is only recently that empirical findings (from domains other than philosophy) also started to

emerge in the debate concerning the relation between the two kinds of knowledge. Adams (2009), for instance, highlights a number of empirical studies conducted by experimental psychologists and cognitive neuroscientists, which distinguish between two kinds of memory that are relevant to learning, namely declarative memory (which stores declarative or factual knowledge) and procedural memory (which stores procedural or skills knowledge). Key examples are the behavioural and neuropsychological studies of individuals with memory impairments (e.g. amnesia), which show that although such individuals are unable to learn new or remember existing facts, the ability to perform and acquire skills generally remains intact. According to Adams:

> the evidence from the empirical studies … demonstrates that it is possible to both acquire and improve skill knowledge even in the complete absence of declarative knowledge. Likewise, related studies suggest that it is possible to acquire declarative knowledge even when it is difficult to acquire or improve skill knowledge (Adams, 2009:111).

These studies suggested to Adams (2009) that the concepts of *know-how* and *know-that* are sufficiently distinct and that *know-how* can sometimes be perceived of as a form of knowledge with no factual content.

On the basis of this, one can conclude that practical knowledge implies skills and/or abilities that are normally demonstrated in practice and through the performance of procedures without one necessarily being able to articulate the facts of the matter. I say “necessarily” because it is not invariably the case that a skillful performer cannot also articulate the underlying facts of the matter. Pears (1971), for instances, sketches two scenarios of *know-how* where the underlying factual content is respectively present and absent:

> [A] cook who knows how to produce a soufflé will almost certainly be able to say how it is done, and when he does, he will be showing that he knows such facts as this: if the product is going to be a soufflé, the yolks and the whites must be separated. (Pears, 1971:26)
>
> I know how to ride a bicycle, but I cannot say how I balance because I have no method. I may know that certain movements, and even that certain muscles are involved, but that factual knowledge comes later, if at all, and it could hardly be used in instruction, like the factual knowledge of the cook. (Pears, 1971:26)

Thagard (2006), who reflected on the *know-how* of collaborating scientifically, also argues that practical knowledge does not always remain implicit and without conscious awareness. He illustrates the point with reference to three hypothetical cases. Firstly, where the *know-how* of doing something is explicit from the start and a verbal rule already articulated. An example is an experienced scientific collaborator who tells a novice that, according to best

practice, one should select only collaborators with complementary strengths, and where the novice acts on this advice and eventually sees it as the main explanation for his/her own *know-how* to collaborate. In the second scenario, there is no verbal rule to start with but some rule can potentially be extracted from the practical knowledge exhibited. An example is an experienced collaborator who displays a certain kind of behaviour, such as how to run a laboratory group meeting, which is then "picked up" by the novice who stores a memory of this behaviour and eventually also duplicates it. The novice, if really pressed, can make the relevant *know-how* explicit by formulating one or more verbal rules for it. Lastly, there are instances where practical knowledge is inherently implicit and impossible to translate into verbal rules, for instance the scenario of a novice who does not have:

> any conscious awareness or memory of the physical, intellectual, or social behaviors of the experienced collaborator but nevertheless encodes and eventually duplicates them. (Thagard, 2006:187)

Moreover, the decisions and actions that flow from practical knowledge are seldom derived from analytical reasoning. They are very often intuitive and happen quickly and effortlessly. It relates to the ability to "sense" (for instance, that something is not the way it should be, or the appropriate action). Intuition implies pattern recognition or the unconscious matching of a particular pattern with similar patterns in a larger reservoir of patterns that have been built through experience. In line with this thinking, Sahdra and Thagard (2003:491) define procedural knowledge (they use this term instead of practical knowledge) as "intuitive recognition of the patterns of one's environment that are the most relevant for making a decision or acting appropriately". Hence, practical knowledge implies judgement as well as a more specialised form of judgement, known as wisdom:

> Judgment involves recognizing that a problem is similar to one whose solution path is known and knowing when to apply a particular procedure. (Gorman, 2002:222)
>
> Wisdom is related to judgment, but it is a different kind of judgment than the one usually exercised by experts who are working in roughly familiar territory. Wisdom is the ability to reflect on what is doing, to question prevailing mental models and procedures and, if necessary, come up with a new course of action. (Gorman, 2002:225)

Embedded within the intuitive aspect of practical knowledge is the notion of "common sense". A common sense view of matters, according to Geertz (1983), means that one attributes certain quasi-qualities to reality, among which are naturalness, practicalness and thinness. Common sense wisdom, in practice, therefore can result in one course of action intuitively selected above another because (i) nothing needs to be queried or reflected upon as the chosen action represents the way things are (naturalness), (ii) the chosen action is

the obvious thing to do and anything else would be impractical (practicalness), and (iii) the chosen action is precisely what it is, nothing more and nothing less (thinness).

Practical knowledge also involves a tacit dimension. Tacit knowledge refers to knowledge that is implicit and not stated (Welsch & Lyons, 2001). Polanyi (1966:4) alleged that not all knowledge can be explained (his famous quote: “we can know more that we can tell”) although it can be communicated in some way if one is provided with adequate means of expression. A key example used by Polanyi is that of instant face recognition. One cannot explain how one knows someone else’s face among a crowd of others, yet, should one be instructed to reconstruct a certain face on the basis of a pool of facial clues (as in compiling a police identikit), one most likely would be able to communicate what facial clues to connect to produce the required image.

Tacit knowledge, or tacit knowing, involves a functional relation between two “terms”: a proximal term and a distal term. In tacit knowing, one attends from the proximal to the distal but it is the proximal term of which one has tacit knowledge. To use Polanyi’s (1966) example, by tacitly knowing a face, one attends from the facial features (proximal) to the face (distal) without necessarily being able to specify the features responsible for the immediate recognition (tacit knowledge of features). Tacit knowing therefore involves the integration of particulars (proximal) to achieve the coherent entity (distal) to which one is attending. However, the process of integration goes beyond the mere observation of particulars. The joint meaning of particulars is only achieved through “in-dwelling”, in order words, when the particulars have been fully internalised and incorporated within oneself. Thus, in the act of knowing tacitly, there are particulars of the object of knowledge that one only has tacit knowledge of, and which are embodied within oneself.

In an earlier account by Polanyi (1958), the distal (although then not yet named as such) is equated with skillful performance and the proximal (also not yet named as such) with the observance of a set of rules which the performer has no knowledge of. Although Polanyi leaves room for the fact that the underlying rules can be made explicit (i.e. expressed as positions), he is also determined that the formulated rules (factual knowledge) can never replace the practical knowledge that is exhibited by the skillful performance. To Polanyi, any skillful performance, even the riding of a bicycle, is a form of art.

> Rules of art can be useful, but they do not determine the practice of an art; they are maxims, which can serve as a guide to an art only if they can be integrated into the practical knowledge of the art. They cannot replace this knowledge. (Polanyi, 1958:50)

Moreover, because skills cannot be fully accounted for by their associated particulars (observed rules), the transmission of skills occurs through interpersonal contact, particular those of a close kind such as co-labouring of a craft master and his/her apprentice. Through joint laboring, an apprentice "unconsciously picks up the rules of the art, including those which are not explicitly known to the master himself" (Polanyi, 1958:53).

Intuition, another central aspect of practical knowledge, is often described by practitioners as instinctive, a hunch, common sense and a gut feeling (Chaffey, Unsworth & Fossey, 2010). It is a cognitive skill and was first identified by Carper (1978) as an important source of knowing in nursing. The defining attributes of intuition, according to Rew (1986), are threefold: (1) knowledge of a fact or truth as a whole; (2) immediate possession of knowledge; and (3) knowledge that is independent of the linear reasoning process. McCormack (1992) also performed a concept analysis of the notion and presented four defining attributes of intuition: (1) immediate, unjustified true belief which is not preceded by inference; (2) non-propositional knowledge which is holistic in nature; (3) immediate knowledge of a concept that is independent of the linear reasoning process; and (4) a form of knowing that represents synthesis rather than analysis.

Loye (1983, in Rew, 1988) distinguishes between three kinds of intuition: *Cognitive inference*, which characterizes situations where conclusions are almost spontaneously reached because the steps involved are happening so fast and subliminally that the person is not even aware of engaging in an analytic reasoning process. In *gestalt intuition* the person perceives the whole and can therefore detect gaps and deficiencies. *Precognition* refers to the knowledge that something is about to happen without any past or present clues supporting that conclusion.

The first two forms relate to a process of pattern recognition based on past experiences. Norman, Young and Brooks (2007) discuss two broad classes of theories that explain this process. In prototype theory, exemplars of any category can result in the formation of an abstract prototype that captures the critical features of individual exemplars and which, to some extent, can be seen as the "average" of exemplars derived from past exposure. Whenever confronted with a new object/situation, a person compares the features of the new object/situation to those of different prototypes stored in memory, to determine to which category the new object/situation belongs. In exemplar theory, on the other hand, a category

is represented by individual exemplars and not by an abstract prototype. Thus, there is no apparent feature-by-feature analysis. A new object/situation is unconsciously matched to stored exemplars to determine the appropriate category to which it belongs. This normally occurs because of a wealth of past experiences where there is a sufficiently large pool of exemplars stored in memory.

In sum, then, experience strengthens the confidence that practitioners have in their intuitions (Chaffey, Unsworth & Fossey, 2010) and intuitive knowledge appears to be also more acute among experts. Expertise, according to Sahdra and Thagard (2003), requires the integration of factual and practical knowledge, and this occurs with the accumulation of experience and practice:

> the sense of "owning" a technique comes after the integration of procedural knowledge of performing or doing it and propositional knowledge of the facts and theory behind the technique; and both exploration and practice are necessary for the integration. (Sahdra & Thagard, 2003:495)

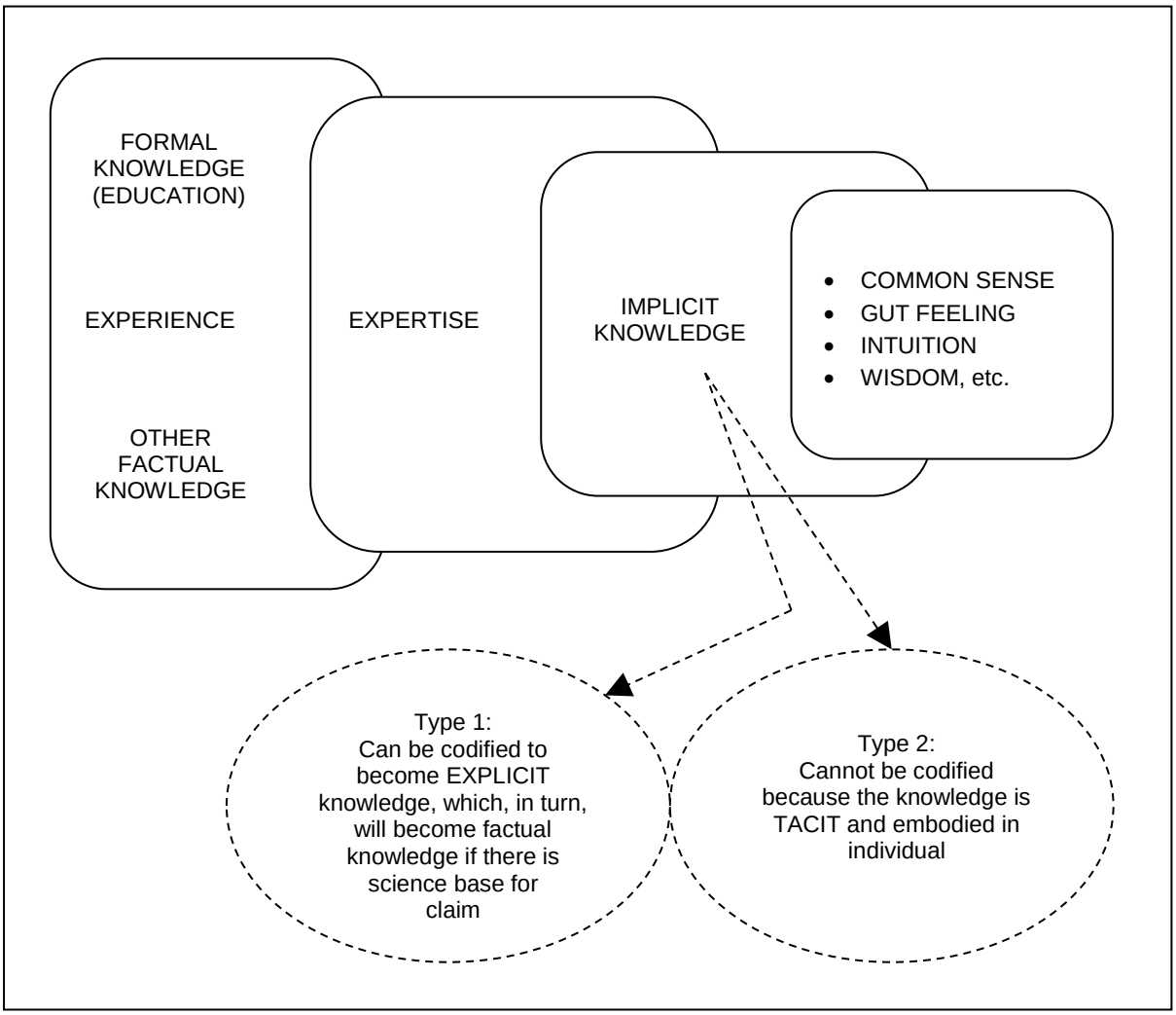
Lastly, a complementary perspective on the development of expertise, which also integrates factual and practical knowledge, is the stage model by Dreyfus and Dreyfus (1986). According to the model, expertise is developed through a skills acquisition process, from the initial conscious application of rule-guided *know-that* to the eventual automation of experience-based *know-how* that has become fully internalised. The authors identify five development stages in the acquisition of skills, namely novice, advanced beginner, competence, proficiency and expert. Benner (1984), who applied an earlier version of the skills acquisition model to clinical nursing practice, highlights three sets of changes that underpin development across the different stages. The first is the shift from reliance on abstract principles (context-free rules) to the use of concrete experiences as paradigms. The second change is perceptual, as it involves a shift from perceiving the demand situation as composed of equally relevant elements to a perception of the demand situation as a whole where only certain elements are relevant. Thirdly, there is a shift from detached observer to involved performer, similar to the "in-dwelling" referred to by Polanyi (1958).

### 3.4.3 Summary

Practical knowledge is internalised expertise-based knowledge that is exhibited in practice. It finds expression in action, particularly as moments of common sense, gut feeling, wisdom, immediate knowing and intuition. Although all practical knowledge is implicit not all practical knowledge remains implicit. In other words, in some instances the implicit knowledge can be made explicit, meaning that the underlying facts of the matter can be expressed as

propositions and therefore codified. A formulated proposition, in turn, can be classified as factual knowledge if verified through scientific investigation or if empirical evidence exists to support the claim contained in the proposition. Practical knowledge can therefore be transferred through codification, where applicable, or in cases where the knowledge is non-codifiable, through close co-labouring and apprenticeships. The notion of tacit knowledge, although used in many ways by different authors, is probably the best descriptor for knowledge that is inherently implicit and non-codifiable (in the Polanyi sense of the notion: "we can know more that we can tell"). Figure 3.2 captures the essence of my description of practical knowledge, together with its relation to factual knowledge.

**Figure 3.2: Structure of practical knowledge**




In the above diagram, expertise is developed through the integration of formal education, experience, and other pieces of factual information acquired over time. Part of the accumulative knowledge associated with expertise becomes internalised and therefore

implicit. Moreover, it is this implicit knowledge component of expertise that constitutes practical knowledge and which is "tapped" during performances, where it is interpreted as common sense, gut feeling, intuition, etc. In this sense the acquisition of expertise very closely matches a skills acquisition process, which implies a move from initial rule-guided factual knowledge to fully internalised experience-based know-how.

Evidence-based medicine (EBM), as part of the knowledge-to-practice movement in health, which will now be discussed in the next section, sometimes also hints at the factual knowledge component (medical training and continuous education) of clinical expertise.

## 3.5 INSIGHTS FROM THE KNOWLEDGE-TO-PRACTICE MOVEMENT IN HEALTH

### 3.5.1 Evidence-Based Medicine (EBM)

The knowledge utilisation paradigm of clinical health practitioners is inextricably linked to evidence-based medicine (EBM), a movement that has been dominating the scholarly debate on clinical practice and evaluation for more than a decade (e.g. Bandopadhayay, Goldschlager & Rosenfield, 2008; Estabrooks et al., 2008; Howland, 2008). The EBM movement partly emerged as a response to physicians' reliance on a variety of knowledge sources and approaches for the treatment of often similar conditions, which is believed to have implications for the efficacy and cost-effectiveness of treatment. Personal preferences of physicians, often disguised as the "art of medicine", tend to take precedence in treatment and it is this personal preference that results in inconsistency of care (Golec, 2009). EBM therefore developed with two objectives in mind: to ensure the quality of health care by strengthening the scientific base of clinical practice (and thus restricting opinion-based decisions) and to control costs by reducing wasteful expenditures on ineffective treatment interventions (Timmermans & Kolker, 2004). Moreover, the intention behind EBM is to change the decision-making process, or clinical judgement of physicians, and not to introduce a new philosophy of medicine as many seem to believe.

Although the philosophical roots of EBM can be traced back to as far as mid-19$^{th}$ century Paris, one of the first and perhaps clearest attempts to demarcate the notion of EBM occurred as recently as 1996, in an editorial by David Sackett and colleagues in the *British Medical Journal*:

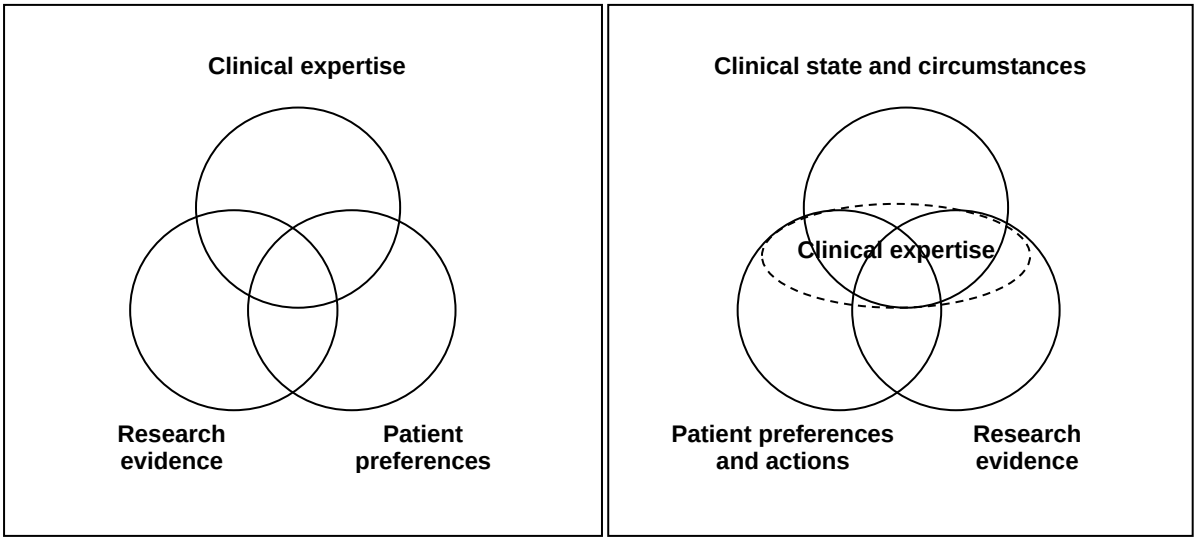
> Evidence based medicine is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of

> evidence based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research. By individual clinical expertise we mean the proficiency and judgment that individual clinicians acquire through clinical experience and clinical practice. (Sackett et al., 1996:71)

Based on this definition, EBM involves three core elements: current best evidence, clinical expertise, and individual patients. The patients not only present a set of clinical symptoms and complaints but also exhibit personal preferences. The configuration of the three core elements in the construction of EBM, however, has shifted with time, as highlighted by Lambert (2006) and which is also illustrated in Figure 3.2. The key modification is that clinical expertise, initially portrayed as equivalent to research evidence and patient preferences in clinical decision making, eventually have come to assume a central position in that process (or at least in theory). Clinical expertise refers to competence that is gained through education, training and experience (APA Presidential Task Force on Evidence-Based Practice, 2006). Haynes, Devereaux and Guyatt (2002), who are credited with the updated model in Figure 3.3, emphasise the rational decision-making aspects of EBM. In the rational model the patient's clinical and physical circumstances provide a first clue as to the nature of the problem and the treatment options available. These options are then weighed in terms of available research to determine the most appropriate course of action, taking into consideration the potential consequences associated with each. However, the patient's preferences and likely actions in response to treatment also need to be considered. The physician therefore relies on clinical expertise to balance the different considerations in order to reach an informed decision concerning the most appropriate treatment also acceptable to the patient. Sackett et al. (1996) stress the centrality of clinical expertise when stating that:

> External clinical evidence can inform, but can never replace, individual clinical expertise, and it is this expertise that decides whether the external evidence applies to the individual patient at all and, if so, how it should be integrated into a clinical decision. (Sackett et al., 1996:72)

**Figure 3.3: Initial and updated model of EBM**




Source: Lambert (2006:2636-2637)

Evidence in EBM is generally understood to be research evidence of a quantitative nature, especially evidence that is generated by randomised controlled trials. Moreover, not all research should be used in clinical practice; only that which has been "appraised and found to be of sufficient rigour" (Bannigan & Bryar, 2002:270). This highlights the importance of critical appraisal of evidence. The principles of EBM clearly state what qualifies as proper and rigorous evidence:

- Clinical decisions should be based on the results of high quality epidemiological studies, clinical intervention trials, and other robust research designs on human subjects.
- The prognosis of disease, and the benefits and harms of different management options, should be expressed as mathematical estimates of probability and risk.
- Randomised controlled trials are more valid and generalisable than 'anecdotal' evidence when assessing interventions.
- Secondary sources of research, especially systematic reviews and the guidelines derived from them, can summarise the relevant research evidence on a topic and provide the busy clinician with a useful short cut to the 'clinical bottom line'.
- The recommended approach to clinical problems is as follows: formulate a focused question, search the literature for relevant research evidence, appraise the evidence for its validity and usefulness, and apply the results. (Sackett et al., 2000, in Greenhalge, 2002:397)

With regard to the recommended approach in EBM (the last bullet listed above), Ely et al. (2002) investigated the obstacles that physicians typically experience when trying to answer clinical questions with evidence. These are: the amount of time needed to find information; difficulty to modify the original question where it was vague and open to interpretation; difficulty to select an optimal information search strategy; failure of a seemingly appropriate resource to provide an answer; uncertainty as to when sufficient relevant evidence has been obtained so that the search can be stopped; and difficulty to integrate multiple pieces of

information into a clinically useful statement. Within this context, according to Boissel et al. (2004), published scientific research acts as a primary (direct) source of information for physicians, whereas intermediaries act as a secondary (indirect) source. Examples of intermediaries are medical journalists and pharmaceutical industry marketing staff, and the products produce by these intermediaries are, for instance, clinical practice guidelines, summaries and Cochrane systematic reviews[14]. From a physician's perspective, however, intermediaries are often preferred, simply because of a lack of time and the lack of technical ability to engage with all scientific developments in a field.

Similarly, Guyatt et al. (2000) highlighted two strategies to ensure evidence based care. The first is to train physicians to interpret the medical literature. However, this is not the best strategy available because not all practitioners have an interest in acquiring advanced skills in assessing and using the original literature, and there is also the issue of time constraints. The second, and more practical strategy, is to produce secondary resources, containing pre-appraised synopses, conclusions and recommendations. This also appears to be the preference of practitioners. McColl et al. (1998), for instance, conducted a questionnaire survey of general practitioners' perceptions of the route to EBM. The practitioners surveyed expressed a generally low level of awareness and use of extracting journals, review publications and databases relevant to EBM. This was largely attributed to a lack of personal time. Most respondents also reported an understanding of the technical terminology used in evidence based publications but less than one-third indicated that they would be able to explain it to others. Moreover, more than half of the survey respondents (57%) believed that the best way to shift from opinion-based practice to evidence-based practice would be by using clinical practice guidelines developed by colleagues.

Clinical practice guidelines are regarded by EBM proponents as important mechanisms to close the research-to-practice gap. In fact, the "dilemma" of EBM is that the clinical management of individual patients lies at its core but that individually tailored treatments cannot be readily informed by the results of clinical research or randomised clinical trials as these are derived from the study of populations (Lambert, 2006). Thus, in EBM, a reliance on clinical practice guidelines is increasingly promoted as a method to bridge the gap between the results of clinical research and the care of the individual (Tonelli, 2010).

Earlier examples of clinical practice guidelines, i.e. prior to the advent of EBM, were based on the opinion of experts. Nowadays, however, under influence of EBM, procedures exist for

[14] Cochrane reviews are often considered as the highest standard in evidence-based health care. It involves the systematic review of controlled trials, with each review addressing a clearly formulated question (e.g. Can X alleviate the symptoms of Y?). Cochrane reviews are published in the online Cochrane Library (www.cochrane.org/cochrane-reviews).

the critical appraisal and systematic grading and weighing of available clinical evidence, where only those to be found of sufficient rigour are converted into a set of practice guidelines. Thus, clinical practice guidelines, in the modern sense, are expressions of factual knowledge with an underlying science base. On the other hand, earlier examples of clinical practice guidelines, and therefore also earlier studies of such guidelines, also included expertise-based practical knowledge, given that these pre-EBM guidelines were largely opinion-based. Moreover, although consensus statements are something different than clinical practice guidelines they are sometimes also grouped under the header of practice guidelines. Consensus statements are based on the collective opinion of a panel of experts (Bousquet et al., 2008). Thus, in the case of consensus statements, we are also dealing with opinion-based expertise, or mainly practical knowledge that has been externalised and codified and written up as recommendations.

Clinical practice guidelines have been well studied in the EBM literature and the insights derived from some of these studies, for instance, regarding the uptake of guidelines in practice, are also relevant for the purposes of the current research (e.g. the uptake of factual knowledge in practice). It is also worthwhile to point out that clinical practice guidelines feature in two ways in the EBM movement: Firstly, under influence of EBM, a strong scientific evidence base has been injected into clinical practice guidelines, and secondly, related to this, clinical practice guidelines have become carriers of the most preferred evidence type in EBM, which is research.

### 3.5.2 Practice Guidelines as Carriers of Research Evidence in EBM

Clinical practice guidelines are considered one of the key mechanisms in the facilitation of EBM, next to systematic reviews (primarily Cochrane reviews), professional education and continuous development. Burgers et al. (2003:15) define clinical guidelines as “documents that contain a set of individual recommendations covering one specific disease area”. Clinical practice guidelines normally have their origin in published research findings that have been synthesised (Haynes & Haines, 1998). Silagy, Stead and Lancaster (2001), for instance, investigated the extent to which clinical practice guidelines incorporate evidence from available systematic reviews of clinical research (mostly Cochrane reviews). In their example, on average, no more than 36% of recommendations in the guidelines on smoking cessation, published between 1994 and 2000, were supported by Cochrane reviews.

Davis and Taylor-Vaisey (1997 – no page number) provide a detailed account of the steps involved in the production and dissemination of clinical practice guidelines:

> First, a local group or, more often, a national body decides to develop guidelines in a clinical area in which there is a demonstrated need for such guidelines. Second, data are synthesized from research information and relevant practice patterns by searching the literature (including existing guidelines) and then weighing the strength of the evidence from the resulting trials or studies. Third, these data are further reviewed, appraised, distilled and collated as guidelines; that is, as recommendations about strategies for investigation and management. Fourth, the sponsoring organization and other interested organizations then endorse the guidelines. Fifth, [clinical practice guidelines] are disseminated, usually by traditional means such as mailing them to members or publishing them in recognized professional clinical journals. Sixth, various groups or individual practitioners may attempt to implement the guidelines more actively, through various, often multiple, strategies to assist, convince or otherwise influence physicians, patients and their caregivers. Finally, the guidelines are subjected, albeit irregularly, to re-appraisal, evaluation and reiteration of the process.

Clinical practice guidelines, once disseminated, can be modified or discontinued for a number of reasons. These include, among others, changes in current evidence on the benefits and harms of interventions, new treatments that emerge which supersede or complement existing ones, changes in the values placed on certain treatment options, etc. (Shekelle et al., 2001).

A question that arises is to what extent clinical practice guidelines are in fact being used by physicians. Grol (2001), for instance, found that guidelines are followed, on average, in 67% of decisions made by physicians but the figure differs by the kind of guideline involved (e.g. even as low as 34-36% in some cases). Timmermans and Kolker (2004) cited various studies where it was found that adherence to clinical practice guidelines in the diagnosis and treatment of asthma is relatively poor. Grilli and Lomas (1994) reported compliance rates that vary between 43% and 64%, depending on the area of clinical practice. The general perspective is that clinical practice guidelines are under-utilised and associated with low compliance rates (Gagliardi et al., 2011).

A number of researchers studied the attributes of clinical practice guidelines or factors surrounding such guidelines that influence their uptake in clinical practice. Grol et al. (1998), for instance, reported a higher compliance rate for guideline recommendations based on scientific evidence compared to those that do not incorporate scientific evidence (71% versus 57%). Moreover, recommendations that are non-controversial and compatible with current values, precisely and correctly described, specifically formulated and not demanding changes in existing routines, are more likely to be adhered to than guidelines lacking these attributes. In a similar line, Foy et al. (2002) found two attributes of guidelines to be significantly associated with higher compliance rates, namely the extent to which a guideline is compatible with a user's current norms and values, and the extent to which it does not require changes to fixed routines or habits.

Burgers et al. (2003) compared the attributes of clinical practice guidelines with high compliance rates to the attributes of clinical guidelines with low compliance rates, and examined the nature of the differences between the two sets of guidelines. Specifically, 96 key recommendations were selected from 29 available clinical guidelines that were developed by the Dutch College of General Practitioners and which appeared in a scientific journal for general practitioners. Altogether 63 of these recommendations had high compliance rates and 33 had low compliance rates. A panel of general practitioners was asked to determine the extent to which twelve attributes (six potential facilitators of use and six potential barriers to use) were either present or absent in the recommendations. As it turned out, recommendations with high compliance rates were more often supported with explicit references to evidence, more often compatible with existing norms and values, less often part of a complex decision tree, and less often requiring new skills. According to Cólon-Emeric et al. (2007), physicians in nursing homes (together with other nursing staff) often express the belief that clinical practice guidelines and other protocols are not reconcilable with individualised patient care and also inferior to professional experience. Overall, Davis and Taylor-Vaisey (1997) highlighted six categories of factors, based on their review of the literature, that can either impede or facilitate the adoption of guidelines in clinical practice. These pertain to the qualities of the guidelines (e.g. relative advantage, compatibility with existing values and beliefs), characteristics of the health care professional (e.g. demographic variables such as age and country of training), characteristics of the practice setting (e.g. beliefs of colleagues and existing organisational structures and procedures), incentives (e.g. compensation for particular procedures), regulation (e.g. accreditation for hospitals based on guideline adherence), and patient demands (e.g. patient preferences influencing compliance). The bottom line is that clinical practice guidelines, in order to be adopted:

> … should be user-friendly and based on the best evidence, without necessitating significant changes to existing practice routines. Guideline recommendations should be clear and suited to most patients. Furthermore, they should discuss patient preferences and fears experienced by patients and participants. (Dahan et al., 2007:617)

Recently, Gagliardi et al. (2011) made a first attempt at a conceptual framework to guide the adoption and implementation of practice guidelines. Specifically, they provided a taxonomy involving eight domains or clusters of elements that need to accompany guidelines in order to facilitate their use (Table 3.2). This approach is firmly located in the domain of knowledge translation (see Section 3.5.3), where the focus is on developing and implementing strategies for effective research use. For that reason, for instance, apart from conveying guideline content, the guidelines should also equip potential users with appropriate

strategies to identify relevant barriers of uptake, and even go a step further by including strategies to tailor guidelines for adoption in local contexts.

**Table 3.2: Conceptual framework of implementability of practice guidelines**

| Domain | Definition |
|---|---|
| Adaptability | The guideline is available in a variety of versions for different users or purposes |
| Usability | Content is presented, organised, or formatted to enhance the ease with which the guideline can be employed (e.g. easy navigation; evidence presented in narrative or tabulated format, or both) |
| Validity | Evidence is summarised and presented such that its quantity and quality are apparent, and it can be easily reviewed, understood, and interpreted (e.g. total number of distinct references to evidence upon which recommendations are based; a system is used to categorise quality of evidence supporting each recommendation) |
| Applicability | Contextual or supplementary clinical information is provided by which to interpret and apply the recommendations for individual patients (highlighted as tips or practical issues using sub-titles or text boxes, or summarised in tables and referred to in recommendations or narrative contextualising recommendations) |
| Communicability | Information is included to support discussions with patients, or patient involvement in decision making (e.g. Informational or educational resources for patients/caregivers, questions for clinicians to facilitate discussion) |
| Accommodation | Costs, resources, competencies and training, technical specifications, and anticipated impact required to accommodate use are identified (e.g. anticipated changes in workflow or processes during/after adoption of recommendations; direct or productivity costs incurred as a result of acquiring resources or training needed to accommodate recommendations) |
| Implementation | Strategies for identifying barriers of use, and selecting, planning, and applying promotional strategies are described (e.g. individual, organisational, or system barriers that are associated with adoption; instructions, tools or templates to tailor guideline/ recommendations for local context) |
| Evaluation | Performance measures for audit or monitoring are included (e.g. suggestions for evaluating compliance with organisation, delivery and outcomes of recommendations) |

Source: Gagliardi et al. (2011, Tables 2 and 4)

Moreover, the strategy used to disseminate clinical practice guidelines plays a decisive role in the use and knowledge of such guidelines. According to Grimshaw et al. (2001) passive dissemination of clinical practice guidelines and other educational materials is generally ineffective in bringing about change in practitioner behaviour; at best they create awareness about the desired behaviour change. With passive dissemination is meant, for example, the mailing of the educational materials to targeted clinicians. Stakeholder engagement as a dissemination strategy appears to be more effective. In a study that was conducted in the Netherlands (Grol, 2001), guideline materials were sent to the organisers of local continuing education and the representatives of local family physicians in two districts. In one of these districts, however, the dissemination was supplemented by outreach visits to the relevant people, to provide explanation and instruction on the use of the materials. A survey was sent to all family physicians in the two study districts. The physicians were asked whether they have been informed about the materials, whether they have the materials in their possession, whether they have read the materials and whether they have used the

materials. In all four instances, respondents in the study district that also received outreach visits reported the highest knowledge about and use of the materials.

Lastly, some comments about the use of clinical practice guidelines (factual knowledge) in relation to clinical expertise (internalised experience-based know-how, exhibited as practical knowledge) are warranted. Firstly, physicians make clinical decisions regarding the best available course of care for a particular patient, with their expertise facilitating the link between the results of research (incorporated in a guideline) and the conditions and preferences of the individual patient. Thus, physicians rely on own expertise to determine whether a clinical guideline is appropriate for a particular case. Secondly, the expertise of others can enter the process of developing clinical practice guidelines in instances where developers subconsciously draw upon clinical expertise when having to distil and collate relevant research evidence in order to present it as a set of guidelines. Thirdly, given the earlier comment that clinical practice guidelines are under-utilised and associated with low compliance rates one could rightfully ask what forms of knowledge are predominantly used in everyday clinical practice? Increasingly a body of research is pointing towards the centrality of practical knowledge and its different variants – tacit knowing, intuition or gut feeling – in the clinical decision-making process. In the next section we consider these alternative forms of evidence and practice knowledge, other than research-informed clinical practice guidelines, that characterise the daily actions and decisions of physicians and health practitioners.

### 3.5.3 Thinking beyond Research: Alternative Perspectives about Evidence and Practice Knowledge

The expansion of EBM beyond physicians has broadened the scholarly debate about the nature of evidence. As other health care professions joined the movement of trying to base their practice on current best evidence, EBM eventually escalated into evidence-based practice (EBP). The other professions include nursing (Boström, Wallin & Nordström, 2006; Rutledge and Bookbinder, 2002), psychology (APA Presidential Task Force on Evidence-Based Practice, 2006; Chwalisz, 2003; Ramey & Grubb, 2009; Stricker, 2003), social work (Van de Luitgaarden, 2009) and veterinary sciences (Everitt, 2008; Holmes & Ramey, 2007; Schmidt, 2007). Illustrative of the new perspectives of evidence in EBP is the threefold distinction by Chwalisz (2003), elaborated on by Stricker (2003), whereby evidence is conceptualised as being hierarchical, triangulating and dialectical. Evidence is considered hierarchical because some evidence can be more powerful and compelling than others; it is triangulating because evidence from different sources often converge; and dialectical

because of an interplay between scientific evidence and practice-based evidence. Stricker also emphasises that, in the EBP debate, it should not be about whether or not there is evidence for something but rather the extent to which there is evidence for something.

Moreover, the EBM movement increasingly became criticised for the disproportionate weight assigned to research evidence, disseminated through clinical practice guidelines and other media of research synthesis, as the primary source of knowledge for practice. The traditional view of evidence in EBM – as being research based – is strongly challenged by Gabbay and Le May (2004). Their ethnographic study of practitioners in two general practices in the United Kingdom showed that primary care practitioners do not use the traditional routes of evidence into practice as proposed by EBM, such as clinical practice guidelines. In fact, the practitioners heavily relied on knowledge conveyed through networks with other practitioners and professionals, without questioning as to whether or not these views of others are rooted in research evidence. The overwhelming tacit dimension of the practitioners' knowledge base compelled the investigators to introduce the notion of "mindlines":

> … clinicians relied on what we have called "mindlines", collectively reinforced, internalised tacit guidelines, which were informed by brief reading, but mainly by their interactions with each other and with opinion leaders, patients, and pharmaceutical representatives and by other sources of largely tacit knowledge that built on their early training and their own and their colleagues' experience. (Gabbay & Le May, 2004:1014)

Thus, mindlines represent knowledge in practice and are therefore not static but dynamic, given that practitioners continuously refine their mindlines by comparing their implicit as well as explicit knowledge with that of others. Other forms of implicit knowledge, in medical practice, include "rules of thumb" (André et al., 2002; André, Borgquist & Mölstad, 2003). One example of a rule of thumb that a practitioner could formulate and subconsciously apply during her/his engagement with patients in clinical practice is the following: "*Able to lay down and sleep at night, no heart failure*" (André et al., 2002:620). Such rules are based on the practitioner's own experience and that of others, which has been internalised, and also on knowledge that is immediately available although not always conscious.

What the aforementioned studies show is an increased emphasis on the non-analytical elements of clinical decision-making. Another example is the recent qualitative studies by Stolper et al. (2009a, 2009b, 2010) on the concept of gut feelings in clinical practice, a form of intuitive knowing in practice originally frowned upon. Stolper et al. (2009a) identified two types of gut feelings on the basis of focus groups discussions held with a number of general practitioners in the Netherlands. These are, respectively, a sense of <u>alarm</u> and a sense of <u>reassurance</u>. A sense of alarm is composed of a number of elements. The first is an uneasy

feeling that something is wrong with the patient even though the practitioner cannot seem to find any indications that objectively support that feeling; secondly, a distrust of the situation because the prognosis appears to be uncertain; and thirdly, a need for some kind of intervention in order to avoid an adverse health problem. A sense of reassurance, on the other hand, is a secure feeling because the appropriate intervention is clear in the mind of the general practitioner even though a proper diagnosis could be lacking. A gut feeling can often be regarded as a source of knowledge of general practitioners, as one respondent in the study by Stolper et al. (2009a – no page number) also confirms: "*At a certain moment, it becomes a matter of knowing, this gut feeling of alarm or reassurance, you just know*."

The main determinants of gut feelings, according to Stolper et al. (2009a), are as follows:

- Fitting and alerting factors: General practitioners tend to form overall (expected) pictures of patients and diseases based on prior experience and accumulative knowledge. A feeling of alarm arises if there is a misfit between the expected picture and the picture presented, which then becomes an alerting factor. A sense of reassurance, on the other hand, occurs when the current picture is compatible with the one expected.
- Contextual information: Additional information about a patient, other than the presented symptoms, constitutes contextual knowledge. The latter provides a frame of reference when determining a fit between the current picture and the overall picture.
- Interfering factors: Gut feelings can be inhibited in cases where strong emotional reactions (sympathy, aversions, guilt) interfere with the work of the general practitioner.
- Medical education and experience: Gut feelings can be taught although they are not easily learned. In addition to the hypothetic-deductive method (where diagnoses are hypothesised on the basis of signs and symptoms, followed by supplementary questions, i.e. a rational diagnosing process), diagnostic feelings can also be developed through reflection. However, it is only through experience that a general practitioner is able to find meaning in the "noise" and peculiarities that surround the presentation of symptoms and signs.
- Personality: The ability to take risks and tolerate uncertainty is often needed to act upon and deal with gut feelings. Also, general practitioners who lack self-confidence may not trust the sense of reassurance or alarm.
- Need for a compass amidst uncertainty: A single correct intervention or referral from acting on gut feelings provides direction when similar cases are presented in the

future. A diagnosis that is reached on the basis of a sense of alarm or reassurance also helps with the management of complex situations and effectively manages the limited time available.

- Perceived consequences: The perceived consequence of not dealing with a sense of alarm is a motivating factor for the general practitioner to act upon gut feelings, in order to be on the safe side.

Stolper et al. (2010) locate gut feelings as occurring on the interface between, on the one hand, a general practitioner's knowledge and experience and, on the other hand, the information provided by patients. This interface, recalling again Figure 3.3, is what EBM considers to be clinical expertise. Thus, gut feelings can be considered an integral part of clinical expertise and a form of implicit knowing. According to Stolper et al. gut feelings need to be taken seriously as they fulfill an important role in clinical reasoning. The same authors conceptualise medical knowledge as constituting an associative network of inter-connective knowledge parts that involve high-level concepts, contextual factors, patient information, symptoms, treatments, drugs, etc. Moreover, the richer and denser this network becomes in terms of medical expertise, the more automated and non-analytical the process of clinical reasoning also becomes, thereby sparking regular instances of gut feelings:

> With increasing experience, their knowledge network will become richer and more coherent, and non-analytical reasoning will more often be invoked, but experienced GPs are able to switch to analytical reasoning when the automatic approach is not enough to explain the patient's situation. The sense of alarm can be regarded as the first warning sign that automatically pops up from the knowledge network to slow down when no familiar pattern can be identified. Sometimes no satisfactory explanation can as yet be found, but prompt intervention is necessary bypassing a diagnosis. And sometimes GPs can feel reassured about the expected course of an illness even if they have as yet no clear diagnosis. (Stolper et al., 2010:200-201)

Welsh and Lyons (2001), who are from the nursing sciences, postulated a link between intuition, tacit knowledge and formal knowledge. Specifically, tacit knowledge for them is the result of the synthesis of formal knowledge (e.g. training received) with clinical experience. Tacit knowledge, in turn, informs intuition and for that reason is positioned between formal knowledge and intuition. Thus, whenever an intuitive decision is made, some element of formal knowledge is also being used, albeit indirectly. It is only through reflecting on one's actions that the tacit knowledge can be articulated and the underlying formal knowledge exposed. In effect, the discussion by Welsh and Lyons suggests that there are two forms of intuition: that which is based on the acquisition of formal knowledge (and hence classifiable as "evidence-based") and that which occurs without any reference to a formal

knowledgebase. The first is deemed acceptable and the latter, in the authors' opinion, "has no place in professional practice" (Welsh & Lyons, 2001:305).

These recent investigations into the non-analytical facets of EBM, such as gut feelings, tacit knowledge and mindlines, all seem to serve a single purpose: to argue for the scientific foundations and undertones of intuitive clinical judgement.[15] These investigations cannot easily be separated from the broader objective to achieve a synthesis between, on the one hand, clinical intuition, and, on the other hand, the rational choice approach that is typical of EBM. Such an objective is born out of a perception that clinical judgement is under attack within EBM and that EBM undermines the value of tacit clinical knowledge in practice (Gabbay & Le May, 2004; Moussa, 2008), given that EBM's "epistemological foundations are constructed on the elimination of clinical intuition" (Braude, 2009:196). However, despite the prominence of EBM within clinical practice its ability to eventually become practice-by-default is far from being settled:

> EBM will never entirely replace *claim-based medicine* (blind or as a justified conclusion of a logical argument); *faith-based medicine* (belief and trust in something); *experience-based medicine* (as given by the active involvement of a recorded or unrecorded individual in an activity or exposure to events or people over a period of time that leads to an increase in knowledge and skills); *conviction-based medicine*, based on firmly held opinions and beliefs (with or without grounds); *'big heart'-based medicine* as dictated by the doctor's compassion, empathy, will to help and affection for the human suffering; *reference (spoken and written word)-based medicine* as conveyed to listeners and readers; *gut feeling-based medicine* as instinctive and intuition-driven understanding and decision making; *authority-based medicine*, whatever the authority (as the right or power, justified or not, to enforce rules or give orders that are administrative or competency based) … (Jenicek, 2006:412)

Lastly, another view of the nature of evidence used in practice is that it can involve both propositional and non-propositional knowledge. EBM largely reduces evidence to propositional knowledge (statements informed by scientific research) whereas alternative lines of research also emphasise non-propositional knowledge as evidence in clinical practice. A study by Estabrooks et al. (2005), for instance, showed that the knowledge of

[15] Apart from conceptual developments in relation to the "scientification of clinical judgement", similar developments with regard to the inverse can also be observed, which is to expose the judgemental character of scientific evidence, particularly evidence that is held in high esteem by proponents of EBM. This line of study is familiar territory for social constructivists who would argue that all evidence is socially shaped and not invariably scientific. De Vries and Lemmens (2006), for example, criticise EBM on the basis that the scientific evidence is contaminated with the biases of researchers and clinicians. The authors explained in great detail how commercial interests of largely drug companies can influence the design of the research protocol (for randomised controlled trials). One example is where researchers with industry sponsorship from drug companies manipulate trial design and subject selection (e.g. by selecting weak comparators to a sponsor's drug in a clinical trial, by using inappropriate dosages of the comparative drug, by manipulating the eligibility criteria to include subjects who will respond more positively to the sponsor's drug, etc.). Moreover, since industry funded researchers have the necessary money to recruit subjects for clinical trials, industry sponsored drugs are more researched and therefore more visible in the scientific literature. Also, review articles are very influential in EBM as they are incorporated into clinical practice guidelines. For that reason journals publishing review articles only appoint the most eminent experts in a particular field, who have no financial relationship with the sponsors of any of the products of clinical trials being reviewed. However, there are indications that journal editors are increasingly becoming relaxed in this regard as instances have been reported where the review authors have direct interests in the drugs being reviewed.

nurses can be categorised as falling into four groups, namely social interactions, documents, experiential knowledge and *a priori* knowledge. Estabrooks et al. describe their proposed taxonomy of knowledge sources as follows:

- Social interactions are the processes of communication, information exchange and relationship formation among nurses, as well as between nurses and other health care professionals, patients and their families. Social interactions as a source of practice knowledge, according to Estabrooks et al. (2005), is the most dominant form of knowledge in the case of nurses. The investigators further distinguish between social interactions that are informal (spontaneous interactions which occur as needed) and formal (structured according to time and place, e.g. conferences, short courses, ward rounds, journal clubs, etc.).
- Experiential knowledge is the second most important knowledge source among nurses and refers to knowledge gained through observations in nursing practice, and which is normally the product of a nurse's own observations as well as those of others.
- Documents, as the next source of practice knowledge, are self-explanatory – they can be either unit-based (patient charts, bulletin boards, treatment protocols, etc.) or off-unit (books, journals, research reports, etc.). It is not uncommon for experiential knowledge and documented knowledge to directly compete, especially in instances where documentary evidence (in journals, protocols, etc.) requires a change of practice but the practitioner's experiential knowledge suggests otherwise. Often this results in the nurses' rejection of the implementation of the documentary evidence.
- Lastly, *a priori* knowledge, as defined by Estabrooks et al. (2005), refers to intrinsic knowledge that nurses bring with them to their unit, which includes knowledge acquired at nursing school, personal beliefs and common sense.

In the taxonomy by Estabrooks et al. (2005), documents are typical carriers of propositional knowledge. Given the diversity of documents used in practice (both research based and non-research based) the documents may or may not have an underlying science base. Propositions can also be articulated and transmitted during formal and informal social interactions and again the formulated statements can be either with or without an underlying science base. Experiential knowledge and *a priori* knowledge, on the other hand, are illustrative of non-propositional knowledge exhibited in practice (thus practical knowledge) but, as stated elsewhere, non-propositional does not necessarily mean that these cannot ultimately be formulated as verbal rules (propositions). In instances where verbal rules can

be extracted, the scientific foundation needs to be demonstrated in order for the rules to qualify as facts.

The taxonomy by Estabrooks et al. (2005), for nurses, is also supported by studies conducted among general practitioners. For instances, Kitto et al. (2007) reported that general practitioners express more confidence in their own judgement than in EBM mechanisms such as clinical practice guidelines. Cialdella et al. (1991) also reported personal experience to be highly valued among French general practitioners. Moreover, interactions with fellow practitioners and experts are often cited as the most frequently mentioned or most preferred information source for clinical physicians although differences exist according to area of specialisation (Boerkamp et al., 1996; Ely et al., 1999; Falshaw, Carter and Gray, 2000; Smith, 1996).

This concludes the section on alternative perspectives about evidence and knowledge in EBM. Social interactions and documents, encountered in the taxonomy by Estabrooks et al. (2005), are mechanisms of knowledge transfer (knowledge transfer media) and therefore part of the broader conception of knowledge utilisation. In the next section we will see how such a broader conception has increasingly become important in EBM and EBP, where it is no longer referred to as knowledge transfer but as knowledge translation. Knowledge translation is based on the perception that new factual knowledge, if let to its own devices, will seldom be used in practice because of a complexity of factors that work against its uptake (e.g. context, existing user norms and values, rival knowledge sources). A holistic approach to knowledge implementation is required, where utilisation – or the smooth integration of knowledge in user practice – is achieved through stakeholder interaction, ideally during all stages of the knowledge translation process (Haines & Donald, 1998; Pronovost, Berenholtz & Needham, 2008). We will now discuss such planned knowledge utilisation.

### 3.5.4 The Rise of Knowledge Translation

Essentially EBM is about changing the behaviour of clinical practitioners from opinion-based practice to evidence-based practice. However, with time it has been realised that behavioural change is a complex and multi-faceted process because practitioners are embedded in systems that involve multiple stakeholders. Therefore the values, norms and interests of all stakeholders need to be considered and incorporated in the “change process”, including those of researchers, patients, managers and policy makers. Such a systems orientation towards behavioural change is part of the knowledge translation paradigm which recently gained prominence in the field of health policy. Various papers

explicitly mention the notion of knowledge translation in relation to EBM (e.g. Davis et al., 2003; Glasziou & Haynes, 2005; Lang, Wyer & Haynes, 2007; Simunovic & Baxter, 2009).

Knowledge translation (KT) normally has at its starting point a particular research finding or thematic message or knowledge product that needs to be implemented within a user domain, through a "change process" that incorporates all stakeholders, including the potential users and their concerns. Since the purpose of my study is not to study the uptake of a particular knowledge product, i.e. from inception to implementation in a user domain, but rather the kinds of knowledge and knowledge sources that winemakers utilise and how they utilise it, the sudden shift to a discussion of KT may at first seem out of place. However, it has deliberately been included for three reasons.

- Firstly, KT is a natural branching of EBM, specifically as a strategy to facilitate evidence-based practice, and therefore warrants some discussion.
- Secondly, an objective of the current study is to provide some recommendations with regard to the development of a model of knowledge utilisation for the winemaking industry, based on current international developments in the broad field of knowledge uptake. In this context a discussion of KT is imperative as it presently dominates the field of planned knowledge use.
- Thirdly, a discussion of KT and its different models also provides insight into factors that should be taken into consideration when conducting any study of knowledge utilisation.

It is against this backdrop that I will now, in the remainder of this section (3.5.4), present a brief reconstruction of the history of KT together with a short discussion of its components. The next section (3.5.5) looks at the different KT models in closer detail.

The development of KT as a field of study can largely be attributed to developments in the health policy environment in Canada. In that country, since 1997, a strong move towards evidence-based decision making could be observed after the National Forum on Health recommended the development of an evidence informed health care system, proposing that policies and clinical decisions should incorporate high quality research knowledge (Dobbins et al. 2007). KT has since been adopted by the Canadian Institutes of Health Research (CIHR, the federal agency responsible for the funding of health research) as the primary method for bridging the gaps from knowledge to practice. The CIHR also runs a research programme on KT and as such has made significant contributions towards the conceptual development of KT. Research on KT is part of a new scholarly domain known as

implementation science. The latter is “the scientific study of methods to promote the uptake of research findings and hence to reduce inappropriate care” (Eccles et al. 2005:1)

KT nowadays also characterises the works of other international health agencies, such as the National Center for Dissemination of Disability Research in the United States (NCDDR), and the World Health Organization (WHO). What these agencies have in common is the realisation that standard forms of knowledge creation (primary research), knowledge distillation (systematic reviews and clinical practice guidelines) and knowledge dissemination (mainly through journal publications), individually or combined, are insufficient to ensure actual knowledge use (Straus, Tetroe & Graham, 2009).

KT is often perceived as an acceleration of the knowledge cycle, involving a complex system of social interaction between researchers and various stakeholders, in order to move knowledge into action (Graham et al., 2007). The CIHR defines KT as a

> dynamic and iterative process that includes the synthesis, dissemination, exchange and ethically sound application of knowledge to improve health, provide more effective health services and products, and strengthen the health care system. (Straus, Tetroe & Graham, 2009)

The NCDDR in the United States uses a similar definition:

> The collaborative and systematic review, assessment, identification, aggregation, and practical application of high-quality disability and rehabilitation research by key stakeholders (i.e., consumers, researchers, practitioners, and policymakers) for the purpose of improving the lives of individuals with disabilities. (NCDDR, 2005)

The defining characteristics of KT, according to Sudsawad (2007:2-3), are as follows:

- KT includes all steps between the creation of new knowledge and its application.
- KT needs multidirectional communications.
- KT is an interactive process.
- KT requires ongoing collaborations among relevant parties.
- KT includes multiple activities.
- KT is a nonlinear process.
- KT emphasizes the use of research-generated knowledge (that may be used in conjunction with other types of knowledge).
- KT involves diverse knowledge-user groups.
- KT is user- and context-specific.
- KT is impact-oriented.
- KT is an interdisciplinary process.

The CIHR distinguishes between end-of-grant KT and integrated KT (NCDDR, 2007). The difference between the two is that, with end-of-grant KT, the research is already completed once the knowledge translation activity starts whereas, in the case of integrated KT, the researchers and users are collaborating to shape the research process. End-of-grant KT therefore includes the normal dissemination strategies of researchers, which involve publications and presentations at various platforms. It also involves more interactive dissemination strategies and the use of brokers. Integrated KT is often described in similar terms as action-oriented research or collaborative research, with the production of findings that are highly relevant and therefore also usable. Thus, the KT effort can transfer both new knowledge and existing knowledge that has not yet been taken up in user domains.

In essence, however, one could argue that KT involves three central elements: the synthesis and tailoring of research outputs; an exchange between researchers and users; and social interaction as part of a complex process (Wallin, 2009). But the notion of KT has also acquired more generic meanings in some circles. For instance, it is seen as an encompassing concept that includes all variants of knowledge utilisation and dissemination (research use, implementation research, etc.), technology transfer, as well as notions typically associated with health care practice, including clinical practice guidelines and continuing medical education (NCDDR, 2007). Simunovic and Baxter (2009) also describe KT as encompassing traditional mechanisms of facilitating EBM, such as clinical practice guidelines, continuing medical education and educational outreach. Others, for instance Lang, Wyer and Haynes (2007:355), view KT as "any activity or process that facilitates the transfer of high-quality evidence from research into effective changes in health policy, clinical practice, or products."

### 3.5.5 Models of Change in Knowledge Translation used to Explain and Guide Research Use

The conceptual underpinning of KT relates to models of change, which, in turn, can be either classical change models or planned change models. Classical change models explain how change occurs whereas planned change models, which incorporate insights from classical change models, are specifically designed to guide and bring about change (Graham et al., 2007). Planned change models in KT are strongly influenced by planned action strategies and for that reason often include a number of action categories which are typical of planned action (NCDDR, 2007):

- Identification of a problem that requires attention
- Identification of the need for change

- Identification of change agents, i.e. the actors that can bring about change
- Identification of the target audience
- Assessment of barriers that could prevent intervention
- Review of evidence and literature
- Tailor/develop intervention
- Link with relevant stakeholders
- Implement intervention
- Evaluate
- Maintain change or sustain the use of knowledge that is part of the intervention
- Disseminate the results of implementation.

The model on the diffusion of innovations by Rogers (2003 – Section 3.5.5.1 below) is an example of a classical change model as it explains how change occurs by highlighting various elements in the diffusion and adoption process. Moreover, it is a generic model as the targeted adopters represent a variety of audiences, e.g. farmers, educators, health practitioners and consumers. On the other hand, models of planned action are currently concentrated in health services, with the prevailing ones being the Ottawa model of research use, the knowledge-to-action model, the Stetler model of research utilisation, and the PARiHS framework (Promoting Action on Research Implementation in Health Services). Each of these will now be discussed. In addition, Section 3.5.5.6 raises some shortcomings of these models as frameworks for knowledge implementation.

#### *3.5.5.1 Classic change models: Rogers' Model of Diffusion of Innovations*

Everett Rogers (2003), the leading scholar in the diffusion of innovations paradigm, uses "diffusion" to refer to the spread of innovations. An innovation is "an idea, practice or object that is perceived as new by an individual or other unit of adoption" (Rogers, 2003:12) and innovation diffusion the "process by which an (1) *innovation* (2) is *communicated* through certain *channels* (3) *over time* (4) among the members of a *social system*" (Rogers, 2003:11). Four elements can therefore be distinguished: the innovation, communication channels, time, and a social system. Each element from Roger's extensive work will subsequently be considered in more detail.

**Element 1: Innovation**

The notion of "new" is expressed subjectively and in relative terms – if something is perceived as new or considered for the first time by a potential adopter, regardless of how old it is, it is considered to be an innovation according to Rogers' terminology. Moreover,

certain perceived attributes of innovations can accelerate their rate of adoption. Those innovations that are adopted more rapidly tend to be perceived as:

- Having *relative advantage*, i.e. being better than the idea, practice or object that it supersedes;
- Being *compatible* to the values, experiences and needs of potential adopters;
- Lacking *complexity*, i.e. not being too difficult to understand and use;
- Being *trialable*, i.e. can be experimented with on a limited basis before full-scale implementation; and
- Having results that are *observable* or visible to others, as this may increase their decision to also adopt (Rogers, 2003:15-16).

**Element 2: Communication Channels**

> At its most elementary form, the process [of communication] involves (1) an innovation, (2) an individual or other unit of adoption that has knowledge of, or has experienced using, the innovation, (3) another individual or other unit that does not yet have knowledge of, or experience with, the innovation, and (4) a communication channel connecting the two units. (Rogers, 2003:18)

Thus, communication channels are structures through which the message about an innovation is conveyed among individuals. Although mass media channels can also fulfill this role, it is mostly interpersonal channels that facilitate the transfer of knowledge about new innovations. Effective communication is more likely to occur when individuals are more homophilous, i.e. when the interacting individuals "are similar in certain attributes, such as beliefs, education, socioeconomic status, and the like" (Rogers, 2003:19). Geographical and social proximity is one determinant of homophily. However, as Rogers points out, in the diffusion of innovations the participants are usually quite heterophilous, especially in the case of directed adoption when change agents are used. These agents are often more educated or technically competent than the potential adopter. The ideal condition for rapid adoption is one where the individuals are heterophilous with regard to their technical grasp of an innovation but homophilous in terms of socio-economic status and education.

**Element 3: Time**

According to Rogers' model, the notion of time features in three ways in the diffusion of innovations. The first is expressed as chronological time, which represents the lapse of time from an individual's first awareness of a new innovation to his/her eventual adoption or rejection thereof. The second is expressed as relative time, which compares an individual's adoption to that of others in a social system, resulting in the individual being classified as an

early or late adopter. The third conception of time pertains more to the innovation than the individual's behaviour, as it deals with the rate of adoption of an innovation, which is measured as the number of individuals in a social system adopting the innovation within a certain time period (Rogers 2003). Rogers refers to these time elements respectively as the (1) innovation-decision process, (2) innovativeness and adopter categories, and (3) rate of adoption. Each is discussed below.

Innovation-decision process: Rogers (2003:20) conceptualises five steps in the innovation-decision process, namely knowledge, persuasion, decision, implementation and confirmation. The innovation-decision process spans the period of time that it takes moving through the five steps, and this differs between individuals.

- *Knowledge* is acquired when the individual first learns about the innovation and the manner in which it functions. Three types of knowledge are essential. The first is "awareness-knowledge", which refers to information that an innovation exists. The others are "how-to knowledge", referring to knowledge about the correct (often technical) use of an innovation, and "principles-knowledge", referring to a general understanding of the principles and fundamentals underlying the working of the innovation.

- *Persuasion* refers to the attitude that the individual develops towards the innovation, which can be either favourable or unfavourable. Innovation evaluation, i.e. selective perceptions of the advantages and disadvantages of the innovation – which are important at this stage, is generally obtained from within the individual's social network:

> This type of information, while often available from scientific evaluations of an innovation, is instead sought by most individuals from their near peers, whose subjective opinions of the innovation (based on their personal experience with adoption of the new idea) are more accessible and convincing to them. (Rogers, 2003:175-176)

- A *decision* is made when the individual either rejects or adopts the innovation, based on his/her knowledge and attitude. Often a decision is preceded by a small-scale trial, which can either be executed by the individual him-/herself or by peers in the social network. Instances of active rejection will occur when the individual initially considered the use of the innovation but then, for various reasons (including the outcome of the trial), decides not to adopt. Passive rejection, on the other hand, signifies situations where the individual never really considered using the innovation in the first place.

- The three steps mentioned thus far all represent mental processes, such as thinking, reflecting and deciding. *Implementation* is a process that involves overt behaviour, as it refers to the innovation being put to use. It also covers the consequence of adopting the innovation. Moreover, during the process of adopting and implementing an innovation, re-invention of the innovation often occurs. Re-invention is "defined as the degree to which an innovation is changed or modified by a user" (Rogers, 2003:180). This tends to occur in various instances, for instance when the innovation is relatively complex and not easily comprehensible, when detailed knowledge about the innovation is lacking, when the innovation is a generic tool or concept with many possible applications, or when the innovation must be tailored to fit the structure of the organisation of the adopting individuals. Generally, innovations that are characterised by higher degrees of re-invention during implementation also tend to display higher degrees of sustainability in the long run.

- *Confirmation* will be required if there are conflicting messages concerning the innovation once the innovation has already been put to use. Such conflict creates a state of dissonance or internal disequilibrium, which can be reduced by discontinuance of the innovation. Two kinds of discontinuance are possible. The innovation can either be rejected in order for it to be replaced by a better development that is a logical successor (replacement discontinuance) or because of lack of performance and poor results generated by the innovation (disenchantment discontinuance). Often, however, discontinuance is impossible because of significant financial investments or other factors, meaning that some form of reinforcement is needed in order to guarantee the innovation's continued use.

<u>Innovativeness and adopter categories</u>: Innovativeness refers to the extent to which members of a social system are relatively earlier in adopting a new innovation, compared to others in the same system. Five adopter categories are used to classify members of a social system on the basis of their degree of innovativeness: Innovators, early adopters, early majority, late majority, and laggards (Rogers, 2003).

- *Innovators* are active information seekers, highly exposed to the mass media and risk-prone. Their key attribute is venturesomeness. However, because of this personality trait they often are least integrated in a social network of peers and tend to be more cosmopolite in their social interaction. Innovators nevertheless act as gatekeepers as they are the ones introducing new ideas in a social system, given their interconnectivity and proneness to innovation.

- *Early adopters* are the true opinion leaders in a social system. Compared with innovators, they are significantly more "localite" in their social interaction (i.e. integrated in a social network of peers) and also enjoy high respect among their peers. For that reason they are being looked up and taken seriously by others in a social system with regard to the subjective evaluation and approval of new ideas and innovations.

- The *early majority* are not among the first to try out new ideas and innovations but also not among the last. They constitute about one third of the members of the social system to which they belong and frequently interact with others in that system. They are seldom considered among the opinion leaders in that system but are followers who tend to deliberate for some time before completely adopting new ideas. They usually adopt new ideas and innovations just before the average system member.

- The *late majority* adopt new ideas just after the average system member. They also make up about one third of their social system and their decision to eventually adopt is often the result of peer pressure. Their general orientation towards new ideas is that of scepticism.

- The final category, *laggards*, is composed of traditionalists, i.e. those do things in terms of what has worked in the past. Their interaction within the system is with the few other members who share a similar belief. Laggards are the last in the system to embrace new ideas and adopting innovations.

Rate of adoption: The rate of innovation, when presented cumulatively, tends to assume an S-shape. Initially only a few individuals (the innovators) adopt a new innovation. Thereafter more and more individuals tend to adopt as the innovation spreads through the social system, resulting in the graph showing a steep climb. However, after a while the graph tends to level off, as fewer members in the system remain who did not adopt as yet. The S-curve eventually reaches its asymptote and the diffusion process is complete (Rogers, 2003).

**Element 4: Social System**

Individuals, or whatever the set of interrelated units in diffusion research might be, are embedded within a social system. These units display a particular set of patterned arrangements, called structure, which affects any diffusion. Two sets of structure can be identified. The first is *social structure*, referring to the formal structure among the units, such as implied or explicit hierarchy, which ascribes a sense of regularity and stability to human

behaviour as knowledge of the social structure can be used to predict behaviour. The second is *communication structure*, which is an informal structure, normally "created in a system in which homophilous sets of individuals are grouped together in cliques" (Rogers, 2003:24). In ordinary language, communication structure sheds light on who is talking to who and under what conditions. Knowledge of these two sets of structures provides valuable clues as to the behaviours of the members of a system, which, in turn, can be informative in understanding their adoption of an innovation. In addition, any system is guided by norms, which are "the established behaviour patterns for the members of a social system" (Rogers, 2003:26).

The most innovative member of a social system, according to Rogers (2003), is often considered to be significantly deviant from the other members of a system, to such an extent that he/she is never really perceived as an opinion leader. An opinion leader refers to "an individual [who] is able to influence other individuals' attitudes or overt behaviour informally in a desired way with relative frequency" (Rogers, 2003:27). A key characteristic of an opinion leader is that an individual's general orientation tends to reflect a system's norm: if a system is very receptive of change, those regarded as opinion leaders will also be highly innovative whereas, if a system's norms are against change, the opinion leader's behaviour and attitude will also reflect the same. Even more important is that an opinion leader operates at the centre of interpersonal communication networks. For this reason, opinion leaders are strategically targeted by change agents (extension officers, representatives of commercial companies, etc.) in an attempt to diffuse their products and innovations among members of a social network. The risk however exists that, should an opinion leader significantly conform to the values and beliefs of the change agent because of persistent targeting efforts, the opinion leader eventually will lose credibility among the other members of the system and thus also his/her central role and opinion leadership.

Furthermore, different units of a social system are involved in the decision to adopt or reject an innovation (Rogers, 2003). The most basic form, called *optional innovation-decisions*, is where an individual member decides to adopt an innovation, independent of the decision of any other member of the system. This contrasts with *collective innovation-decisions*, where consensus first needs to be reached among the units of the system where after all members are obliged to adopt the decision that was taken collectively. *Authority-innovation-decisions* are top-down decisions imposed on the members of a system by those in a position of authority. The role of the individual is decisive when distinguishing between the three types of innovation-decisions. In the case of authority decisions the individual has no influence over the decision taken. In the case of optional and collective decisions, respectively, the

individual takes complete responsibility for the decision or has contributed towards the decision taken.

This concludes our discussion of the classical change model that is currently dominant within KT. The focus now shifts to four planned change models within KT, namely the Ottawa model of research use (3.5.5.2), the knowledge-to-action-model (3.5.5.3), the Stetler model of research utilisation (3.5.5.4), and the PARiHS framework (3.5.5.4).

#### *3.5.5.2 Ottawa Model of Research Use*

The Ottawa model of research use (OMRU) is a model for planned research use. It was developed by Logan and Graham (1998) as a holistic framework to guide the process of implementing research evidence. The process is portrayed as consisting of six central elements, namely: (1) the practice environment; (2) potential adopters; (3) evidence-based innovation; (4) strategies for transferring the evidence into practice; (5) use of the evidence; and (6) the outcomes of the process. Closer inspection of the OMRU reveals a richer description – in terms of examples cited – for the first four elements than for the last two. This is not surprising as the construction of elements was informed by an overview of literature in four study domains: research utilisation, the diffusions of innovations, physician behavioural change, and the development and implementation of practice guidelines. At the time of development of the model (mid- to late 1990s), however, studies with regard to the evaluative aspects of knowledge implementation initiatives were still relatively under-developed, and the same applies to studies on the use of evidence in health practitioner settings.

The OMRU, in a nutshell, involves the assessment of potential barriers and supports that could affect the implementation of research evidence. These assessments are normally performed in relation to the first three elements (practice environment, potential adopters and the evidence-based innovation).

In the case of the first element, practice environment (health setting), the enabling and disabling factors are categorised as structural, societal and patient factors respectively:

- *Structural factors* are setting-specific influences such as the decision-making structure, rules and regulations, physical structure, workload, resources and incentives.

- *Societal factors* refer to the prevailing beliefs within a setting as well as personalities and the presence of advocates of evidence-based innovation.
- *Patient factors*, which are unique to health care settings, largely refer to patients' willingness or unwillingness to comply with a treatment for various reasons.

With regard to the second element, potential adopters, the model proposes that those wishing to facilitate research transfer should:

> identify all potential adopters or target audiences to whom they intend to direct the evidence and to define and describe them in terms of their attitudes, knowledge, motivation for adopting the evidence, skills, and current practices. (Logan & Graham, 1998: 232)

It is believed that the profiling of adopter attitudes will highlight additional barriers to be utilised in the design of a research transfer strategy. With regard to the third element, evident-based innovation, the assessment essentially concerns the relation between the potential adopters' arguments for adoption and use (or not), on the one hand, and their perceptions of the attributes of the innovation and the process by which the innovation has come about.

On the basis of these multiple assessments, effective research transfer strategies (fourth element) are then designed and implemented, by incorporating insights of existing barriers and supports. According to Logan and Graham's (1998) interpretation of the literature, more effective strategies tend to be those ones that are tailored to salient barriers and supports. Once implemented, the way that the evidence is used (fifth element) needs to be systematically monitored, to determine and understand instances of non-use and modified use. Eventually, however, evaluations of outcomes (sixth element) are required, as research use in practice settings is largely unpredictable and a need exists to establish to what extent both intended and unintended effects are created.

The model has been applied at limited occasions as a framework for planned research use, e.g. to facilitate the use of clinical guidelines to treat pressure ulcers as part of skin care (Graham & Logan, 2004; Logan et al., 1999), the adoption of a decision support protocol by call centre nurses (Stacey et al., 2006) and the implementation of a research-based family assessment tool in a neonatal transport team (Hogan & Logan, 2004).

#### *3.5.5.3 Knowledge-to-Action Model*

Ian Graham, the CIHR's vice president of knowledge translation, introduced the term "knowledge-to-action" (KTA) to refer to KT. The term serves two purposes (Graham et al., 2007): (1) to have a generic term that encompasses and includes the various variants of knowledge utilisation (knowledge translation, knowledge exchange, knowledge transfer, research utilisation, knowledge exchange, implementation, dissemination, diffusion, etcetera) and (2) to have a term where the action element is broad enough to include knowledge use by all possible stakeholders (practitioners, policy-makers, the public, etc.). In an earlier co-authored paper, Graham et al (2006) provide a model of the KTA process, consisting of two key interacting components: knowledge creation and an action cycle (Figure 3.4).

Knowledge creation consists of three phases which correspond to first-, second-, and third-order knowledge. First-order knowledge refers to the numerous research studies being conducted, published in different formats, accessible to various degrees, and also of varying quality. Basically, they are the direct outputs of knowledge inquiry. Second-order knowledge refers to knowledge that is already sifted and ordered in terms of quality and importance. The various forms meta-analyses and syntheses are examples of these. Third-order knowledge refers to tools based on knowledge. In the health field a primary example is clinical practice guidelines. These three forms are presented in a filter format because knowledge needs to be increasingly distilled and refined in order to better suit the target audience. At any of these three stages of knowledge creation the knowledge producers can tailor their knowledge for specific audience. During knowledge inquiry, for instance, the research question can be tailored in such a way that it addresses the needs of potential users. Guidelines, for instance, can be tailored by the producing organisation to meet the resistance and needs of clinicians within a particular specialty.

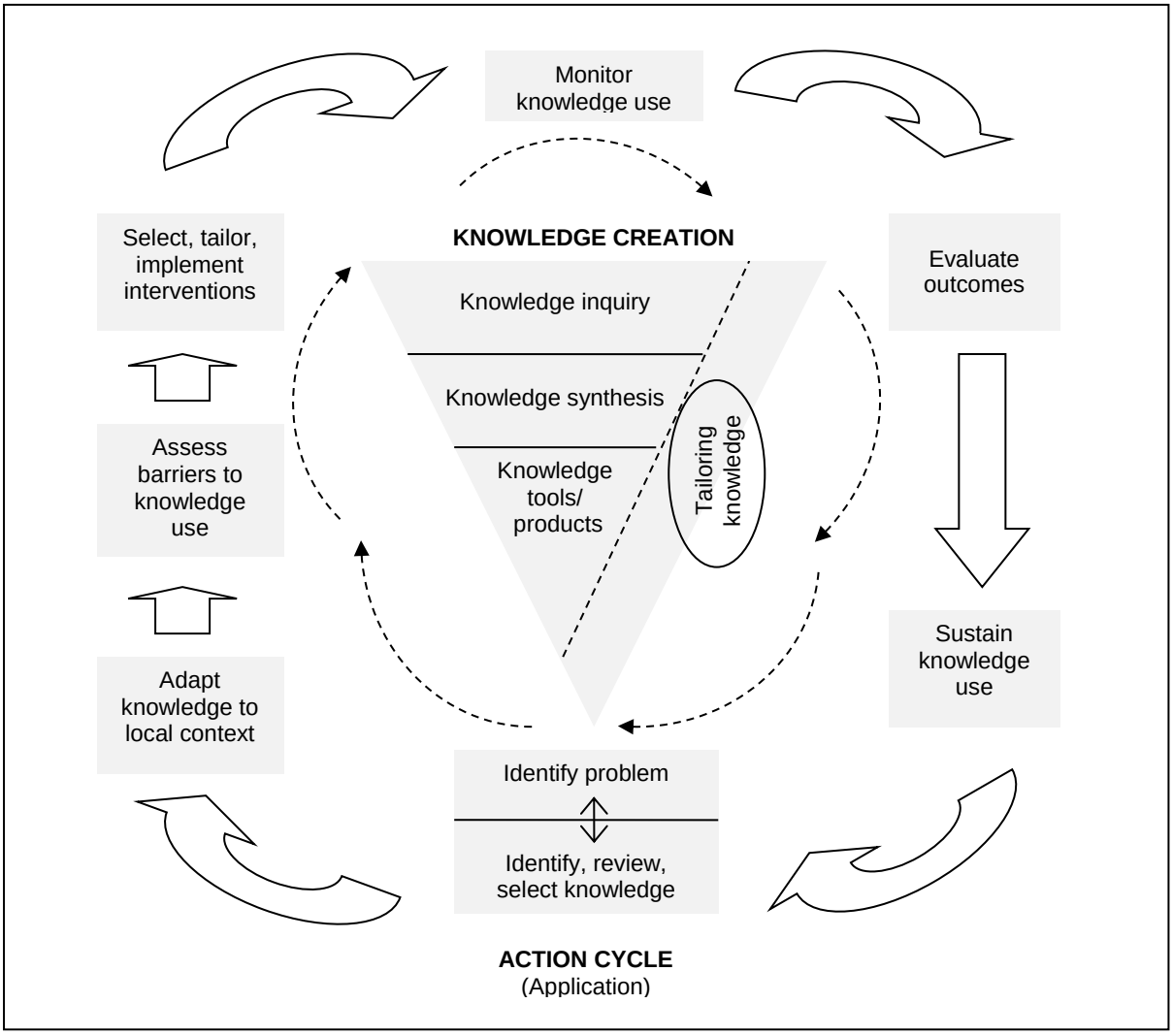
The action cycle is largely informed by a study of planned action theories and models conducted by Graham et al. (2006:20). The authors identified seven phases that are common to the various theories and frameworks and these appear in the diagram:

- Identify a problem that needs to be addressed and identify, review and select the knowledge or research relevant to addressing the problem
- Adapt the identified knowledge or research to the local context
- Assess barriers to using the knowledge
- Select, tailor and implement interventions to promote the use of knowledge

- Monitor the use of knowledge
- Evaluate the outcomes of using the knowledge
- Sustain on-going knowledge use

The seven action stages do not necessarily need to occur sequentially; they can also occur simultaneously. At any point in the cycle can the knowledge phase alter or change the stages in the action phase (Straus, Tetroe & Graham, 2009). The boundaries between the two components are often blurred in reality.

**Figure 3.4: Knowledge-to-action (KTA) model**




Source: Graham et al. (2006:19, Figure 1)

### *3.5.5.4 Stetler Model of Research Utilisation*

The previous models largely operate on the assumption that knowledge utilisation is exhibited in the use of formal policies, procedures or protocols that are institutionalised and

informed by research. However, knowledge utilisation can also be much less formal as practitioners often informally use research knowledge as part of their routines. Cheryl Stetler has developed a series of critical thinking and decision-making steps to guide this everyday use of research, and presented it as a model. Her model was originally developed in 1976, together with Marram, as the Stetler/Marram model (Stetler & Marram, 1976) but has since undergone two revisions to become the Stetler model of research utilisation. The first revision occurred in 1994 (Stetler, 1994), when the conceptual underpinnings and assumptions of the model were made explicit, and the second in 2001 (Stetler, 2001) when the model – under influence of EBM – was further refined to also become a framework for practitioners to facilitate evidence-based practice. Although the Stetler model is located in nursing it is equally relevant for use in other practice settings. The model is based on a set of six assumptions:

- The formal organisation may or may not be involved in the individual practitioner's utilisation of research.
- Utilisation may be instrumental, conceptual or symbolic.
- Decision-making or problem-solving often not only involves research evidence but also non-research-related information (e.g. experiential information) and the different knowledge sources are combined.
- Both internal and external factors (e.g. the practitioner's existing knowledge and attitudes versus organisational characteristics) can influence an individual practitioner's frame of mind (or that of a group that he/she is part of) and therefore also influence the use of evidence.
- Appropriate and effective use can be inhibited by a lack of knowledge and skills regarding research utilisation and EBP.

The Stetler model, as said, consists of a series of critical thinking and decision-making steps that could help individuals to guide the use of research findings. The model involves five phases:

Phase 1: Preparation. In the preparatory phase the purpose behind using relevant research information needs to be clarified. This can range from the solving of a clinical, educational, managerial or other problem to an interest in maintaining the most updated knowledge base in a specialty area (Stetler, 1994). In this phase relevant sources of research information are identified. Critical thinking comes into play to the extent that the user needs to be conscious of external and internal factors that can influence the use of certain sources. External factors

refer to factors unique to the organisational setting and broader environment whereas internal factors refer to personal considerations, such as existing beliefs and attitudes.

Phase 2: Validation. This phase is characterized by a critique of the research findings identified during the preparation phase. It is not so much a traditional research critique of a study but an utilisation research critique. The focus is on the strengths and weaknesses of a study in terms of its applicability for utilisation (Stetler, 1994, 2001). The probabilistic meaning of the identified study's statistics in relation to other populations and individual subjects needs to be critically appraised. It is suggested that practitioners use existing tools, for instance, utilisation-focused review tables (e.g. Stetler et al. 1998) designed to determine the suitability of research results for incorporation in integrative reviews. On the basis of the validation exercise a study is either rejected or accepted. If accepted, phase 3 becomes the next step.

Phase 3: Comparative evaluation/decision-making. The core of this phase is a set of applicability criteria which, as a gestalt, can assist to determine the desirability of applying the validated study's results to the identified issue. The first criterion is whether or not there is any other substantiating evidence (additional research, professional standards, case studies, etc.) to support the findings. The second criterion relates to current practice, specifically what can be said about the level of effectiveness of current practice, in the light of the findings, and reflections on the need for bringing about changes in practice. The fitness of the findings for the user and his/her setting is a third criterion. The fourth and last criterion is the feasibility of implementing the findings, and involves assessments in terms of risks, resources required, and the readiness of other parties where external participation is required (Stetler, 1994, 2001).

Taken into consideration the different operations and activities so far, the user should now be in a position to decide on whether or not to use the findings of the validated study(ies). Any one of three decisions is possible, namely not to use, to use, or to consider use after collecting additional, pragmatic information. Obviously phases 4 and 5 only apply to instance of use and considered use.

Phase 4: Translation/application. This phase starts with a confirmation of the applicable type of utilisation (instrumental, conceptual or symbolic) as well as the method (formal or informal) and level of utilisation (individual, group or division/organisation). In some instances little if any translation of findings is required, and this is normally the case for expert individual users. However, in other instances of use, especially where the focus is on

the formal and instrumental utilisation of findings by organisations (i.e. the individual wants to bring about formal organisational change), translation of the research findings becomes crucial and the process then becomes one of planned research utilisation. Planned research always results in a blurring of boundaries between this phase and the next, which is evaluation, as evaluation is an essential component of planned research models. Moreover, in instances where the use of findings is still being considered, specifically with the aim to implement formal changes in an organisational setup, a pilot project is first required to collect the information needed in order to eventually decide between using and not using.

Phase 5: Evaluation. Individual practitioners can assess the effect of their own utilisation of findings by means of direct observation. At higher levels of utilisation (instance of use by groups and organisations), formative data need to be collected to determine whether the findings are in fact being used as intended, and eventually also summative data to assess outcomes and goal achievement.

In conclusion, the Stetler model incorporates two notions of research utilisation that were earlier identified by Stetler (1985), namely the use of the products (findings) of research and the use of the individual components of the research process for routine problem solving. The model's primary focus, however, is on the use of the findings of research although the use of elements of the research process comes into play in the evaluation phase.

#### *3.5.5.5 PARiHS Framework*

Another conceptual framework for KT is the PARiHS framework (Promoting Action on Research Implementation in Health Services), originally developed in 1998 by Kitson, Harvey and McCormack. A more recent version of the PARiHS framework (Kitson et al. 2008) portrays successful implementation as a function that can be denoted as: SI = f (E, C, F). Specifically, successful implementation (SI) is a function (f) of three elements: the nature of evidence (E); the quality of the context (C) in which the evidence is introduced; and the type of facilitation (F) of the process. In earlier works Kitson and her colleagues (Harvey et al., 2002; McCormack et al., 2002; Rycroft-Malone et al., 2004b) performed detailed conceptual analyses of the three key elements.

Rycroft-Malone et al. (2004b) who considered the first of these elements, evidence, regard the latter as knowledge obtained from a variety of sources, provided that the knowledge has been tested and found to be credible. Thus, what counts as evidence must be independently observed and verified. Although the references to observation and verification suggest that

Rycroft-Malone et al. are restricting evidence to research evidence only (i.e. factual, propositional knowledge), this is not the case. In fact, the conception of evidence by Rycroft-Malone et al. allows for both propositional and non-propositional knowledge:

> Propositional knowledge is formal, explicit, derived from research and scholarship and concerned with generalisability. Non-propositional knowledge is informal, implicit and derived primarily through practice. It forms part of professional craft knowledge (the tacit knowledge of professionals) and personal knowledge … Unlike research-based knowledge, professional craft knowledge is not usually concerned with transferability beyond the case or particular setting. However, this non-propositional knowledge has the potential to become propositional knowledge once it has been articulated by individual practitioners, then debated, contested and verified through wider communities of practice … (Rycroft-Malone et al., 2004b:83)

Thus, Rycroft-Malone et al. (2004b) are suggesting that tacit, professional craft knowledge should be articulated and made explicit (on the basis of various suggestions in the knowledge management literature) and subject to public scrutiny and assessment in order to be verified as evidence. Rycroft-Malone et al. furthermore suggest that the notion of evidence, apart from including knowledge based on research evidence and knowledge based on clinical experience, should also include knowledge from clients and patients (in health settings) as well as knowledge from the local context. The latter includes organisational audit and performance data, knowledge about the culture of the organisation, social and professional networks, and local and national policy. In another study that is based on limited empirical data, Rycroft-Malone et al. (2004a) express a clear need to understand the integration of the various forms of evidence in everyday clinical decision-making and practice.

The second element of successful implementation, namely context, can generally be interpreted as the setting in which practice takes place (McCormack et al., 2002). However, the notion of context is conceptually complex and the study thereof in relation to the implementation of evidence also needs to include the notion of culture, which refers to the ways that things are normally done in a particular context. Moreover, McCormack et al. describe a context that is conducive to the successful implementation of evidence as one where the following conditions are in place: clear definition of boundaries (physical, social, cultural and structural), appropriate and transparent decision-making processes, appropriate resources, adequate information and feedback systems, and receptiveness to change. Next to a receptive organisational culture, other contextual factors that are conducive to successful knowledge uptake include effective and clear organisational leadership, and monitoring and evaluation mechanisms.

The last of the three elements, facilitation, refers to the process of enabling the implementation of evidence into practice (Harvey et al. 2002). The outcome of this process, according to Harvey and co-workers, can either be orientated towards the accomplishment of specific tasks, i.e. providing help to achieve a certain goal, or it can be more holistic and targeted towards the development of individuals and group processes, such as reflecting on or changing attitudes, skills, habits, etc. Moreover, according to the concept analysis, a facilitator is a change agent who is appointed in that role, and the facilitator can be either internal or external to the organisation where the change is to be implemented.

More recently Kitson et al. (2008) have started to promote the PARiHS framework as a diagnostic tool, where the most appropriate style of facilitation can be determined on the basis of the potential users' assessment of their organisational context and the nature of the evidence to be implemented.

#### *3.5.5.6 Future Considerations*

In addition to a lack of empirical studies on the effectiveness of KT models (Armstrong et al. 2006), a number of other shortcomings with respect to current models of KT also exist (Kontos & Poland, 2009). Firstly, it is taken for granted that there is an interconnection between the different elements in the broad process of research transfer and utilisation but there is no theoretical underpinning that explicates these connections or explains how the connections facilitate or impede the transfer and use of research findings. Secondly, the evaluative component of KT mainly relies on "hard" outcome measures derived from quantitative methods, which does not facilitate understanding of the multiple realities of the stakeholders involved or the complexities of their contexts. Thirdly, KT models do not include approaches that encourage critical self-reflection by the potential adopters (e.g. health practitioners) about the often subtle ways in which contextual and cultural factors manage to shape their conceptions, assumptions and practices. Kontos and Poland therefore suggest the introduction of critical realism, a philosophical approach, in existing KT models to address these shortcomings.

The need for strong theories of KT, other than models and frameworks, is a growing concern. It was first noted by the "Improved Clinical Effectiveness through Behavioural Research Group" (ICEBeRG, 2006), in the United Kingdom, that there is a need to design theoretically-informed implementation interventions. Promising theories have started to emerge, such as Normalization Process Theory (May & Finch, 1009; May et al., 2009), which is built around the three key concepts of implementation (the social organisation of

bringing practices into action), embedding (the process of making practices routine elements of everyday life) and integration (the process of sustaining embedded practices in their social contexts).

Moreover, according to Jacobson (2007:120), current research in KT tends to focus more on the use of models and frameworks "to explain, plan, or research transfer and exchange processes than on using it to understand knowledge and the relationships between knowledge and these processes." What is required is a theory that engages with the knowledge component of KT. For that reason she suggests social epistemology as a potentially useful new theory for KT, as it focuses on the role of social factors in the shaping of both individual and collective knowledge.

## 3.6 CONCLUSION

This chapter addressed a number of topics that are relevant to the study of knowledge utilisation – a historical overview of knowledge utilisation and associated generic models serving as typologies; clarification of the central notions of utilisation and knowledge; and a closer look at KT, which represents the latest fad in studies of knowledge utilisation. A few key points can be extracted, specifically also in relation to winemaking, which are as follows:

- Knowledge utilisation, which originally had roots in the social sciences and public policy, has become totally engulfed by the knowledge-to-practice movement which is most prominent in the health sciences and nowadays re-interpreted as KT.

- IN KT models, we see a combination of insights from the generic models of knowledge utilisation. For instance, user requirements determine the need for certain knowledge (demand-pull model), the identified knowledge is then translated for user audiences through stakeholder interaction (interactive model), where organisational factors, user orientations and correct tailoring and communication of the knowledge are important considerations in the translation process (organisational interest and dissemination models). These KT models, although interactive in their diagrammatic presentation, are to some extent also knowledge-driven as scientific information is facilitated into user domains (science-push model).

- Whereas knowledge utilisation has evolved into KT, the notion of utilisation, as a typology, seems to have stabilised around variations of Weiss' original contribution

(conceptual, instrumental and symbolic). Moreover, the notion of knowledge is under-developed in studies of knowledge utilisation and is unpacked in this study as factual and practical. The various pointers of practical knowledge (common sense, gut feeling, intuition, etc.) are also salient in the EBM/EBP and KT literature. In KT specifically, internalised practical knowledge is seen as (i) an alternative form of evidence or knowledge source (other than research evidence) and (ii) as a knowledge type that needs to be reckoned with in KT, given that incoming factual knowledge is never translated into a vacuum but into an existing pool of knowledge which is also very much implicit.

- The similarity between EBM and winemaking lies in the fact that in both cases the key actors are practitioners. The injection of more science into their respective practices is believed to enhance quality. However, in EBM the quality focus is targeted at standardising treatment and health outcomes whereas, in the case of wine, it serves to aid the development of unique, high quality products in terms of style and blending. A further difference is that patients are the end-users of science-based practice in EBM but in winemaking the end-user is the consumer. When dealing with a particular case, the medical practitioner – in order to decide on the best course of action – relies on her/his clinical expertise to combine the latest knowledge developments with the clinical condition presented and the patient's treatment preferences. Similarly, the winemaker uses expertise (which is internalised practical knowledge with roots in training, experience and factual knowledge) to align the state of the harvested grapes and wine-in-making, with consumer preferences and new and existing knowledge and ways of doing things.

- The demand environment within which winemakers function has been highlighted in the previous chapter. Winemakers need to ensure the basic intrinsic quality of their wine and are also increasingly aiming for wine to be sold at higher price levels where the notion of quality is more defined in terms of consumer demands and perceptions. Knowledge is needed in order for the winemaker to have full control over what he/she is doing, i.e. to also understand the theory behind procedures and decisions. In that way the winemaker can anticipate and correct for faults that potentially could jeopardize wine quality. Currently there are transfer strategies in place in the South African wine industry, which essentially focus on the provision of an industry-wide platform to disseminate scientific knowledge to winemakers. Winetech provides such an intermediary structure where information flows are running in both directions: wine producers' needs are communicated to researchers, research projects

conceptualised and conducted, and results communicated back to producers through various media. There is however no formal KT initiative in the wine industry. With the latter is meant a systemic intervention and stakeholder exchange procedure to ensure the smooth integration and sustainable use of a specific, tailored knowledge-based message (protocol, practice guideline etc.) in all practice settings, combined with close monitoring and evaluation of the entire KT process.

In order to suggest an appropriate model of KT for the South African wine industry, which is the primary focus in Chapter 7 (the conclusion/recommendation chapter), it first needs to be understood what knowledge sources winemakers are currently using and to what extent scientific knowledge in particular is influencing their winemaking practice. Similarly, one could ask how valued is scientific knowledge among winemakers and what is the relative importance attached to practical knowledge in relation to factual (scientific) knowledge? These are the questions that will now be answered through empirical data based on a survey and interviews. The data are presented in Chapters 5 and 6. Before doing so, Chapter 4 will first discuss the methodology followed in collecting the data.

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# Chapter 4

# RESEARCH DESIGN AND METHODOLOGY

## 4.1 INTRODUCTION

The study employed a mixed-methods design, consisting of a web-based survey of winemakers and subsequent individual interviewing of six winemakers and three consultants. The purpose of the survey was to provide a broad overview of the knowledge sources and scientific research utilisation of winemakers as well as of other aspects that can strengthen the understanding of knowledge utilisation in winemaking. An example includes the profiling of opinion leaders, as these individuals are important carriers of knowledge within informal communication networks. The purpose of the interviews, on the other hand, was not so much to explore unknown territory by constructing concepts that are grounded in reality, a process that is normally achieved through carefully selected text segments demonstrating the functionality and inter-connectivity of concepts. Instead a more pragmatic objective was pursued, namely to illustrate and enhance the findings of the survey (and literature component) through extracts from real life situations and perspectives.

## 4.2 WEB-BASED SURVEY OF WINEMAKERS

### 4.2.1 Survey Questionnaire

For the purposes of the survey a winemaker questionnaire was constructed, which is attached as Annexure 1. The questionnaire consists of four components:

- The first component relates to the different *knowledge sources* of winemakers and is divided into two distinct sub-components. In the first, the winemakers had to rate 29 potential sources of knowledge in terms of how frequently they engage with that source. The first sub-component thus collected information about the frequency of knowledge-sourcing activities. In the majority of cases a 4-point response category system was used (“at least once a month”; “at least once in 3 months”; “at least once in 6 months”; “never / almost never”). The second sub-component listed 30 potential sources of knowledge, for which the respondents had to indicate the importance thereof for their own winemaking (“of extreme importance”; “of some importance”; “of little importance”; “of no importance”). Here the focus is on the relative importance attached to knowledge sources. In addition the respondents had to specify which of these sources they regard as the single most important for their winemaking. The list

of knowledge sources included in both groupings can be inspected in Part A (Questions 1 to 7) of the questionnaire.

- The second component consists of a single question where the respondents had to indicate how often fellow-winemakers approach them for information and advice. This question was included as a measure of *opinion leadership and network links*, and corresponds to the self-designated technique of such measurement as specified by Rogers (2003). The question appears as Question 8 in Part A of the questionnaire attached.

- The third component examined the winemakers' perceptions about their *utilisation of scientific research findings* on winemaking. Eleven statements were formulated, each listing a particular role or aspect of scientific research findings in the respondent's practice (e.g. "scientific research findings on winemaking are too complex to be of use in my winemaking"). The respondents had to rate each in terms of the extent to which they agree or disagree with the statement ("strongly agree"; "agree"; "neutral"; "disagree"; "strongly disagree"). Four of the statements are particularly important as they were designed to measure standard types of research utilisation, based on insights generated by Estabrooks (1999) and Weiss (1979). The utilisation types and associated statements are:
  - Instrumental utilisation ("scientific research findings on winemaking have led me to do things differently in my winemaking");
  - Conceptual utilisation ("scientific research findings on winemaking have led me to develop a better understanding of some aspect of my winemaking");
  - Symbolic utilisation ("scientific research findings on winemaking have strengthened my personal belief concerning winemaking"); and
  - Persuasive utilisation ("scientific research findings on winemaking have led me to advise other winemakers to do things differently in their winemaking").

  The 11 statements are listed in Question 9 in Part C of the questionnaire.

- The last component consists of 28 *demographical items*. These include questions that solicited both cellar based as well as winemaker specific information. Questions that are cellar based focused on the type of cellar where the winemaker is working (producer cellar, estate cellar, etc.); the region where the cellar is located; and what percentage of the total volume of wine product is exported to other countries. Winemaker specific questions, on the other hand, enquired about gender and age; the highest relevant qualification and where and when it was obtained; the number of

years of experience as a winemaker; the number of cellars a winemaker previously worked at and also the number of such cellars located abroad; the winemaker's position at her/his current cellar; the area of specialisation in winemaking; the number of awards that the winemaker received at national and international wine competitions, challenges and professional tastings; which South African wine societies and associations the winemaker belongs to; and whether there are other winemakers in the family. The demographical items are included in Section C (Questions 10 to 28) of the questionnaire attached.

Draft versions of the questionnaire were reviewed and commented on by two experienced social scientists. The final questionnaire was also sent to the Director of Winetech for feedback.

### 4.2.2 Distribution List of Winemakers

According to the 2010/11 South African Wine Industry Directory (WineLand, 2010), there were 896 winemakers in total in 2010, including 161 assistant winemakers. These figures were obtained by manually counting the lists of names provided in the directory. However, the directory does not provide any email addresses for winemakers and the latter were essential for conducting the web survey. That being said, the directory includes a comprehensive listing of wine producing organisations (wine farms and wine cellars), which does contain the full contact details of these organisations, including email addresses. Closer inspection revealed that not all of these organisations listed a winemaker among their staff. Only organisations that specified a winemaker were therefore considered for selection. A manual count of such organisations generated a total of 737 eligible wine farms and cellars. The names of the organisations together with their contact details were captured in a Microsoft Access database.

### 4.2.3 Survey Administration

The questionnaire was converted into a web-based questionnaire by an experienced web designer, with the functionality that any data submitted online can be downloaded into an Excel file. Once the efficacy of the system was tested and confirmed, an email explaining the objective of the survey was sent to the 737 wine producing organisations, with the request that it be forwarded to all winemakers and assistant winemakers within the organisation. The email was compiled in both Afrikaans and English and included a hyperlink for the winemaker to click on in order to access the web questionnaire.

Participation in the survey was voluntary and winemakers could stop completing the questionnaire at any time. Completion of the questionnaire was anonymous as neither the winemaker's name nor the name of the estate/cellar/firm was required. However, the last question stated that there would be some follow up on some of the interesting responses by means of interviews. Winemakers willing to talk in more depth about their winemaking were therefore invited to provide their contact details but this was voluntary and they were under no obligation to do so.

The first emails were sent in early October 2010 and the last during mid-November 2010. During this six-week period a number of email reminders were distributed in five waves. However, a total of 147 emails either failed or could not be accounted for. This means that 590 emails eventually reached their target. The latter figure seems realistic in the light of additional information released by SAWIS (2011), according to which there were 573 active wine cellars in South Africa (where "active" refers to cellars that crush grapes).

### 4.2.4 Survey Respondents

Altogether 211 respondents submitted usable questionnaire responses, of which 166 specified that they were either a winemaker or cellar master, and 20 that they were an assistant winemaker. Altogether 25 specified neither their position nor cellar classification. Although 590 emails reached their target the response rate cannot be calculated with this figure in mind as the unit of analysis is not a cellar but a winemaker/assistant winemaker. Some cellars also employ more than one winemaker. Since there were 896 winemakers in South Africa in 2010, the 211 questionnaires should be expressed as a percentage of this figure, which implies a survey response of 24%.

Table 4.1 compares the cellar distribution of the 186 winemakers and assistant winemakers (who specified both their position and cellar type) to that of the population. Two sets of sample figures are provided. Assistant winemakers are included in the first but excluded in the second. The reason for generating two sets of sample figures is because winemaker(s) and assistant winemaker(s) from the same cellar could have completed questionnaires. The exclusion of assistant winemakers is therefore an attempt to control for the duplication of cellars in the sample figures.

**Table 4.1: Sample and population of winemakers compared in terms of cellar type**

| Type of cellar | Sample | | Population |
|---|---|---|---|
| | Assistant winemakers included | Assistant winemakers excluded | |
| Producer cellar | 18% | 15% | 9% |
| Producing wholesaler | 3% | 3% | 5% |
| Estate cellar | 37% | 37% | 86% |
| Independent (non-estate) cellar | 34% | 36% | |
| Garagiste producer | 8% | 9% | |
| **Total** | **100% (N=186)** | **100% (N=166)** | **100% (N=573)** |

Population figures were taken from SAWIS (2011), Table 3.

Table 4.1 shows that producer cellars constitute about 15-18% of organisations in the sample whereas, in the population, their representation is about 9%. Similarly, 79-82% of wine cellars in the sample are private and independent (estate, non-estate and Garagiste) whereas the corresponding percentage in the population is somewhat higher at 86%. However, the sample figures are only approximations because the unique number of cellars in the sample data cannot be accurately calculated, as cellar names were not asked for. In addition the unit of analysis in this study was the winemaker not the cellar. The population figures in Table 4.1 can also not be disaggregated in terms of the two categories of private cellars (estate and non-estate) and Garagiste producers. Overall, however, the sample figures of winemakers – presented as a proxy for cellars – do not appear to be markedly different from the population figures.

The response rate of about 24%, which is relatively good for an on-line survey, is even more significant in the light of a previous attempt by Theron (2008) to survey the winemaker community. In the latter case responses from only 13 producer cellars could be obtained. However, it needs to be kept in mind that some response bias could be at play in the realised sample. For instance, it is possible for winemakers who are technologically less inclined to have delegated the task of completing the questionnaire to another winemaker at their cellar rather than also completing a copy themselves.

### 4.2.5 Analysis of Survey Data

The Excel file containing data from the online submissions was imported into IBM SPSS. The latter is a dedicated software package for the analysis of quantitative data. The variables were first defined in SPSS and a number of checks performed to establish the consistency on the data. In analysing the data three broad categories of statistics were used: univariate, bivariate and multivariate:

- Univariate data analysis, as the name implies, is concerned with the analysis of individual variables. In the study it took the form of frequency tables and summary statistics.

- Bivariate data analysis refers to a body of tests that examine the relationship between two variables. The appropriate test is determined by the nature of the variables concerned.
  - In the case of examining the relationship between two categorical variables the appropriate test of statistical significance is the Chi-square test. A finding is deemed statistically significant if the probability that the result could have occurred by chance is less than 5 out of 100. Thus, a significantly result is concluded if $p<0.05$. Fisher's exact test is used as an alternative to Chi-square whenever too many expected frequencies fall below the acceptable statistical criterion, as the latter situation makes Chi-square invalid.
  - In the case of examining the relationship between a categorical and a scale variable, the comparison is one of determining whether respondents at the different levels of the categorical variable also differ significantly in terms of their mean scores on the scale variable. Depending on whether the categorical variable is dichotomous or non-dichotomous, the appropriate significance test is either the independent t-test or the one-way ANOVA. In the case of a non-dichotomous categorical variable (one-way ANOVA), post-hoc tests such as Bonferonni are required to determine which levels of the categorical variable are significantly different from which in terms of the mean scores.
  - Where both variables are scale variables, the appropriate significance test is the Pearson product-moment correlation coefficient, also known as Pearson r. As before, significant correlations are concluded if $p<0.05$.
  - Apart from determining statistical significance, a measure of practical significance (i.e. an indicator of the strength of the observed effect) is equally important. Thus, effect sizes were also calculated, involving Cramer's V in the case of Chi-square, Omega-squared in the case of a one-way ANOVA, and Pearson r in the case of an independent t-test. A rule of thumb to interpret effect sizes based on Omega-squared is the following: 0.01 = weak effect; 0.06 = moderate effect and 0.14 = strong effect. For Pearson r and Cramer's V the following guideline can be used: 0.1 = weak effect, 0.3 = moderate effect and 0.5 = strong effect (Field, 2009).

- The multivariate procedure used is principal component analysis (PCA), which is a form of exploratory factor analysis, normally applied to extract the underlying

dimensions of a set of rating scale items. The logic and steps involved in performing a PCA are illustrated in the relevant sections in the result chapters (Section 5.3.4 in Chapter 5 and Section and 6.3.4 in Chapter 6).

## 4.3 INTERVIEWS OF WINEMAKERS AND CONSULTANTS

### 4.3.1 Selection of Interviewees

Of the 211 respondents who submitted a questionnaire, 53% (or 111) also included their name and contact details, thereby expressing a potential willingness to be interviewed as part of the follow-up to the survey. Since an objective of the interviews was to explore winemaker perceptions of intuitive knowing – as an expression of practical knowledge – the pool of 111 candidates were significantly reduced to only those who expressed strong appreciation for intuition in the survey. Furthermore, since the interviews also wished to explore the relative importance of intuitive knowledge versus factually based scientific knowledge in decision-making, the pool of candidates was further reduced by including only winemakers who also reported utilisation of scientific research findings on winemaking, specifically direct application of such findings in practice. Thus, the selection procedure targeted respondents who acknowledged the value of scientific research findings in their practice while also stressing the importance of intuition as a source of knowledge. Responses to two questions in the survey served as input for the selection, namely:

- Rating of the importance of *intuition / common sense / personal knowledge* for own winemaking (1 = of extreme importance; 2 = of some importance; 3 = of little importance; 4 = of no importance)
- Rating of the extent of agreement to the following statement: *Scientific research findings on winemaking have led me to do things differently in my winemaking* (1 = strongly agree; 2 = agree; 3 = neutral; 4 = disagree; 5 = strongly disagree)

The survey respondents to be considered for interviews were therefore winemakers who (1) provided contact details; (2) rated intuition / common sense / personal knowledge as extremely important in their winemaking and (3) strongly agreed to the statement that scientific research findings led them to do something differently in their winemaking. A total of 28 respondents out of the original 211 met all three criteria.

The pool of 28 candidates comprised 24 men and 4 women. In terms of a breakdown by cellar type, two candidates were from producer cellars (W01 and W02 in Table 4.2), 12 from estate cellars (W3 to W14), 10 from independent non-estate cellars (W15 to W24), and two each from producing wholesalers (W25 and W26) and Garagiste producers (W27 and W28).

The minimum number of winemaker interviews planned was five, one from each cellar category.

- In the three smallest cellar categories (producer cellar, producing wholesaler and Garagiste producer) the first winemaker in each category was sent a request for a telephonic interview (i.e. W01, W25 and W27). All three winemakers responded positively by agreeing to be interviewed.
- In the estate cellar category three Stellenbosch winemakers were potentially identified for interviews (W06, W08 and W09). One declined and the other two ignored both the interview request and a friendly reminder, although confirmation of delivery and reading was received. As a result, a new candidate (W07) was selected, who agreed to be interviewed. However, since one of the winemakers originally selected was a woman (W06) it was felt that a female winemaker from an estate cellar should also be included. None of the remaining candidates in the estate cellar category was female. Hence, a female winemaker was selected from outside the list of 28 – someone from the larger pool of survey respondents who agreed (and not strongly agreed) to the statement about scientific utilisation but still rated intuition as extremely important. The latter winemaker (W99 in Table 4.2) agreed to be interviewed.
- Also in the independent non-estate cellar category one male and two female winemakers were initially selected for interviews (W17, W20 and W24). One female winemaker (W24) did not respond and the other declined because of work pressure (W18). The male winemaker (W20) responded positively by granting an interview.

**Table 4.2: Demographics of winemakers who met the eligibility criteria for interview selection**

| Code | Region | Gender | Age | Interview requested | Response to interview request | Cellar type |
|---|---|---|---|---|---|---|
| W01 | Little Karoo | Male | 61-65 | Yes | Granted | Co-operative cellar |
| W02 | Robertson | Male | 51-55 | No | -- | |
| W03 | Paarl | Male | 36-40 | No | -- | Estate cellar |
| W04 | Robertson | Male | 66-70 | No | -- | |
| W05 | Robertson | Male | NS | No | -- | |
| W06 | Stellenbosch | Female | 41-45 | Yes | No response | |
| W07 | Stellenbosch | Male | 41-45 | Yes | Granted | |
| W08 | Stellenbosch | Male | 26-30 | Yes | Declined | |
| W09 | Stellenbosch | Male | 26-30 | Yes | No response | |
| W10 | Stellenbosch | Male | 26-30 | No | -- | |
| W11 | Stellenbosch | Male | 51-50 | No | -- | |
| W12 | Stellenbosch | Male | 56-60 | No | -- | |
| W13 | Stellenbosch | Male | 66-70 | No | -- | |
| W14 | Tulbagh | Male | 36-40 | No | -- | |
| W99 | Little Karoo | Female | 26-30 | Yes | Granted | |
| W15 | Constantia | Male | 41-45 | No | -- | Independent (non-estate) cellar |
| W16 | Great Karoo | Male | 26-30 | No | -- | |
| W17 | Olifants River | Male | 51-50 | No | -- | |
| W18 | Robertson | Female | 36-40 | Yes | Declined | |
| W19 | Stellenbosch | Female | 31-35 | No | -- | |
| W20 | Stellenbosch | Male | 36-40 | Yes | Granted | |
| W21 | Stellenbosch | Male | 36-40 | No | -- | |
| W22 | Swartland | Male | 51-55 | No | -- | |
| W23 | Swartland | Male | 51-55 | No | -- | |
| W24 | Worcester | Female | 26-30 | Yes | No response | |
| W25 | Paarl | Male | 31-35 | Yes | Granted | Producing wholesaler |
| W26 | Olifants River | Male | 41-45 | No | -- | |
| W27 | Darling | Male | 66-70 | Yes | Granted | Garagiste producer |
| W28 | Robertson | Male | 41-45 | No | -- | |

Note: W99 was added to the original list of 28 because the only female winemaker in the estate cellar category (W06) failed to respond to the interview request.

Apart from the six winemakers selected above, three consultants who regularly interact with winemakers in an advisory capacity were also selected as interviewees. They included a winemaker who is a winemaking consultant for other wine producers (C01), an independent winemaking consultant who has ties with the technology transfer arm of Winetech (C02), and a technical consultant from a wine yeast manufacturing firm (C03). The reason for also including consultant interviews in the study is because consultants have established relationships with winemakers and are normally among the first to be approached when a

cellar is experiencing winemaking challenges. Furthermore, given that consultants need to provide expert solutions to their winemaking clientele – which require getting to the root of a problem – they are often more reflective about the practices of winemakers than the winemakers themselves.

### 4.3.2 Interview Questions

Two sets of interview questions were developed for winemakers. The first, set A below, is strongly influenced by questions that Stolper et al. (2009a) previously posed to general practitioners, in order to ascertain the main determinants of their gut feelings. In the current study the questions served to explore the nature and conditions of intuitive knowing as an expression of practical knowledge in the winemaking context.

Set A

- Do you sometimes get a gut feeling/ intuitive sense of what to do when making wine?
- When does this tend to happen? What stage, what process?
- What normally happens when you get the gut feeling/ intuition?
- How do you deal with this?
- What cues normally trigger your intuition?
- To what extent do you think this is influenced by professional experience?
- Do you trust your gut feelings?
- Do you trust it more than you trust other sources of knowledge?

The second set of questions, set B, connects with the first and was developed to explore the relation between different knowledge sources in winemaking, particularly the interplay between practical and factual knowledge, and codified and embodied knowledge. The questions tried to establish which knowledge sources are prioritised and under what circumstances.

Set B

- What knowledge do you rely on when you have to do some manipulation or hands-on implementation in order to achieve a particular wine style (to satisfy consumer preference)? How do you use the knowledge under these circumstances?
- How are these knowledge sources different from the ones that you use during routine winemaking, i.e. when wine is basically doing “its own thing” while going through the normal processes of fermentation etc.?

- Is there a preferred order of using external knowledge? (Probe: asking people before using publications or the other way around?) Where does experience and personal knowledge fit in? Be specific.
- What happens if external knowledge does not sit well with your intuition? (Probe: Do you rely on your own knowledge? Do you seek a third opinion, etc.?)

The survey responses of the selected winemakers were also studied before each interview and, on the basis of that, additional questions formulated for a particular winemaker.

Lastly, the three consultants were asked a different set of questions, namely set C. The latter was specifically designed for them, in order to determine the source of their factual knowledge, as well as obtaining an outsider perspective on a winemaker's implementation of (factual) knowledge in practice settings.

Set C

- When do winemakers normally contact you for advice?
- What type of problems/challenges do they experience?
- How do you go about finding a solution?
- How do they respond to the advice/solution that you offer?
- Do you find that they implement your advice/solution?
- What factors respectively prevent and facilitate their implementation of your advice/solution?
- Do they sometimes implement your advice/solution differently than you intended?
- Do they have habits/beliefs that are difficult to change? Are these based on their own experience?
- Where do you get your knowledge from?

### 4.3.3 General Procedure

Each selected winemaker/consultant received via email a request for a telephonic interview, which also briefly outlined the reason for the interview. A 20-30 minute time slot was requested based on the person's schedule and availability. Where a winemaker/consultant agreed to be interviewed he/she had to confirm the appropriate time via email, together with the telephone number (preferably landline) to be contacted on. The winemaker/consultant was then contacted at the dedicated time.

At the start of each interview the winemaker/consultant was thanked for setting time apart and appreciation expressed for her/his contribution. In all instances the winemaker/consultant voiced no objection to the interview being recorded. A professional digital voice recorder was used for this purpose, which generated an electronic (wave sound) file. The interviews lasted between 10-20 minutes with the average duration being 17 minutes. Altogether six interviews were conducted in Afrikaans and three in English. Moreover, eight of the interviews occurred during normal office hours and one in the early evening as it was the only time that suited the winemaker concerned. In two instances an interview had to be rescheduled as unforeseen circumstances prevented the relevant winemaker from doing the interview. The interviews were conducted between August 2011 and January 2012.

The interviewees were informed that the results of the study will be published as a popular article in *Wynboer* in the WineLand magazine, in order to inform the industry about the outcome of the investigation.

### 4.3.4 Analysis of Interviews

The electronic files of the interviews were transcribed (verbatim) in MS Word. The ensuing transcripts, all single spaced, ranged between three to seven pages. In analyzing the text each transcript was carefully studied and a number of “key ideas” generated. The sources of these ideas were threefold: the literature study (e.g. the relation between experience and intuition), the survey data (e.g. what kind of knowledge do wine consumers contribute) and the interview data (e.g. the role of trials in the achievement of wine style). Next each transcript was again scrutinised but this time to identify relevant text segments that could illustrate these “key ideas”. The identified segments were copied and pasted in a new MS Word file, and a narrative written to serve as a bridge between the segments and explaining variations in comments.

## 4.4 CONCLUDING COMMENT

The next two chapters present the results for the web-based survey and interviews. The quantitative results from the survey (Chapter 5) highlight the pervasiveness (or not) of certain knowledge sources, together with the determinants thereof. Chapter 6 on the other hand also presents findings from the winemaker survey, and more specifically the extent of scientific research utilisation among winemakers. The qualitative findings are also incorporated in Chapter 6, providing insights with regard to the use of certain knowledge

sources, thereby highlighting certain broad practice-based contexts for knowledge utilisation in winemaking, as well as a discussion of intuition and sense-impressions as elements of a winemaker's practical knowledge.

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# Chapter 5

# SOURCES OF KNOWLEDGE OF WINEMAKERS

## 5.1 INTRODUCTION

This chapter presents findings from the web-based survey of winemakers and serves to answer the following broad questions:

- What are the sources of knowledge of South African winemakers? What sources do they regularly engage in and which do they regard as most important for their practice? Are there any natural groupings of knowledge sources?
- Can the knowledge sources easily be separated into, for instance, factual and practical knowledge? What types of knowledge characterise the knowledge sources of winemakers?
- What routes of knowledge transfer can be inferred from the knowledge sources?
- What cellar based and winemaker specific factors are associated with the different knowledge sources?

The chapter is structured in four sections. First, the demographics of the winemakers are presented in Section 5.2. This is followed in Section 5.3 by a detailed analysis of the knowledge sources consulted by winemakers. This section not only examines the *frequency* of using knowledge sources but also the *relative importance* of the different knowledge sources and the underlying structure of the sources (i.e. which sources tend to group together). The groupings of knowledge sources (refer to as knowledge source components) are related to selected demographical variables. Lastly, Section 5.4 involves a general discussion that highlights the main conclusions.

As stated in Chapter 4 a total of 211 respondents participated in the web-based survey. However, not all of these respondents completed all questions. For that reason the number of respondents in the findings presented below range between 211 and 150.

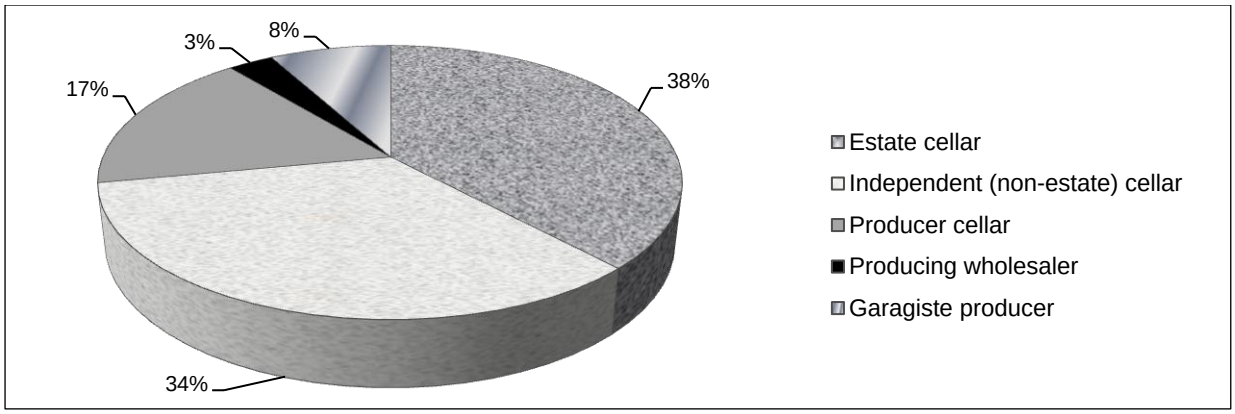
## 5.2 DEMOGRAPHICS OF WINEMAKERS

Of the 184 respondents who specified their gender 80% are male and 20% female. The respondents are predominantly from private cellars (estate, non-estate and Garagiste[16]),

[16] In the case of Garagiste producers a cellar refers to the space that they have allocated for winemaking. This could involve a variety of settings, including a garage at home or backyard structure or a premise that is rented from an established winemaker.

namely 80% in total, of which the largest shares (38% and 34%, Figure 5.1) are from estate and non-estate cellars.

**Figure 5.1: Distribution of winemakers by cellar type (N = 191)**




Altogether 11% of the respondents are assistant winemakers and they also comprise the minority of respondents in each cellar category (Table 5.1).[17] It needs to be noted though that small numbers of respondents from producing cellars (n = 6) and Garagiste settings (n = 14) completed the survey, which most probably is a result of their smaller proportional representation in the population.

**Table 5.1: Distribution of winemakers by cellar type and position (N = 186)**

| Type of cellar | Winemaker / cellar master / production manager | Assistant-winemaker | Total |
|---|---|---|---|
| Estate cellar | 62 (89%) | 8 (11%) | 70 (100%) |
| Independent (non-estate) cellar | 60 (95%) | 3 (5%) | 63 (100%) |
| Producer cellar | 25 (76%) | 8 (24%) | 33 (100%) |
| Producing wholesaler | 5 (83%) | 1 (17%) | 6 (100%) |
| Garagiste producer | 14 (100%) | 0 (0%) | 14 (100%) |
| **Total** | **166 (89%)** | **20 (11%)** | **186 (100%)** |

Tables 5.2 and 5.3 show that just more than a quarter of the winemakers are from the Stellenbosch region (27%), followed by the Paarl/Franschhoek and Robertson regions (14% and 11%). In terms of winemaking specialisation, the top five wine grape varieties listed all represent noble cultivars (Shiraz, Cabernet Sauvignon, Sauvignon Blanc, Chardonnay and Merlot).

[17] Although a distinction was made between winemakers and assistant winemakers in the questionnaire, all references to "winemaker" in the remainder of this chapter include both groupings.

**Table 5.2: Region where winemakers' cellars are located (N = 189)**

| Region | Count | % of 189 | Region | Count | % of 189 | Region | Count | % of 189 |
|---|---|---|---|---|---|---|---|---|
| Stellenbosch | 51 | 27% | Worcester | 7 | 4% | Cape Point | 2 | 1% |
| Paarl / Franschhoek | 26 | 14% | Walker Bay | 7 | 4% | Darling | 2 | 1% |
| Robertson | 20 | 11% | Durbanville | 6 | 3% | Great Karoo | 2 | 1% |
| Little Karoo | 14 | 7% | Wellington | 6 | 3% | Tulbagh | 2 | 1% |
| Breedekloof | 11 | 6% | Overberg | 5 | 3% | Agulhas | 1 | <1% |
| Swartland | 11 | 6% | Constantia | 3 | 2% | Cape Town | 1 | <1% |
| Olifants River | 9 | 5% | Orange River | 3 | 2% | Swellendam | 0 | 0% |

**Table 5.3: Winemakers' area of specialisation in winemaking (N = 190)**

| Specialisation | Count | % of 190 | Specialisation | Count | % of 190 | Specialisation | Count | % of 190 |
|---|---|---|---|---|---|---|---|---|
| Shiraz | 113 | 60% | Viognier | 44 | 32% | Pinot Noir | 17 | 9% |
| Cabernet Sauvignon | 104 | 55% | Muscadel / Hanepoot | 36 | 19% | Other sparkling | 14 | 7% |
| Sauvignon Blanc | 94 | 50% | Sémillon | 35 | 18% | Grenache | 14 | 7% |
| Chardonnay | 85 | 45% | Cabernet Franc | 32 | 17% | Blanc de Noir | 12 | 7% |
| Merlot | 74 | 39% | Cap Classique | 32 | 17% | Cinsaut | 11 | 6% |
| Chenin Blanc | 69 | 36% | Colombar | 30 | 16% | Jerepigo | 11 | 6% |
| Pinotage | 68 | 36% | Port | 29 | 15% | Cape Riesling | 6 | 3% |
| Rosé | 52 | 27% | Ruby Cabernet | 21 | 11% | Sherry | 5 | 3% |
| Bordeaux | 48 | 25% | Cape Blend | 20 | 11% | Mourvedre | 5 | 3% |

Note: The figures are not mutually exclusive as the respondents could select all that apply.

About 31% of winemakers reported that they have completed the four year BScAgric degree offered by Stellenbosch University (SU) (Table 5.4). The qualification with the next highest percentage of responses (29%) is a one year diploma in either agriculture or cellar technology from the Cape Institute for Agricultural Training (CIAT) at Elsenburg. However, the diploma in cellar technology involves more than just a one year course as the admission requirement is either a two year higher certificate with oenology as major subject, or a BAgric degree with oenology up to second year level (CIAT, 2011b). Thus, at least two years of dedicated study in oenology is required before a student can enroll for the diploma in cellar technology at the CIAT. Also, learners who had completed the three-year BAgric

degree at the CIAT, followed by an additional one year at CIAT to complete the diploma in cellar technology, arguably have a qualification equivalent to the four-year BScAgric degree offered by the SU. Nevertheless, the SU-based BScAgric degree and the CIAT-based diploma account for 60% of all qualifications reported by winemakers. In the rest of this chapter, in any comparison that involves highest degree as a grouping variable, only the three categories with the largest numbers of responses will be compared: BScAgric from the SU (59 respondents), Dip Agric / Cellar Tech from the CIAT (54 respondents), and no relevant qualification (21 respondents).

**Table 5.4: Highest relevant qualification completed by winemakers**

| Qualification | Count | Percent |
|---|---|---|
| Bachelors degree in wine / agricultural sciences from SU (4 years) | 59 | 31% |
| Bachelors degree in agriculture / cellar technology from CIAT at Elsenburg (3 years) | 10 | 5% |
| Postgraduate degree in wine / agricultural sciences from SU (honours / masters) | 9 | 5% |
| Postgraduate degree from other SA / foreign institution | 2 | 1% |
| Higher certificate in agriculture from CIAT at Elsenburg (2 years) | 6 | 3% |
| Diploma in agriculture / cellar technology from CIAT at Elsenburg (1 year) | 54 | 29% |
| Diploma from Cape Wine Academy | 4 | 2% |
| Agricultural diploma from another SA institution | 3 | 2% |
| Diploma / bachelors degree from an international institution | 6 | 3% |
| Short courses | 10 | 5% |
| Incomplete (but relevant) studies | 4 | 2% |
| No relevant qualification | 21 | 11% |
| **Total** | **188** | **100%** |

The average age of the winemakers studied is about 39 years (N = 181), with ages ranging between 23 and 69 years. About 22% of all winemakers are younger than 30 years (Figure 5.2 and Table 5.3 below). Garagiste winemakers, on average, are older than winemakers at private and producer cellars. Garagiste producers are about 48 years while the other winemakers are mostly in their thirties.

**Figure 5.2: Age of winemakers at time of completion of survey**

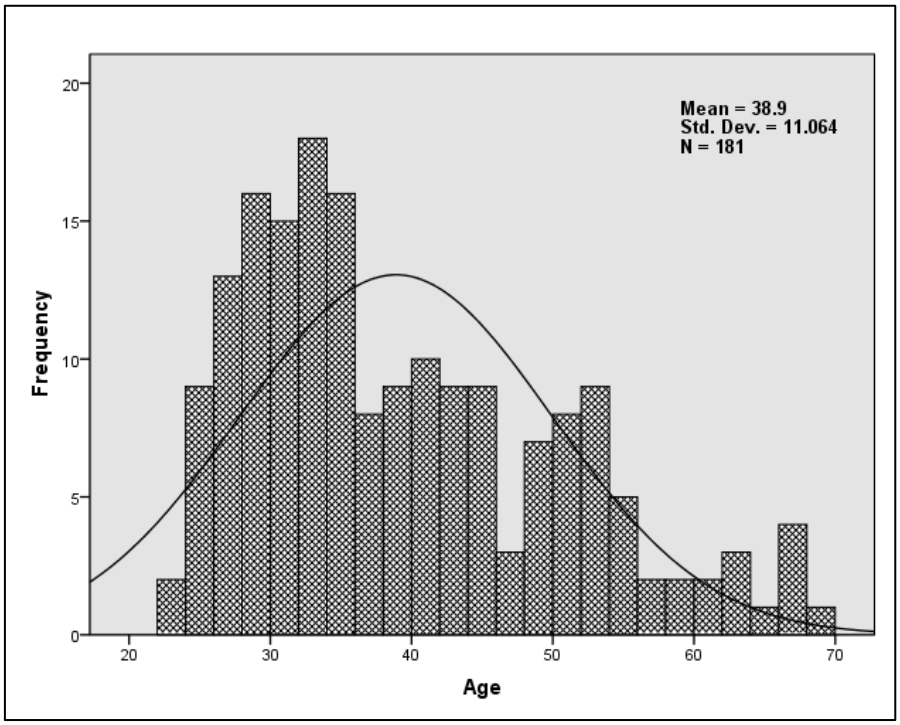



**Table 5.5: Age of winemakers at time of completion of survey, by cellar type**

| Type of cellar | Mean age | Median age | Standard deviation | Minimum age | Maximum age | % younger than 30 years |
|---|---|---|---|---|---|---|
| Estate cellar (n=69) | 38.8 | 36.0 | 11.3 | 23 | 69 | 23% |
| Independent (non-estate) cellar (n=59) | 38.0 | 35.0 | 9.7 | 25 | 62 | 26% |
| Producer cellar (n=33) | 37.9 | 34.0 | 11.7 | 23 | 62 | 33% |
| Producing wholesaler (n=6) | 33.2 | 32.0 | 4.8 | 28 | 42 | 17% |
| Garagiste producer (n=14) | 47.9 | 48.5 | 12.4 | 30 | 67 | 0% |
| **Total (N=181)** | **38.9** | **36.0** | **11.1** | **23** | **69** | **22%** |

In terms of experience, the average number of years that the respondents have been working as a winemaker is 12 years (Figure 5.3). Winemakers at producer cellars have the most experience and Garagiste producers the least (about 15 years versus 10 years, Table 5.6).

**Figure 5.3: Years of experience as winemaker**

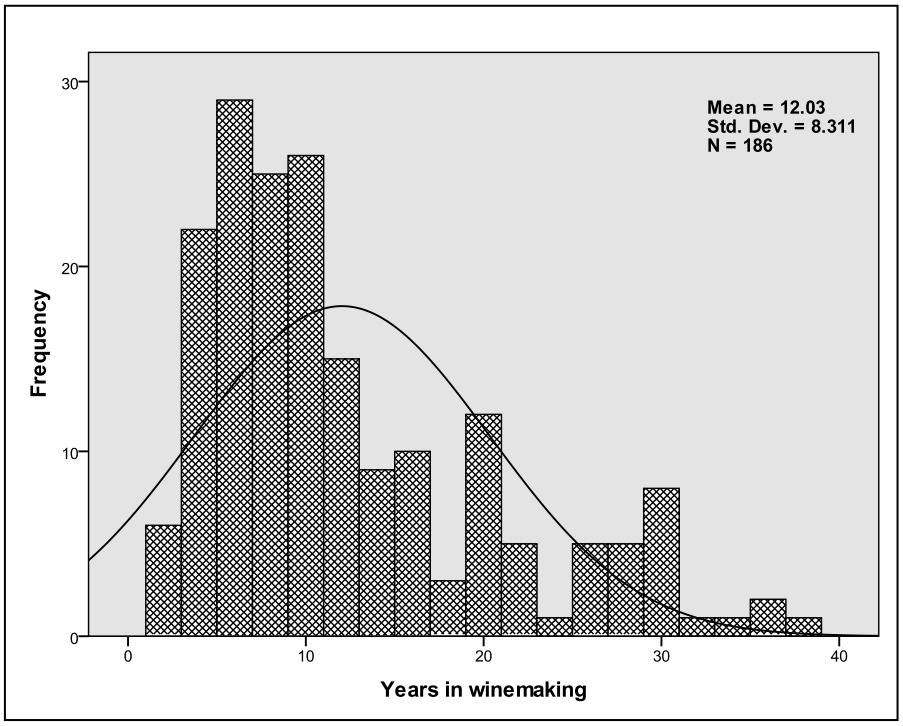
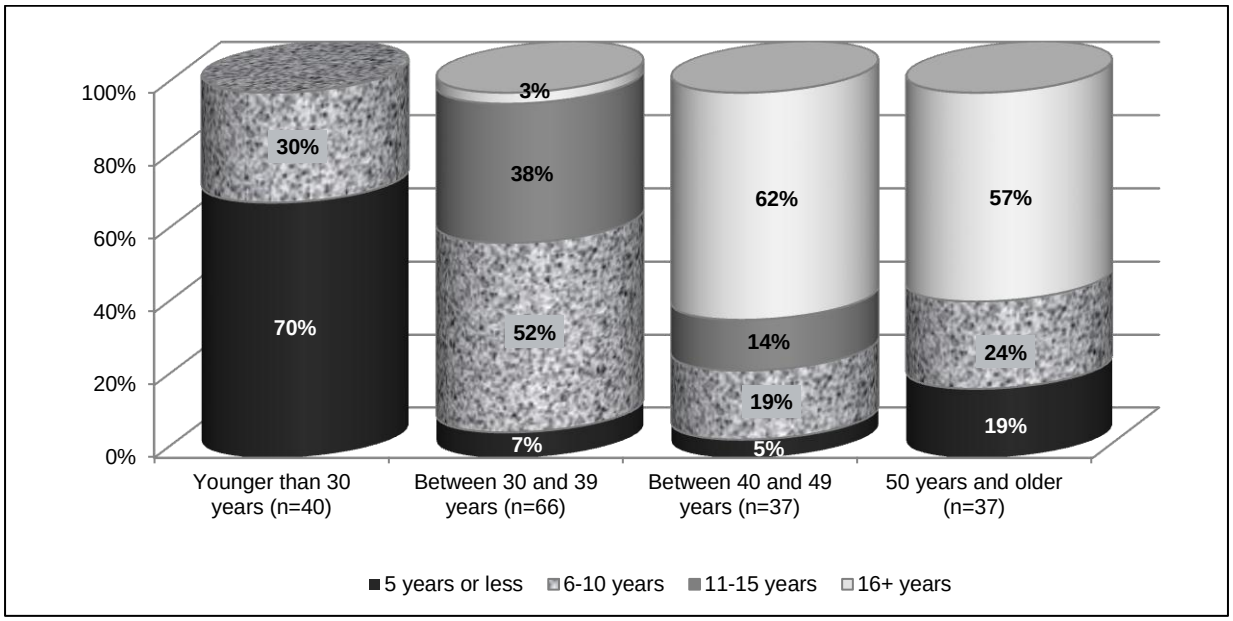



**Table 5.6: Years of experience as winemaker, by cellar type**

| Type of cellar | Mean years | Median years | Standard deviation | Minimum years | Maximum years | % fewer than 5 years |
|---|---|---|---|---|---|---|
| Estate cellar (n=70) | 11.4 | 8.5 | 8.1 | 2 | 36 | 29% |
| Independent (non-estate) cellar (n=62) | 11.8 | 10.0 | 7.2 | 3 | 31 | 23% |
| Producer cellar (n=33) | 15.2 | 11.0 | 11.2 | 2 | 37 | 27% |
| Producing wholesaler (n=6) | 10.7 | 9.5 | 5.6 | 5 | 20 | 17% |
| Garagiste producer (n=15) | 9.7 | 8.0 | 6.0 | 4 | 27 | 7% |
| **Total (N=186)** | **12.0** | **10.0** | **8.3** | **2** | **37** | **24%** |

As expected there is a clear and statistically significant relationship between age and experience, with 70% of winemakers younger than 30 years reported having 5 years or less experience. Concomitantly, a large proportion (62%) of those older than 40 years also reported more than 15 years of research experience (Figure 5.4).

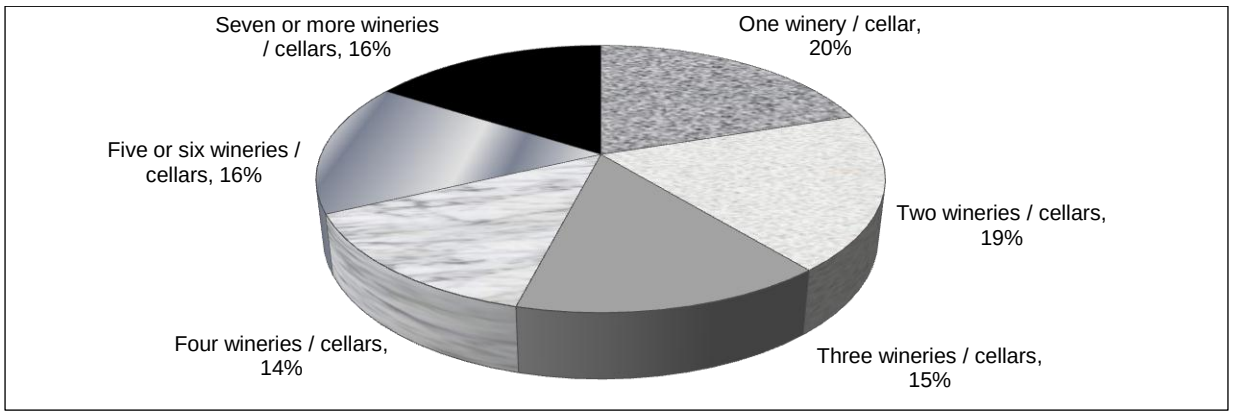
**Figure 5.4: Age of winemakers by years of experience (N = 180)**




Chi-square = 146.96; df = 9; p<0.05; Cramer's V = 0.52

One-fifth of winemakers stated they have worked in only one cellar so far, which is also their current cellar (Figure 5.5). Although there is a statistically significant relationship between age and the number of cellar worked at (Table 5.7), the relationship is not a linear one. In other words, it is not necessarily the case that older winemakers are more likely to have reported a higher number of past cellars. In fact, a larger proportion of older winemakers (38% of those in the 50+ category) reported that their current cellar is the only one they have ever worked at. Respondents in this age group are therefore also the least likely to report (11%) that they have worked at five or more cellars during the course of their career. On the other hand, winemakers in the 30-39 age group reported the most varied cellar experiences, given that 46%of them had worked in at least five cellars at the time of the survey.

**Figure 5.5: Number of cellars winemakers worked at (N = 188)**




Note: Current cellar is included.

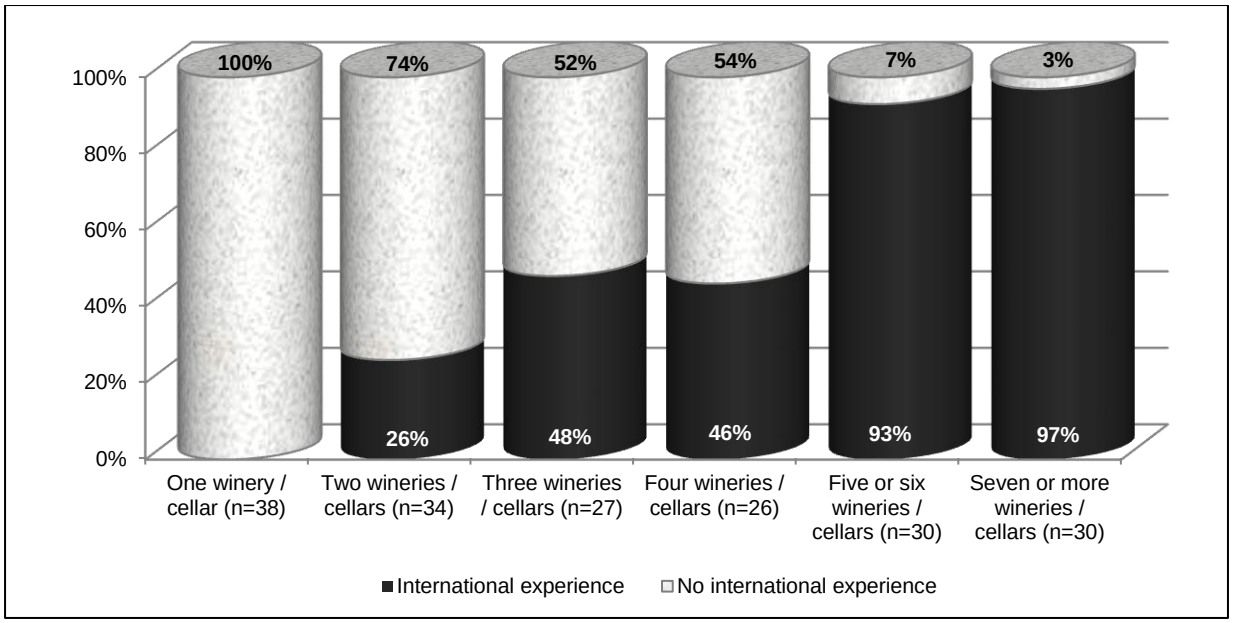
**Table 5.7: Number of cellars winemakers worked at, by current age (N = 181)**

| Age | Number of cellars (current included) | | | | |
|---|---|---|---|---|---|
| | One | Two | Three | Four | Five or more |
| <30 yrs (n=40) | 22.5% | 22.5% | 20.0% | 7.5% | 27.5% |
| 30-39 yrs (n=66) | 12.1% | 12.1% | 15.2% | 15.2% | 45.5% |
| 40-49 yrs (n=38) | 15.8% | 23.7% | 10.5% | 18.4% | 31.6% |
| 50+ yrs (n=37) | 37.8% | 24.3% | 10.8% | 16.2% | 10.8% |
| **Total (N=181)** | **20.4%** | **19.3%** | **14.4%** | **14.4%** | **31.5%** |

Chi-square = 23.84; df = 12; p<0.05; Cramer's V = 0.21

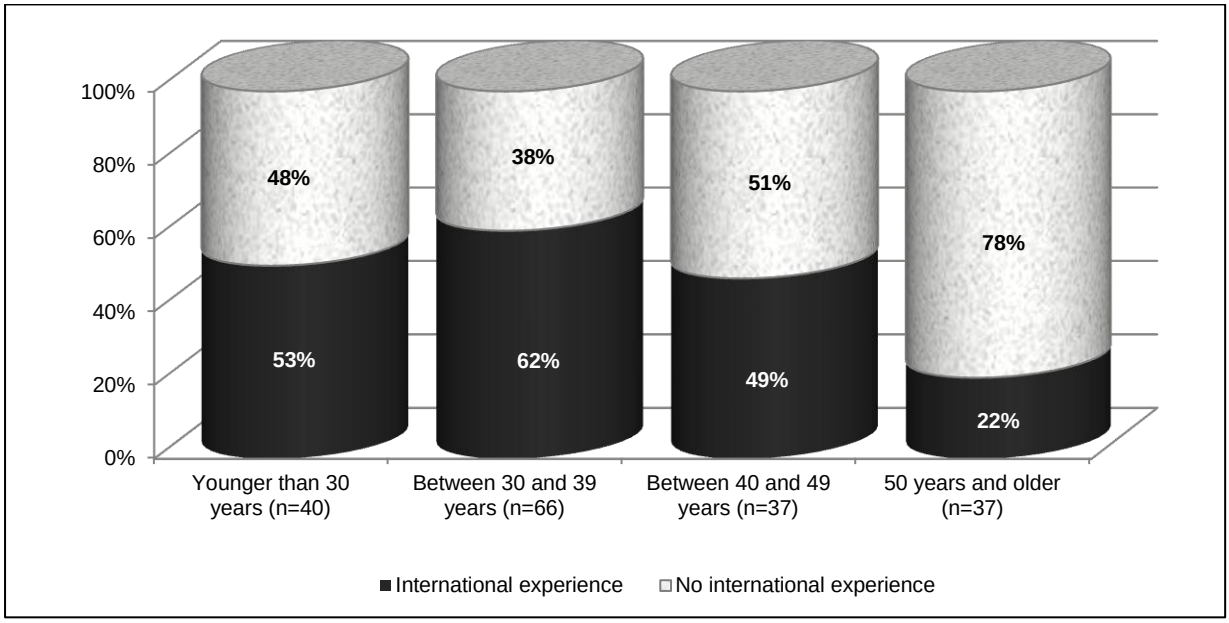
The number of cellars a winemaker worked at is a strong and significant correlate of international experience. More than 90% of winemakers who reported experience from five or more cellars also said that at least one of the cellars was outside the country (Figure 5.6). The age of winemakers also correlated significantly with international experience (Figure 5.7). Those older than 50 were the least likely to have reported international experience (22%), compared to those in the 30-39 and younger than 30 age groups, where respectively 62% and 53% reported such experience. The most likely explanation for this is political, as South Africa's international isolation under apartheid in the 1980s would have made it almost impossible for those currently over 50 years to have gained experiences abroad during their early years of winemaking.

**Figure 5.6: Number of cellars winemakers worked at, by whether or not they have experience in at least one international cellar (N = 185)**




Chi-square = 94.36; df = 5; p<0.05; Cramer's V = 0.71

**Figure 5.7: Current age of winemakers, by whether or not they have experience in at least one international cellar (N = 184)**




Chi-square = 15.84; df = 3; p<0.05; Cramer's V = 0.30

Nearly a quarter (24%) of the 186 winemakers said that there are also other winemakers in their family. However, having family members who are also winemakers is not significantly related to cellar type.

About 35% of the respondents said they are members of the South African Society for Enology and Viticulture (SASEV), according to Table 5.8. Relatively small percentages of respondents in the survey (5%) also stated membership of producer societies, specifically societies for estate winemakers and Garagiste producers. Two societies that are exclusively defined in terms of expertise and excellence (Cape Winemakers Guild and Institute of Cape Wine Masters) also appeared in the study but their associated percentages are very low (5% and 2% respectively).[18] The societies' details are as follows:

- *Institute of Cape Wine Masters* (ICWM). The institute consists of a group of knowledgeable people who are formally qualified and informed on local and international wine masters. The members are active in the wine industry as wine judges, wine educators, winemakers, and marketing and sales administrators. Members have all successfully completed the Cape Wine Masters Programme, which is offered by the Cape Wine Academy. The programme, although not

[18] There are about 45 guild members in the country, out of approximately 896 winemakers. Thus, guild members represent 5% of all winemakers nationally. Guild members are therefore adequately represented in the survey, given that 5% of respondents stated membership of the CWG.

accredited, is dissertation-oriented and produces a higher qualification in the South African wine industry (www.capewineacademy.co.za; www.capewinemasters.co.za).

- *Cape Winemakers Guild (CWG)*. Membership of the guild is by invitation only, following a process of nomination and voting at the CWG's annual general meeting. It is granted to winemakers who have produced outstanding wines for a minimum of five years and who continue to do so. The CWG meets regularly as a technical tasting group, thereby providing its members with an opportunity to evaluate wine from all over the world and to exchange knowledge and ideas (www.capewinemakersguild.com).

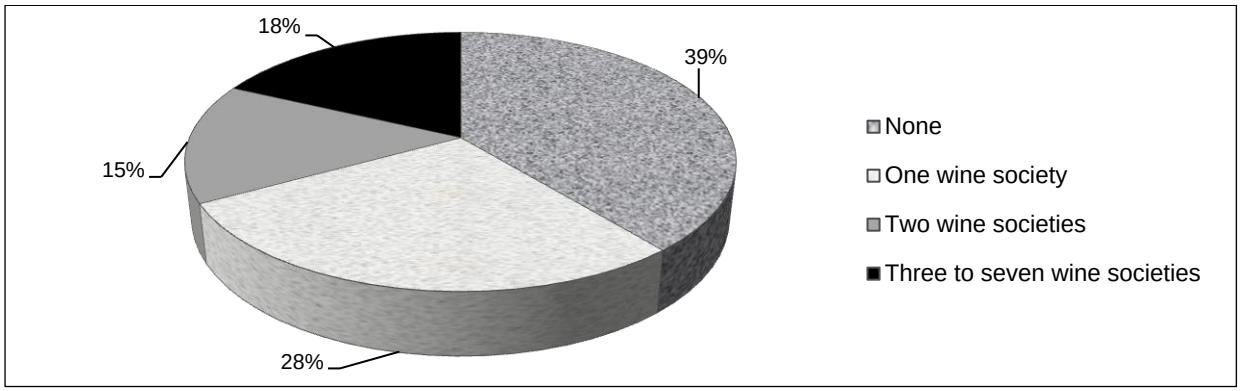
Lastly, there are a number of wine associations to which winemakers belong, and that are organised around select cultivars and wine styles. Of these the associations for Pinotage (26%), Shiraz (23%) and Sauvignon Blanc (22%) appear to be the most prominent, given relatively higher numbers of respondents who reported membership (Table 5.8). These wine societies often serve as mechanisms of knowledge transfer. For instance, the Pinotage association has the generic objective of increasing their members' knowledge of all viticultural and vinicultural aspects of Pinotage production through various means, whereas both the Shiraz and Sauvignon Blanc associations provide technical workshops to their members (WineLand, 2010).

**Table 5.8: Wine-related societies that winemakers belong to**

| Wine-related societies | Count | Percent |
|---|---|---|
| **Scientific society** | | |
| South African Society for Enology and Viticulture (SASEV) | 65 | 35% |
| **Producer societies** | | |
| Cape Estate Wine Producers' Association | 9 | 5% |
| Garagiste Movement | 9 | 5% |
| **Societies based on expertise** | | |
| Cape Winemakers Guild | 10 | 5% |
| Institute of Cape Wine Masters | 4 | 2% |
| **Specific wine associations** | | |
| Pinotage Association | 49 | 26% |
| Shiraz Forum | 43 | 23% |
| Sauvignon Blanc Interest Group | 42 | 22% |
| Méthode Cap Classique Producers' Association | 29 | 15% |
| Chenin Blanc Association | 28 | 15% |
| Chardonnay Forum | 24 | 13% |
| South African Port Producers' Association | 15 | 8% |
| Muscadel South Africa | 12 | 6% |
| Pinot Noir Interest Group | 2 | 1% |

Note: A number of respondents also added that they are members of BOWWUS (*Bond vir Oudstudente Wingerd- en Wynkunde US* – Alumni Association of Viticulture and Oenology US) and EKOV (*Elsenburg Kollege Oudstudente-vereniging* – Elsenburg College Alumni Association).

**Figure 5.8: Number of wine associations that winemakers belong to**




About 61% of winemakers in the survey reported belonging to one of the nine wine associations listed in the survey whilst 33% indicated that they are members of two or more associations (Figure 5.8). On average, according to Table 5.9, winemakers at producer cellars belong to more wine associations (median = 2) than those in other cellars (median = 1 or less).

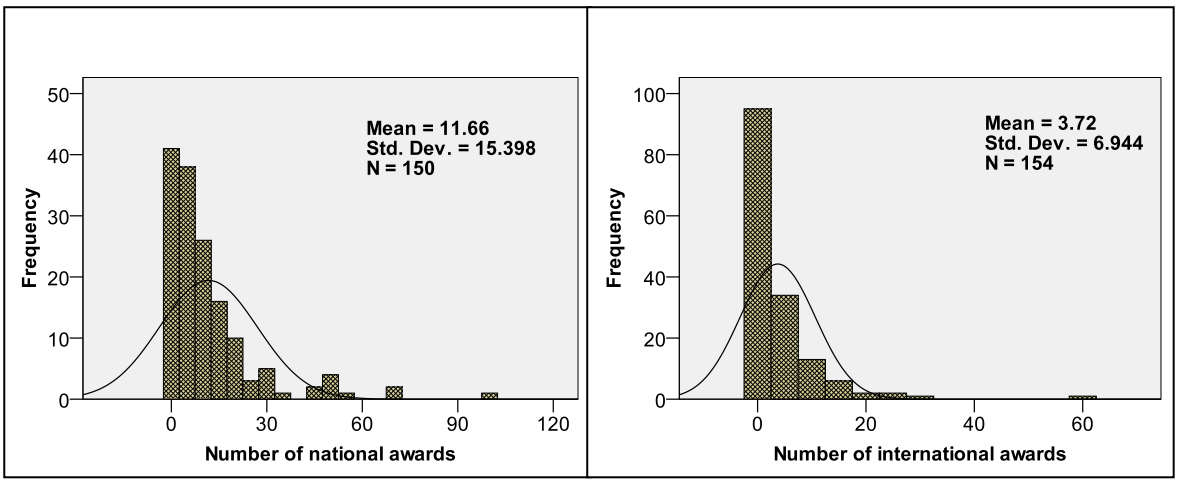
**Table 5.9: Mean number of wine associations that winemakers belong to, by cellar type (N = 188)**

| Type of cellar | Mean number of societies | Median number of societies | Standard deviation | Lowest number | Highest number |
|---|---|---|---|---|---|
| Estate cellar (n=71) | 1.4 | 1.0 | 1.5 | 0 | 6 |
| Independent (non-estate) cellar (n=62) | 1.0 | 1.0 | 1.3 | 0 | 6 |
| Producer cellar (n=33) | 2.0 | 2.0 | 1.7 | 0 | 7 |
| Producing wholesaler (n=6) | 1.8 | 0.5 | 2.8 | 0 | 7 |
| Garagiste producer (home winemaker) (n=16) | 0.6 | 0.0 | 0.7 | 0 | 2 |
| **Total (N=188)** | **1.3** | **1.0** | **1.5** | **0** | **7** |

Respondents were also asked to specify how many awards their wines had received in the past three years, at national and international events respectively. The distribution of responses is shown in Figure 5.9 below. About 16% of the winemakers reported zero national awards and 46% reported zero international awards. Smaller numbers of respondents answered each question though (150 and 154 respectively). On average, the number of national awards received is 11.7, compared to a figure of 3.7 for international awards. The natural range of responses for national awards appears to be between 0 and 50 and for international awards between 0 and 20. There are thus outlier scores, given that four

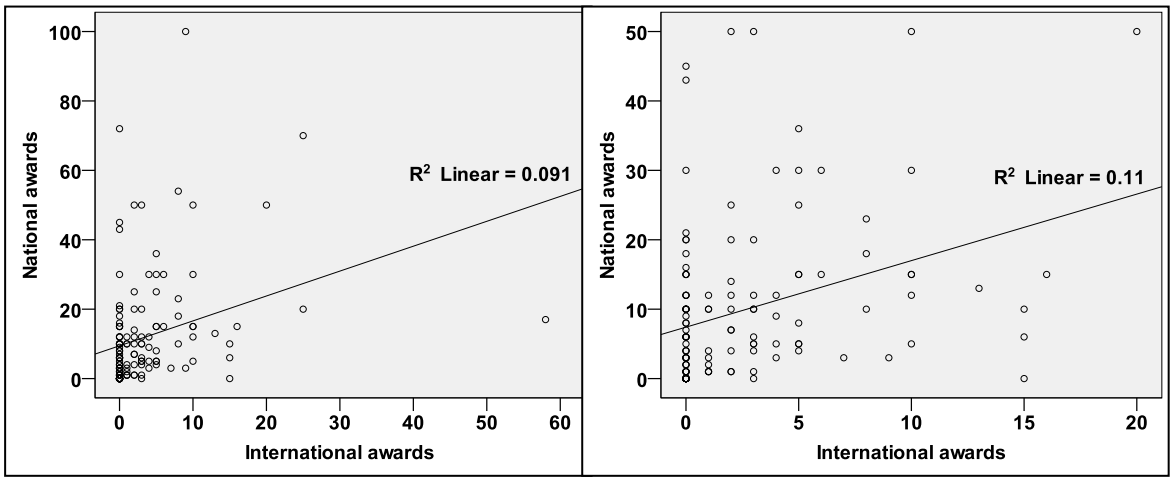
respondents reported more than 50 national awards and four respondents also more than 20 international awards.

**Figure 5.9: Distribution of the numbers of national and international awards received by winemakers**




In determining the relationship between the numbers of national and international awards, outliers were respectively included and excluded in the analysis. In Figure 5.10 the scatterplot on the left shows the correlation between the two sets of awards. The size of the correlation (r) is 0.302, which is why the coefficient of determination ($R^2$) is 0.091, as the correlation coefficient is the square root of the coefficient of determination. The latter means that 9.1% of the variability in one set of awards can be explained by the other, representing a moderate effect. If the outliers are excluded (scatterplot on the right) the correlation coefficient marginally improves to 0.331, which is associated with 11% of shared variability between the two sets of awards. Overall then, there is only a weak to moderate correlation between the two sets of awards, meaning a moderate tendency for winemakers with national awards to also achieve international awards. On the other side of the spectrum there is also some tendency for zero (or close to zero) awards on the one to be associated with zero (or close to zero) awards on the other.

**Figure 5.10: Correlation between the number of national and international awards, with outliers included (left) and excluded (right)**




Finally, as far as wine exports are concerned, the winemakers stated that, on average, their cellars export about 39% of the total volume of wine produced (natural, fortified and sparkling).[19] The highest percentage of exports is associated with estate cellars (43% in Table 5.10). Garagiste producers, on the other hand, are the least orientated towards international exports (17%). This is no surprise as they produce wine in very small quantities (Table 5.10) and often engage in winemaking for personal gratification rather than being orientated towards international markets.

**Table 5.10: Mean number of total wine production exported, by cellar type (N = 186)**

| Type of winery / cellar | Mean | Median | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Estate cellar (n=69) | 42.6% | 45% | 27.4 | 0% | 100% |
| Independent (non-estate) cellar (n=64) | 40.7% | 40% | 32.1 | 0% | 99% |
| Producer cellar (n=33) | 36.3% | 40% | 25.2 | 0% | 95% |
| Producing wholesaler (n=6) | 35.7% | 4% | 25.8 | 0% | 60% |
| Garagiste producer (n=14) | 17.2% | 3% | 27.4 | 0% | 75% |
| **Total (N=186)** | **38.7%** | **40%** | **29.2** | **0%** | **100%** |

Before shifting to the knowledge sources of South African winemakers, which are analysed in much detail in the next session (Section 5.3), the profile of the winemakers in the sample will first be summarised.

[19] The corresponding figure for South Africa, overall, is about 49%, according to SAWIS figures for 2010 (SAWIS, 2011).

Summary

- The winemaker respondents, who range between 210 and 150 depending on the question asked, are predominantly male (80%) and, on average, 39 years old. Their average winemaking experience is about 12 years.
- The winemakers are mostly from estate cellars (38%) and independent non-estate cellars (34%). Their cellars are diffused across the different regions, with the largest proportions from Stellenbosch (27%) and neighbouring regions such as Paarl/Franschhoek (14%). On average, the cellars export about 39% of their total volume of wine production.
- The winemakers' area of specialisation, as far as winemaking is concerned, mainly involves the vinification of noble grape cultivars, such as Shiraz (60%), Cabernet Sauvignon (55%) and Sauvignon Blanc (50%).
- About 84% of winemakers received at least one national award in the past three years, with 54% who received at least one international award over the same period.
- In terms of highest qualification, the two largest categories are winemakers who completed the 4-year BScAgric at Stellenbosch University (31%) and those who completed a diploma in agriculture/cellar technology from the CIAT at Elsenburg (29%).
- Just over a third (35%) of winemakers are members of SASEV, the science based wine society. Significant proportions of winemakers also belong to wine societies, such as the Pinotage Association (26%), Shiraz Forum (22%) and Sauvignon Blanc Interest Group (22%). About 61% of winemakers belong to at least one wine society.

## 5.3 KNOWLEDGE SOURCES

### 5.3.1 Classification of Knowledge Sources

Factual knowledge is explicit knowledge produced by research, meaning that it has an underlying scientific evidence base to verify the knowledge claim being made. Such scientific knowledge, according to Turnbull (1997:552), is "uniquely distinguished by its rationality and methodology. It is universal, objective and true within the limits of its own fallibility". Next to factual knowledge there is potential factual knowledge, which involves beliefs or opinions that may or may not be classifiable as facts, depending on whether or not any scientific research evidence exists to back the belief. In addition, there is also practical knowledge, which is always implicit and exhibited in practice. As discussed in Section 3.4 in a previous chapter, in some cases the implicit knowledge can be made explicit. This happens if the underlying "rules" of knowing can be extracted and expressed as propositions and thus

codified. Moreover, if the extracted "rules" can be verified through scientific investigation or if research evidence already exists to support the claim being made, factual knowledge can be concluded. On the other hand, practical knowledge that is inherently implicit and not expressible as propositions, meaning that it is non-codifiable, is referred to as tacit knowledge in the context of this study.

In Table 5.11 the potential sources of knowledge of winemakers have been classified in terms of the underlying type of knowledge (factual or potential factual knowledge versus practical knowledge). Two more variables have been included to strengthen the classification of knowledge sources, namely the status of the source in terms of level of codification (already codified; can be codified; cannot be codified) and the broad source category (documents; people; a combination of documents and people; and self).

- The documents listed in Table 5.11 are presumed to represent mainly factual knowledge as these documents are either produced by scientific or knowledge-based organisations or are known for reporting/incorporating the results of scientific research. Internet material is the only form of documentation that is also classified as potential factual knowledge, given that some of the relevant information on the internet may involve anecdotes that are not supported by any scientific evidence. Documents represent already codified information as it has been written up.
- The knowledge that is embedded in people falls into three categories. Firstly, some of the advice sought from people can be classified as factual knowledge as the information is solicited from the producers of scientific knowledge (e.g. researchers and laboratory staff) and/or the disseminators of such knowledge (teachers and consultants).[20] What is conveyed is factual knowledge that has already been written up (codified), e.g. research findings produced in some international publication, or factual knowledge that has not yet been written up but which can be codified. Examples of the latter are conversations between the winemakers and staff from wine laboratories, where the discussion could involve interpretations of scientific data.
- Secondly, some of the advice provided by other categories of people (e.g. cellar co-workers, other winemakers or wine consumers) is best regarded as beliefs/information for which there may or may not be supporting research evidence. Thus, the information may or may not represent factual knowledge. Potential factual

[20] Of course, the possibility exists that some of the advice solicited from experts could also involve speculation or belief which has not yet been empirically verified. This places the advice outside the realm of science and therefore in the category of potential factual knowledge.

knowledge is a good descriptor for this category of knowledge. Since the information is conveyed verbally and thus already expressed as propositions, it means that it can also be written up (i.e. can be codified).

- Thirdly, winemaking families and representatives of a cellar's tradition can also communicate (i.e. verbally) to the winemaker that particular winemaking tradition. This implies potentially codifiable knowledge. On the other hand, the relevant tradition can also become known to the winemaker through co-labouring at the cellar; in other words, it can somehow "rub off" on the winemaker through engagements and activities that involve close interaction with disciples of the particular tradition. In the latter instance, implicit knowledge is being transferred, which places "winemaking tradition as a source of knowledge" under the header of practical knowledge.
- The combination of documents and people refers to formally structured situations and events where knowledge is conveyed by people (e.g. presenters, facilitators) on the basis of certain documentation (e.g. course work, workshop readings). The examples of events provided in Table 5.11 are all science or knowledge based. The documents used at these events represent already codified knowledge. However, some of the information conveyed can also be embedded in people. Since the latter information is verbally communicated it has strong potential of being written up (can be codified).
- The self is also a source of knowledge as winemakers often rely on their experiences and personal knowledge. Knowledge embedded within oneself is implicit and can find expression as intuition, wisdom, common sense, and etcetera. Tacit knowledge represents that component of implicit knowledge that cannot be codified because of the inherent implicitness thereof. However, as said, some implicit knowledge can be expressed as propositions and for that reason has the potential of being codified.

**Table 5.11: Classification of the knowledge sources of winemakers in terms of the type of knowledge, broad source category and the level of codification**

<table>
<tr><th rowspan="2">Broad source category</th><th colspan="3">Type of knowledge</th></tr>
<tr><th>Factual knowledge<br>(Facts that are supported by research evidence)</th><th>Potential factual knowledge<br>(Beliefs/information for which there may or may not be any research evidence)</th><th>Practical knowledge<br>(Exhibited in practice)</th></tr>
<tr><td rowspan="2">Documents</td><td>ALREADY CODIFIED<br>* South African Journal of Enology and Viticulture (SAJEV)<br>* Wynboer in the WineLand magazine<br>* Outlook Gazette by Anchor Yeast<br>* Winetech Scan<br>* Findings of Winetech-funded research<br>* International trade journals<br>* International science journals<br>* International research reports<br>* Contributions in New World Winemaker<br>* Textbooks and manuals<br>* Information in leaflets that accompany commercial products (e.g. yeast)<br>* Results of wine analyses from wine laboratories</td><td>—</td><td rowspan="2">—</td></tr>
<tr><td colspan="2">ALREADY CODIFIED<br>* The internet</td></tr>
<tr><td rowspan="3">People</td><td>ALREADY CODIFIED OR CAN BE CODIFIED<br>Advice obtained from:<br>* Staff at CIAT: Elsenburg<br>* Staff from Stellenbosch University and other universities<br>* Staff from ARC Infruitec-Nietvoorbij<br>* Technical consultants<br>*VinPro consultants<br>* Staff from Wine laboratories</td><td>—</td><td rowspan="2">—</td></tr>
<tr><td rowspan="2">—</td><td>CAN BE CODIFIED<br>* Staff or colleagues at own cellar<br>* Local and international winemakers<br>* Wine consumers<br>* Family members who know about winemaking</td></tr>
<tr><td colspan="2">CAN OR CANNOT BE CODIFIED<br>* Winemaking tradition (of farm, estate, cellar, family etc.)</td></tr>
<tr><td>Documents x people (events)</td><td>ALREADY CODIFIED OR CAN BE CODIFIED<br>* Information sessions/ seminars/workshops/short courses by Winetech, VinPro etc.<br>* Annual conference of the South African Society for Enology and Viticulture<br>* Conferences in other countries<br>* Postgraduate seminars at Stellenbosch University<br>* Formal training received at college/university</td><td>—</td><td>—</td></tr>
<tr><td>Self</td><td>—</td><td colspan="2">CAN OR CANNOT BE CODIFIED<br>* Own experience<br>* Intuition / common sense / personal knowledge</td></tr>
</table>

### 5.3.2 Frequency of Using Knowledge Sources

The winemakers were presented with a list of factual and potentially factual knowledge sources for winemaking (practical knowledge excluded) and asked to specify the extent to which they engage with those knowledge sources. The list corresponds to that in Table 5.11 and the results are presented in Table 5.12. Given that four different sets of response categories were used (starting with: "Read everything in each addition", "Once a month", "At least once a month" and "3 or more times") the results are best interpreted by comparing the proportions of respondents who do not engage with a particular knowledge source. In doing so, it can be seen that winemakers tend to participate in particularly four knowledge sourcing activities: read *Wynboer* in the WineLand magazine (only 2% never do); seek advice from other winemakers in South Africa (3% never do); obtain feedback on the quality of wine products from wine consumers (7% never do); and search the internet for information on winemaking issues (8% never do). If one approaches the results from the positive side (i.e. by establishing what activities winemakers do most frequently, i.e. at least once a month) the same four knowledge sourcing activities emerge as most prominent: read *Wynboer* in the WineLand magazine (74% of winemakers do so at least once a month[21]); seek advice from fellow winemakers in the country (46%); search the internet for information on winemaking issues (47%); and obtain feedback on the quality of wine products from consumers (43%).

Moreover, there are a number of knowledge-sourcing activities that more than half of winemakers indicated that they never engage in:

- Four such activities refer to consulting certain <u>documents</u>: Winetech scan (64%), reports by international research organisations (63%), international science journals (60%), and the Winetech database of funded research (52%).
- In terms of seeking advice from <u>people</u>, four groups of people were never consulted by more than half of all winemakers. Three of these relate to staff from research and training organisations, namely Cape Institute for Agricultural Training: Elsenburg (81%), ARC Infruitec-Nietvoorbij (73%), and Department of Viticulture and Oenology and/or the Institute for Wine Biotechnology at Stellenbosch University (59%). The other category pertains to winemakers outside South Africa (54%).
- With regard to <u>events</u>, two were never attended by more than half of all winemakers. These are postgraduate student seminars at Stellenbosch University (85%) and relevant conferences in other countries (84%).

[21] A new edition of WineLand is published every month. Thus, respondents who said that they read everything in each edition (19%) as well as those reading only parts of each edition (55%), are taken as reading the publication at least once a month.

Lastly, although 47% of winemakers reported that they search the internet at least once in a month for issues related to winemaking, 78% never participated in winemaker forums on the internet.

**Table 5.12: Extent to which winemakers use various knowledge sources**

| **How closely do you read the following South African publications?** | **Read everything in each edition** | **Read parts of each edition** | **Read only some editions** | **Do not read** | **Number of respondents** |
|---|---|---|---|---|---|
| *Wynboer* in the WineLand magazine | 19% | 55% | 24% | 2% | *210* |
| Outlook Gazette by Anchor Wine Yeast | 13% | 29% | 29% | 29% | *202* |
| South African Journal of Enology and Viticulture | 2% | 32% | 28% | 38% | *203* |
| **How often do you read/consult the following sources?** | **Once a month** | **Once in 3 months** | **Once in 6 months** | **Never / almost never** | **Number of respondents** |
| Textbooks and manuals of winemaking practice | 17% | 29% | 28% | 26% | *209* |
| Contributions in New World Winemaker (www.newworldwinemaker.com) | 17% | 25% | 21% | 37% | *207* |
| Trade journals by the wine industries of other countries | 8% | 17% | 27% | 48% | *203* |
| Winetech Scan | 7% | 15% | 14% | 64% | *203* |
| Findings of Winetech-funded research in the Winetech database | 6% | 16% | 26% | 52% | *203* |
| International science journals | 4% | 14% | 22% | 60% | *209* |
| Reports by international research organisations | 4% | 11% | 22% | 63% | *210* |
| **How often do you seek expert advice from the following people?** | **At least once a month** | **At least once in 3 months** | **At least once in 6 months** | **Never / almost never** | **Number of respondents** |
| Other winemakers in South Africa | 46% | 35% | 16% | 3% | *208* |
| Staff from wine laboratories responsible for wine analyses | 25% | 27% | 29% | 19% | *209* |
| VinPro consultants | 12% | 17% | 24% | 47% | *209* |
| Winemakers in other countries | 8% | 13% | 25% | 54% | *207* |
| Technical consultants from other yeast manufacturing companies | 2% | 14% | 51% | 33% | *209* |
| Staff from the Department of Viticulture and Oenology and/or the Institute for Wine Biotechnology (IWBT) at Stellenbosch University | 1% | 8% | 32% | 59% | *209* |
| Technical consultants from Anchor Wine Yeast | 1% | 7% | 47% | 45% | *210* |
| Staff from ARC Infruitec-Nietvoorbij | 1% | 4% | 22% | 73% | *209* |
| Staff from Cape Institute for Agricultural Training: Elsenburg (CIAT) | 0% | 4% | 15% | 81% | *208* |
| **How often do you do the following?** | **At least once a month** | **At least once in 3 months** | **At least once in 6 months** | **Never / almost never** | **Number of respondents** |
| Search the Internet for information on issues related to winemaking | 47% | 31% | 14% | 8% | *210* |
| Obtain feedback on the quality of wine products from wine consumers | 43% | 31% | 19% | 7% | *208* |
| Participate in winemaker forums on the Internet | 3% | 8% | 11% | 78% | *210* |
| **How often have you in the past attended the following events?** | **3 or more times** | **Twice** | **Once** | **Never attended** | **Number of respondents** |
| Information sessions/seminars/workshops by Winetech/VinPro | 46% | 16% | 18% | 20% | *210* |
| Information sessions/seminars/workshops by Anchor Wine Yeast | 30% | 17% | 16% | 37% | *210* |
| Workshops and short courses by the South African Society for Enology and Viticulture | 29% | 18% | 17% | 36% | *210* |
| The annual conference of the South African Society for Enology and Viticulture | 18% | 14% | 20% | 48% | *208* |
| Relevant conferences in other countries | 2% | 4% | 10% | 84% | *207* |
| Seminars at Stellenbosch University where postgraduate students present their theses and dissertations | 2% | 3% | 10% | 85% | *205* |

### 5.3.3 Relative Importance of Knowledge Sources

The respondents were also asked to rate a slightly different version of the knowledge sources in terms of their importance for their winemaking (Table 5.13). Three of the four knowledge sourcing activities that the respondents previously said they most frequently engage in also emerged among the top 10 knowledge sources rated by them as extremely important. These are South African winemakers in other cellars (57% - ranked 5th), the opinions of wine consumers (53%, ranked 6th) and the internet (45% - ranked 9th). However, the three most important knowledge sources are clear illustrations of practical knowledge (own experience, 76% - ranked 1st; and intuition/common sense, 74% - ranked 3rd) and science-based factual knowledge (results of wine analyses from wine laboratories, 76% - ranked 2nd). Formal training, which, together with experience, was presented as a building block of expertise-based practical knowledge (see Section 3.4.3 in Chapter 3), occupies the 7th position as 50% of winemakers regarded it as extremely important for their practice.

**Table 5.13: Extent to which winemakers rate various knowledge sources as important for their winemaking[22]**

| Knowledge source | Rating | | | | Number of respondents |
|---|---|---|---|---|---|
| | Of extreme importance | Of some importance | Of little importance | Of no importance | |
| Own experience (what has worked / not worked before) | 76% | 23% | 1% | 0% | *211* |
| Results of wine analyses from wine laboratories | 76% | 19% | 3% | 2% | *211* |
| Intuition / common sense / personal knowledge | 74% | 25% | 1% | 0% | *210* |
| Staff or colleagues at your cellar / winery / estate | 58% | 28% | 8% | 7% | *207* |
| South African winemakers in other cellars / wineries/ estates | 57% | 35% | 6% | 1% | *209* |
| Opinions of wine consumers | 53% | 36% | 9% | 2% | *210* |
| Formal training received at college / university | 50% | 34% | 10% | 6% | *210* |
| Textbooks and manuals of winemaking | 45% | 43% | 9% | 3% | *209* |
| The Internet | 45% | 41% | 10% | 4% | *209* |
| Information sessions / seminars / workshops for the South African wine industry | 33% | 43% | 15% | 9% | *208* |
| Winemaking tradition (of farm, estate, cellar, family etc.) | 25% | 41% | 24% | 10% | *209* |

[22] Combined ratings were produced in three instances to create three new variables: Information in leaflets of commercial products; commercial technical consultants; and South African researchers and lecturers. For example, in the case of commercial technical consultants, a combined rating was obtained for each respondent by taking the "highest rating" for the three groups of technical consultants underlying the combined rating:

| | *Anchor Wine Yeast* | *Other yeast manufacturing companies* | *Brenn-O-Kem* | *Combined* |
|---|---|---|---|---|
| Winemaker 1 | Some importance | Little importance | No importance | Some importance |
| Winemaker 2 | Extreme importance | Some importance | No importance | Extreme importance |
| Winemaker 3 | Extreme importance | Extreme importance | Some importance | Extreme importance |
| Winemaker 4 | No importance | No importance | Little importance | Little importance |

Thus, winemaker 2 received a combined rating of "extreme importance" for commercial technical consultants because he/she regarded at least once category of technical consultant (Anchor Wine Yeast consultant) as extremely important.

**Table 5.13 (continued)**

| Knowledge source | Rating | | | | Number of respondents |
|---|---|---|---|---|---|
| | Of extreme importance | Of some importance | Of little importance | Of no importance | |
| VinPro consultants | 20% | 40% | 21% | 19% | *210* |
| Information in leaflets of commercial products | 19% | 44% | 26% | 11% | *211* |
| Information in leaflets that accompany commercial products (starter cultures) for malolactic fermentation | 18% | 42% | 24% | 16% | *207* |
| Information in leaflets that accompany commercial yeast products | 15% | 41% | 30% | 14% | *211* |
| Conferences in South Africa | 17% | 49% | 22% | 12% | *210* |
| Commercial technical consultants | 16% | 50% | 22% | 12% | *211* |
| Technical consultants from Anchor Wine Yeast | 12% | 39% | 24% | 25% | *211* |
| Technical consultants from other yeast manufacturing companies | 13% | 46% | 26% | 15% | *210* |
| Technical consultants from Brenn-O-Kem | 1% | 15% | 37% | 47% | *211* |
| South African researchers and lecturers | 16% | 48% | 22% | 14% | *211* |
| Staff from the Department of Viticulture and Oenology and/or the Institute for Wine Biotechnology (IWBT) at Stellenbosch University | 12% | 37% | 30% | 21% | *211* |
| Staff from ARC Infruitec-Nietvoorbij | 7% | 34% | 32% | 27% | *210* |
| Staff from Cape Institute for Agricultural Training: Elsenburg (CIAT) | 6% | 23% | 37% | 34% | *210* |
| Staff from other South African universities | 3% | 12% | 34% | 51% | *210* |
| *Wynboer* in the WineLand magazine | 15% | 54% | 24% | 7% | *211* |
| Family members who know about winemaking | 15% | 18% | 26% | 41% | *208* |
| International scientific publications and reports | 14% | 34% | 36% | 16% | *211* |
| Winemakers in other countries | 13% | 35% | 27% | 25% | *211* |
| South African Journal of Enology and Viticulture | 9% | 43% | 31% | 17% | *209* |
| Trade journals by the wine industries of other countries | 9% | 41% | 34% | 16% | *211* |
| Outlook Gazette by Anchor Wine Yeast | 8% | 45% | 30% | 17% | *207* |
| Conferences in other countries | 3% | 26% | 39% | 32% | *208* |

The respondents were also asked to indicate which knowledge source they regard as the single most important in their winemaking. A total of 188 out of the 207-211 winemakers, who rated the knowledge sources in terms of importance (Table 5.13), also complied by specifying the single most important source. The results are summarised in Table 5.14 below. Altogether 84% of the responses provided can be accounted for by four knowledge sources: own experience (35%), other winemakers (21%)[23], formal training received (16%) and intuition/common sense (12%). Thus, at first glance it appears that accumulative experiences and interaction with fellow-winemakers, together with having completed formal

[23] The fact that winemakers consider fellow-winemakers as important sources of knowledge implies that most winemakers do not see each other as competitors. Neither are winemakers secretive about their own knowledge or extremely protective of it. In fact, most South African winemakers studied at Stellenbosch University or at the CIAT and for that reason tend to maintain close and relaxed social networks throughout their careers. As one of the survey respondents put it: "We are a bunch of young winemakers in pretty good positions and we are not ashamed to ask each other for any advice."

training, are the three most essential sources of knowledge for winemakers. To this can be added intuition and common sense, which are expressions of practical knowledge.

**Table 5.14: Source of knowledge specified by winemakers as the single most important in their winemaking**

| Knowledge source | Count | As % of 188 who answered question |
|---|---|---|
| Own experience (what has worked / not worked before) | 66 | 35% |
| Other winemakers (in South Africa and abroad) | 40 | 21% |
| Formal training received at college / university | 31 | 16% |
| Intuition / common sense / personal knowledge | 22 | 12% |
| The Internet | 10 | 5% |
| Consultants | 7 | 4% |
| Textbooks and manuals of winemaking | 7 | 4% |
| Opinions of wine consumers | 6 | 3% |
| Information sessions/seminars/workshops for the SA wine industry | 5 | 3% |
| Results of wine analyses from wine laboratories | 5 | 3% |
| Staff or colleagues at your cellar/winery/estate | 4 | 2% |
| South African Journal of Enology and Viticulture | 2 | 1% |
| Winemaking tradition | 2 | 1% |
| International scientific publications and reports | 1 | <1% |
| South African Society for Enology and Viticulture | 1 | <1% |
| Staff from Cape Institute for Agricultural Training: Elsenburg (CIAT) | 1 | <1% |
| Staff from the Department of Viticulture and Oenology and / or the (IWBT) at Stellenbosch University | 1 | <1% |
| *Wynboer* in the WineLand magazine | 1 | <1% |

Note: The counts add to 212 instead of 188 because a few respondents listed two or three sources as equally important

The next set of tables presents breakdowns of the percentages of winemakers who rated each of the ten most prominent knowledge sources in Table 5.13 as “of extreme importance” for their winemaking. The percentages are broken down in terms of three demographic variables: cellar type (Table 5.15), age of winemaker (Table 5.16) and years of experience as winemaker (Table 5.17). Knowledge sources considered by at least 70% of winemakers in any category as extremely important have been highlighted. Closer scrutiny of the figures reveals the following:

- Apart from a few notable exceptions, winemakers from different cellars or of different ages or with different years of experience appear to be relatively homogenous in terms of the three knowledge sources rated as most important to their winemaking. These are own experience, intuition / personal knowledge, and the results of wine analyses by wine laboratories. What is surprising, though, is that older winemakers –

relative to winemakers in the younger age categories – are less inclined to regard experience and intuition / personal knowledge as extremely important to their winemaking.

- One exception is Garagiste producers who seem to be less inclined than winemakers in other producer categories to regard experience and personal knowledge as extremely important (69% versus 70-100% and 73-83% of other winemakers respectively, Table 5.15). Instead, Garagiste producers place greater emphasis on the importance of opinions of wine consumers (81%) and textbooks and manuals of winemaking (73%).

- In terms of age, winemakers younger than 30 are also more likely than those in other age groups to regard fellow-winemakers in South Africa as of extreme importance (70% versus 47-58% in Table 5.16). Given a generally close association between age and experience (see again Figure 5.4), and the need of younger winemakers to consult with others, it is therefore expected that winemakers with less than five years of experience would be more inclined to regard fellow cellar staff as extremely important (71% versus 50-60%, Table 5.17).

- Also in terms of less prominent knowledge sources marked differences can be observed between different categories of the three grouping variables. For instance, in terms of cellar type, markedly more Garagiste producers – than winemakers in the other cellar categories – regarded the internet as an extremely important knowledge source (56% versus 33-49%, Table 5.15). The age profile (Table 5.16) provides another example where marked differences between groups can be observed for less prominent knowledge sources. Larger proportions of winemakers younger than 30 years, relative to the other age groups, regarded textbooks and materials as extremely important for their winemaking (63% versus 40-45%).

**Table 5.15: Percentage of winemakers who rated each knowledge source as *extremely important* for their winemaking, by cellar type**

| Knowledge source | Estate cellar (n=72) | Independent (non-estate) cellar (n=64) | Producer cellar (n=33) | Producing wholesaler (n=6) | Garagiste producer (n=16) |
|---|---|---|---|---|---|
| Own experience (what has worked / not worked before) | **82%** | **75%** | **70%** | **100%** | 69% |
| Results of wine analyses from wine laboratories | **71%** | **81%** | **70%** | **100%** | **81%** |
| Intuition / common sense / personal knowledge | **76%** | **73%** | **76%** | **83%** | 69% |
| Staff or colleagues at your cellar / winery / estate | 58% | 60% | 66% | 67% | 40% |
| South African winemakers in other cellars / wineries/ estates | 55% | 63% | 61% | 67% | 50% |
| Opinions of wine consumers | 51% | 57% | 42% | 50% | **81%** |
| Formal training received at college / university | 47% | 55% | 55% | 67% | 33% |
| Textbooks and manuals of winemaking | 43% | 52% | 27% | 33% | **73%** |
| The Internet | 39% | 48% | 49% | 33% | 56% |
| Information sessions / seminars / workshops for the South African wine industry | 36% | 27% | 44% | 33% | 21% |

**Table 5.16: Percentage of winemakers who rated each knowledge source as *extremely important* for their winemaking, by age of winemaker**

| Knowledge source | <30 years (n=40) | 30-39 years (n=66) | 40-49 years (n=38) | 50+ years (n=37) |
|---|---|---|---|---|
| Own experience (what has worked / not worked before) | **85%** | **80%** | **82%** | 62% |
| Results of wine analyses from wine laboratories | **88%** | 65% | **76%** | **78%** |
| Intuition / common sense / personal knowledge | **83%** | **76%** | **82%** | 62% |
| Staff or colleagues at your cellar / winery / estate | 69% | 50% | **71%** | 44% |
| South African winemakers in other cellars / wineries/ estates | **70%** | 58% | 55% | 47% |
| Opinions of wine consumers | 48% | 58% | 61% | 50% |
| Formal training received at college / university | 63% | 52% | 42% | 47% |
| Textbooks and manuals of winemaking | 63% | 40% | 45% | 42% |
| The Internet | 46% | 42% | 50% | 47% |
| Information sessions / seminars / workshops for the South African wine industry | 36% | 30% | 38% | 27% |

**Table 5.17: Percentage of winemakers who rated each knowledge source as *extremely important* for their winemaking, by years of experience of winemaker**

| Knowledge source | <5 years (n=45) | 6-10 years (n=63) | 11-15 years (n=31) | 16+ years (n=47) |
|---|---|---|---|---|
| Own experience (what has worked / not worked before) | **80%** | **76%** | **81%** | **72%** |
| Results of wine analyses from wine laboratories | **80%** | **73%** | **71%** | **77%** |
| Intuition / common sense / personal knowledge | **76%** | **78%** | 68% | **72%** |
| Staff or colleagues at your cellar / winery / estate | **71%** | 50% | 55% | 60% |
| South African winemakers in other cellars / wineries/ estates | 68% | 54% | 61% | 51% |
| Opinions of wine consumers | 49% | 52% | 61% | 57% |
| Formal training received at college / university | 49% | 53% | 42% | 55% |
| Textbooks and manuals of winemaking | 58% | 48% | 40% | 30% |
| The Internet | 40% | 48% | 45% | 46% |
| Information sessions / seminars / workshops for the South African wine industry | 36% | 21% | 39% | 37% |

A question to be answered next is whether there are any natural groupings of knowledge sources and, if so, what these groupings are and which are most important to winemakers, based on their response patterns. Section 5.3.4 therefore first discusses the statistical extraction of knowledge source components, followed by an assessment of their reliability, before using the components in various sub-group analyses.

### 5.3.4 What do the knowledge sources have in common? Reducing the Knowledge Sources to their Underlying Components

The distinction between factual knowledge and potential factual knowledge versus practical knowledge, or between documents, people, events and the self as broad source categories, are heuristic tools to make sense of the knowledge sources. But what groupings are already embedded within the data? With this question in mind a Principal Component Analysis (PCA) was performed and the 24 knowledge source items (in Table 5.13) used as input variables for the PCA. The purpose of a PCA is to identify the underlying groupings or constructs (components) of items, based on their inter-correlations. Thus, it is a method to reduce any number of items to their underlying components, and the underlying components, in turn, can be treated as new variables. The rationale for this exercise was purely exploratory, namely to determine whether there is any natural combination of knowledge sources that goes beyond the classification presented in Table 5.11.

Six components were extracted in the PCA, by specifying the stopping criterion as 'eigenvalue > 1' and by performing an orthogonal rotation (VARIMAX). Altogether 59% of the variance in the set of items can be accounted for by the six components extracted. The components and their respective loadings per item are presented as solution 1 in Table 5.18. The shaded cells represent component loadings that are greater than 0.50, which can be regarded as both practically and statistically significant loadings (Hair et al., 1998).

Two items have loadings of less than 0.50 on any of the six components and it was therefore decided to exclude these ("Results of wine analyses from wine laboratories", and "South African Journal of Enology and Viticulture"). Another item ("Formal training received at college/university") was also excluded as it was the only item loading on component 6. The PCA was therefore repeated with only 21 items, resulting in five components being extracted, explaining altogether 58% of the variability in the set of items (solution 2 in Table 5.17). However, one item ("South African winemakers in other cellars/wineries/ estates") now failed to reach a 0.50 loading. This item was therefore also removed and the PCA again performed but with 20 items. This generated component solution 3. However, since one of the items ("Conferences in South Africa") in this solution appears to be factorially complex as it loads almost equally high on both components 1 and 2, it was decided to discard this item as well. The final component extraction, based on 19 items, is a much purer solution, explaining altogether 60% of the variability in the set of items.

Table 5.19 shows the label assigned to each component, based on an inspection of the content of the individual items that comprise that component:

- Component 1 can be labelled <u>local expertise</u> because the knowledge sources in the relevant items are all concerned with technical information for the local industry, as they refer to local actors, materials and events.
- Four items constitute the next component and all of these pertain to international knowledge sources. Hence, component 2 has been labelled as <u>international expertise</u>.
- What the three knowledge sources under component 3 have in common is the fact that they are all trusted references sources ("companions") and available in the public domain. One could almost say that winemakers have 24-hour access to these sources. Many winemakers have kept their textbooks to be used as reference materials, and most have access to the internet. A significant proportion of winemakers also read *Wynboer* in the WineLand magazine (in fact, 74% of winemakers inspect each edition – see again Table 5.12) and the publication can be

accessed on the internet. For this reason the component was given the label of public reference sources.

- Component 4 was assigned the label of practical knowledge of others. Winemaking tradition, together with input from wine consumers and family members who know about winemaking, are all based on the personal experiences of others and can provide a winemaker with the necessary information about, for instance, the style of the end-product to achieve.
- Lastly, experience and intuition, common sense and personal knowledge, in component 5, are all expressions of the winemaker's own practical knowledge.

**Table 5.18: Extracted knowledge components and their loadings per item, based on a PCA performed on ratings for 24 knowledge sources**

| Knowledge source item | Component solution 1 (59% variance explained) | | | | | | Component solution 2 (58% variance explained) | | | | | Component solution 3 (59% variance explained) | | | | | Final component solution (60% variance explained) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | C1 | C2 | C3 | C4 | C5 | C6 | C1 | C2 | C3 | C4 | C5 | C1 | C2 | C3 | C4 | C5 | C1 | C2 | C3 | C4 | C5 |
| Commercial technical consultants | **.81** | .03 | .11 | .06 | .04 | .02 | **.81** | .01 | .12 | .07 | .06 | **.81** | .00 | .12 | .07 | .06 | **.81** | .00 | .12 | .06 | .07 |
| Information sessions/seminars/workshops for the South African wine industry | **.75** | .21 | .11 | -.01 | .20 | .13 | **.76** | .20 | .14 | .02 | .22 | **.77** | .21 | .10 | .03 | .20 | **.76** | .19 | .10 | .05 | .18 |
| Information in leaflets of commercial products | **.75** | .06 | .10 | .13 | .01 | -.06 | **.73** | .06 | .09 | .13 | .01 | **.74** | .07 | .07 | .13 | .00 | **.75** | .08 | .07 | .10 | .02 |
| VinPro consultants | **.72** | .02 | .01 | .09 | .00 | .12 | **.73** | -.02 | .01 | .10 | .01 | **.74** | .00 | .00 | .10 | .01 | **.74** | .00 | .00 | .09 | .01 |
| Outlook Gazette by Anchor Yeast | **.63** | .12 | .25 | -.04 | -.14 | .21 | **.65** | .09 | .28 | -.02 | -.11 | **.65** | .08 | .30 | -.02 | -.09 | **.66** | .10 | .30 | -.04 | -.07 |
| South African researchers and lecturers | **.57** | .35 | .17 | .19 | -.02 | .22 | **.59** | .30 | .21 | .22 | .00 | **.58** | .29 | .24 | .22 | .02 | **.58** | .29 | .24 | .21 | .03 |
| Staff or colleagues at your cellar/winery/estate | **.53** | .17 | .08 | .37 | .04 | -.18 | **.51** | .16 | .05 | .34 | -.01 | **.52** | .20 | -.02 | .33 | -.05 | **.52** | .20 | -.02 | .34 | -.05 |
| ∞ Conferences in South Africa | **.51** | .46 | .21 | -.15 | .22 | .12 | **.53** | .44 | .25 | -.12 | .24 | **.54** | .46 | .20 | -.12 | .22 | | | | | |
| # Results of wine analyses from wine laboratories | .43 | .07 | .06 | .28 | .36 | -.14 | | | | | | | | | | | | | | | |
| International scientific publications and reports | .14 | **.78** | .13 | .03 | .00 | .14 | .16 | **.78** | .18 | .03 | -.01 | .17 | **.78** | .19 | .03 | .00 | .17 | **.78** | .19 | .00 | .02 |
| Conferences in other countries | .09 | **.79** | .09 | -.05 | .07 | -.08 | .09 | **.79** | .08 | -.07 | .05 | .10 | **.80** | .08 | -.07 | .05 | .08 | **.78** | .08 | -.04 | .02 |
| Winemakers in other countries | .04 | **.69** | .02 | .38 | .22 | -.11 | .04 | **.70** | .02 | .37 | .20 | .05 | **.72** | -.05 | .37 | .16 | .06 | **.73** | -.05 | .35 | .18 |
| Trade journals by the wine industries of other countries | .11 | **.71** | .15 | .13 | -.20 | .12 | .13 | **.70** | .20 | .12 | -.20 | .13 | **.70** | .21 | .11 | -.19 | .15 | **.73** | .21 | .06 | -.14 |
| # South African Journal of Enology and Viticulture (SAJEV) | .36 | .49 | .32 | .01 | .10 | .25 | | | | | | | | | | | | | | | |
| *Wynboer* in the WineLand magazine | .14 | .09 | **.77** | .09 | -.17 | .16 | .14 | .05 | **.79** | .11 | -.17 | .16 | .06 | **.79** | .12 | -.14 | .16 | .06 | **.79** | .11 | -.14 |
| The Internet | .08 | .13 | **.68** | .06 | .10 | -.06 | .08 | .11 | **.65** | .07 | .12 | .09 | .11 | **.66** | .09 | .16 | .08 | .10 | **.66** | .11 | .14 |
| Textbooks and manuals of winemaking | .19 | .32 | **.52** | -.10 | .01 | .26 | .20 | .30 | **.60** | -.07 | .02 | .20 | .29 | **.62** | -.06 | .05 | .20 | .29 | **.62** | -.09 | .07 |
| ‡ South African winemakers in other cellars/wineries/estates | .27 | .13 | **.52** | .13 | .27 | -.23 | .25 | .12 | .47 | .12 | .25 | | | | | | | | | | |
| Winemaking tradition (of farm, estate, cellar, family etc.) | .06 | .05 | -.05 | **.68** | .06 | .45 | .09 | .04 | .04 | **.72** | .08 | .09 | .04 | .05 | **.72** | .09 | .09 | .04 | .05 | **.72** | .09 |
| Opinions of wine consumers | .11 | -.10 | .30 | **.64** | .15 | .15 | .11 | -.11 | .30 | **.66** | .13 | .11 | -.10 | .28 | **.67** | .14 | .10 | -.11 | .28 | **.70** | .11 |
| Family members who know about winemaking | .16 | .23 | -.03 | **.65** | .02 | -.17 | .15 | .22 | -.07 | **.65** | .05 | .16 | .23 | -.10 | **.65** | .03 | .17 | .25 | -.10 | **.63** | .04 |
| Own experience (what has worked/ not worked before) | .02 | .04 | -.03 | .03 | **.81** | -.02 | .03 | .02 | -.05 | .07 | **.84** | .04 | .03 | -.08 | .07 | **.84** | .05 | .03 | -.07 | .05 | **.86** |
| Intuition / common sense / personal knowledge | .04 | .00 | .08 | .12 | **.73** | .28 | .06 | .00 | .14 | .15 | **.75** | .06 | .00 | .15 | .16 | **.78** | .07 | .00 | .15 | .15 | **.79** |
| # Formal training received at college/university | .18 | .13 | .07 | .06 | .15 | **.71** | | | | | | | | | | | | | | | |

# Item deleted after inspection of component solution 1 ‡ Item deleted after inspection of component solution 2 ∞ Item deleted after inspection of component solution 3

**Table 5.19: Labels assigned to final knowledge components extracted**

| Knowledge source item | Component label | | | | |
|---|---|---|---|---|---|
| | C1: Local expertise | C2: International expertise | C3: Public references sources | C4: Practical knowledge of others | C5: Own practical knowledge |
| Commercial technical consultants | **0.81** | * | * | * | * |
| Information sessions/seminars/workshops for the South African wine industry | **0.76** | * | * | * | * |
| Information in leaflets of commercial products | **0.75** | * | * | * | * |
| VinPro consultants | **0.74** | * | * | * | * |
| Outlook Gazette by Anchor Yeast | **0.66** | * | * | * | * |
| South African researchers and lecturers | **0.58** | * | * | * | * |
| Staff or colleagues at your cellar/winery/estate | **0.52** | * | * | * | * |
| International scientific publications and reports | * | **0.78** | * | * | * |
| Conferences in other countries | * | **0.78** | * | * | * |
| Winemakers in other countries | * | **0.73** | * | * | * |
| Trade journals by the wine industries of other countries | * | **0.73** | * | * | * |
| *Wynboer* in the WineLand magazine | * | * | **0.79** | * | * |
| The Internet | * | * | **0.66** | * | * |
| Textbooks and manuals of winemaking | * | * | **0.62** | * | * |
| Winemaking tradition (of farm, estate, cellar, family etc.) | * | * | * | **0.72** | * |
| Opinions of wine consumers | * | * | * | **0.70** | * |
| Family members who know about winemaking | * | * | * | **0.63** | * |
| Own experience (what has worked/ not worked before) | * | * | * | * | **0.86** |
| Intuition / common sense / personal knowledge | * | * | * | * | **0.79** |

* Insignificant component loading

The next step was to perform a series of reliability analyses to determine the internal consistency (as measured by Cronbach's Alpha) of the extracted components. The Cronbach's Alpha coefficients for the three components are reported in Table 5.20. The coefficients in brackets are alternative coefficients, based on the Spearman-Brown formula (Murphy & Davidshofer, 1994), to determine the size of coefficients if all components (theoretically) would consist of 7 items, which is the figure associated with the component with the largest number of items. The reason for producing theoretically expected coefficients is because internal consistency measurement is sensitive to the number of items used. It is therefore not surprising that only two components meet the recommended level of 0.70.[24] The other three components are composed of a restricted number of items (3 items, 3 items and 2 items, respectively), which contribute to the reduction in internal consistency. If these three components are theoretically extended to include 7 items each, all of them would meet the 0.70 criterion.

[24] A value of 0.70 is normally considered the appropriate cut-off point for an ability test. However, when dealing with other constructs, as is the case in this exercise, values below 0.70 are not uncommon (Field, 2009:675).

**Table 5.20: Cronbach's Alpha coefficients for the five knowledge components**

| Number of items | Local expertise (7 items) | International expertise (4 items) | Public reference sources (3 items) | Practical knowledge of others (3 items) | Own practical knowledge (2 items) |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | 0.627 |
| 3 | | | 0.588 | 0.502 | |
| 4 | | 0.799 | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | 0.843 | (0.874) | (0.769) | (0.701) | (0.855) |

A second measure of internal consistency is the extent to which each individual item correlates with its underlying construct (component). Pearson product-moment correlation coefficients were computed as estimates of such item-total correlations. A coefficient of 0.50 indicates a large effect or strong correlation. As can be seen in Table 5.21, the item-total correlations range between 0.611 and 0.857, and the average-item correlations (for each of the five components) are all markedly above 0.50. In fact, these average-item correlations all exceed 0.70.

**Table 5.21: Item-total correlations between each item and its associated knowledge component**

| Component | Item | Item-total correlation |
|---|---|---|
| Local expertise | Information sessions/ seminars/ workshops for the SA wine industry | 0.785 |
| | Commercial technical consultants | 0.782 |
| | Information in leaflets of commercial products | 0.734 |
| | VinPro consultants | 0.732 |
| | South African researchers and lecturers | 0.701 |
| | Outlook Gazette by Anchor Yeast | 0.686 |
| | Staff or colleagues at your cellar/winery/estate | 0.611 |
| | ***Average item-total correlation*** | ***0.719*** |
| | | |
| International expertise | International scientific publications and reports | 0.821 |
| | Winemakers in other countries | 0.790 |
| | Trade journals by the wine industries of other countries | 0.777 |
| | Conferences in other countries | 0.777 |
| | ***Average item-total correlation*** | ***0.791*** |
| | | |
| Public reference sources | *Wynboer* in the WineLand magazine | 0.771 |
| | The Internet | 0.734 |
| | Textbooks and manuals of winemaking | 0.716 |
| | ***Average item-total correlation*** | ***0.740*** |
| | | |
| Practical knowledge of others | Family members who know about winemaking | 0.767 |
| | Winemaking tradition (of farm, estate, cellar, family etc.) | 0.714 |
| | Opinions of wine consumers | 0.646 |
| | ***Average item-total correlation*** | ***0.709*** |
| | | |
| Own practical knowledge | Intuition / common sense / personal knowledge | 0.857 |
| | Own experience (what has worked/ not worked before) | 0.850 |
| | ***Average item-total correlation*** | ***0.854*** |

Next, total scores were computed for each of the components – in other words, each component was reduced to a single variable in the dataset. The item responses were originally captured to range from 1 to 4 (1 = of extreme importance, 2 = of some importance, 3 = of little importance, and 4 = of no importance). These were reverse-scored in the SPSS dataset, starting with zero as the lowest value (so that 3 = of extreme importance, 2 = of some importance, 1 = of little importance, 0 = of no importance).

Theoretically speaking, the total score for component 1 could therefore range from 0 (i.e. 7 items x 0) to 21 (i.e. 7 items x 3). A high total score for this component reflects an orientation towards stressing the importance of local expertise. Similarly, the total score for component 2 could range from 0 (i.e. 4 items x 0) to 12 (i.e. 4 items x 3), where a high score corresponds to an emphasis on the importance of international expertise. A total score for component 3 was calculated in a similar way, with the highest score of 9 (i.e. 3 items x 3)

emphasizing the importance of public reference sources. Similar interpretations also apply to components 4 and 5, where high scores respectively stress the importance of other people's and one's own practical knowledge.

However, the five components' respective maximum theoretical values differ according to the number of items comprising each component. Component scores were therefore standardized by converting all values to a score out of 10. Thus, after standardization all component scores ranged between 0 and 10, with 0 indicating the lack of any importance attached to the knowledge component concerned and 10 emphasizing the importance of that knowledge component. Table 5.22 gives comparable descriptive statistics for the five components created.

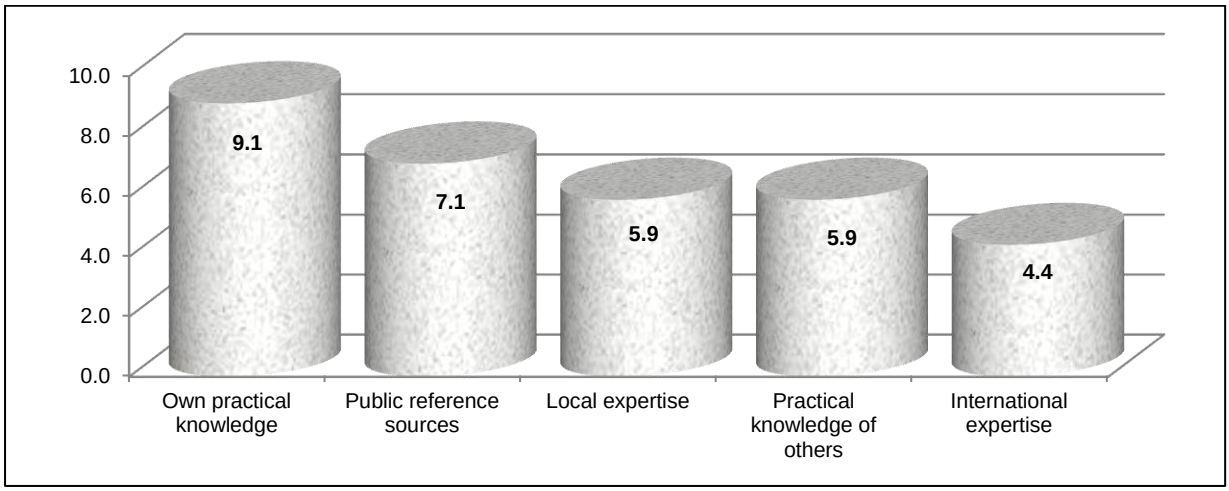
Own practical knowledge, with a mean score of 9.1 (out of 10) is clearly viewed as the most important knowledge source in winemaking. The least important knowledge source, as rated by winemakers, is international expertise, as the mean rating is 4.4 out of 10. International expertise, in this context, refers to such expertise obtained by means other than the internet (as the internet is included under public reference sources). Also, the "lowest" score on own practical knowledge is 5 out of 10, which is an average score and therefore another indication of the importance of one's practical knowledge in winemaking. In the case of the other four components there is always at least one respondent who obtained a score of 0.

**Table 5.22: Descriptive statistics for the five knowledge components**

| Statistic | Own practical knowledge | Public reference sources | Local expertise | Practical knowledge of others | International expertise |
|---|---|---|---|---|---|
| Mean (out of 10) | 9.1 | 7.1 | 5.9 | 5.9 | 4.4 |
| Median | 10.0 | 6.7 | 6.2 | 5.6 | 4.2 |
| Mode | 10.0 | 6.7 | 6.7 | 6.7 | 4.2 |
| Standard deviation | 1.3 | 1.9 | 2.2 | 2.2 | 2.4 |
| Minimum score | 5 | 0 | 0 | 0 | 0 |
| Maximum score | 10 | 10 | 10 | 10 | 10 |
| Number of cases | 210 | 207 | 199 | 205 | 208 |

The order of importance of the five knowledge components, based on their average score out of 10, is shown in Figure 5.11.

**Figure 5.11: Order of importance of the five knowledge components**




### 5.3.5 The Knowledge Source Components and their Relation to Selected Demographical Variables

Each knowledge component created can now be treated as a measure of the importance of a particular form of knowledge (local expertise, international expertise, own practical knowledge, etc.), thereby allowing for an examination of the relationship between each knowledge measure and a selection of demographical variables. The selected demographical variables are as follow:

- Whether or not the winemaker is a member of the South African Society for Enology and Viticulture (SASEV)
- The number of South African wine associations that the winemaker is a member of
- The category of cellar where the winemaker is working
- The percentage of the total volume of cellar wine that is exported to other countries
- Whether or not the winemaker has ever worked at a cellar abroad
- Number of cellars that the winemaker has been working at (including current)
- Number of years that the winemaker has been making wine
- The age of the winemaker
- The highest relevant qualification completed by the winemaker

Subsequently, mean scores of the five knowledge measures were calculated for each of the nine demographical variables, resulting in a total of 45 comparisons (see matrix in Table 5.23 below). Statistically significant differences were determined by means of either an independent t-test (when the demographical variable is dichotomous) or a one-way ANOVA of variance or F test (when the categorical variable is non-dichotomous). Scores on four of

the five knowledge source components differ significantly in relation to a number of demographical variables. The four knowledge source components, together with the applicable demographical variables, are indicated by means of a tick (√) in Table 5.23. The fact that the component of public reference sources does not "discriminate" between anything, illustrates the pervasiveness of particularly two of the three knowledge sources included in this component: the use of the internet and manuals and textbooks. Publicly available reference sources can therefore be argued to be the most "egalitarian" form of knowledge (in terms of accessibility). This contrasts with the two measures of practical knowledge, which are more "privately owned", and the measures of local and international expertise, which tend to be structured in terms of certain "social capital" related variables (memberships, networks, age, etc.)

**Table 5.23: Table indicating demographical variables that are associated with significant differences in mean scores on the knowledge source components**

| Demographical variable | Local expertise | International expertise | Public reference sources | Practical knowledge of others | Own practical knowledge |
|---|---|---|---|---|---|
| Member of SASEV | √ | X | X | X | X |
| Number of South African wine associations that winemaker is a member of | √ | X | X | X | X |
| Type of cellar | √ | X | X | X | X |
| % of wine exported to other countries | X | √ | X | X | X |
| Ever worked in a cellar abroad | X | √ | X | X | X |
| Number of cellars worked at (current included) | X | √ | X | X | √ |
| Number of years making wine | √ | X | X | X | X |
| Age of winemaker | √ | X | X | √ | √ |
| Highest relevant qualification completed | X | X | X | X | X |

Summary statistics calculated for the eleven instances of statistically significance are presented in a series of tables below. In addition to statistical significance it is also imperative to know the nature of the differences that occurred, i.e. which level of a demographical variable differs significantly from which other level(s) of the same variable in terms of mean scores on the knowledge source component. The nature of the differences was established by means of a series of post hoc tests, namely Bonferroni. Effect sizes are also reported, which indicate the strength of the relation between the relevant demographical variable and the knowledge source component.

Table 5.24 first considers the relation between the measure of <u>local expertise</u> and the selected demographical variables.

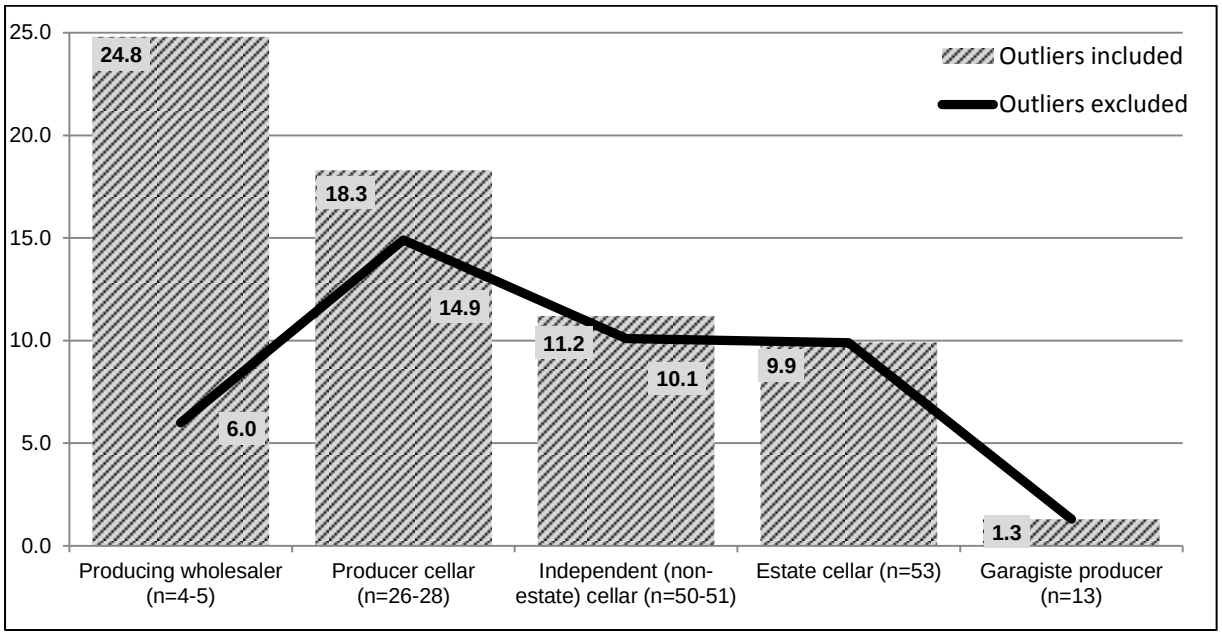
**Table 5.24: Demographical variables associated with statistically significant differences in mean scores (out of 10) on the measure of the importance of local expertise**

| Demographical variables | Mean score | Median score | Standard deviation | Lowest score | Highest score | Significance |
|---|---|---|---|---|---|---|
| **Member of SASEV** | | | | | | |
| Yes (n=62) | 6.5 | 6.7 | 1.7 | 2.9 | 10.0 | t = 3.173<br>p < 0.05 |
| No (n=115) | 5.6 | 5. | 2.2 | 0.0 | 9.5 | |
| ***Total (N=177)*** | ***5.9*** | ***6.2*** | ***2.1*** | ***0.0*** | ***10.0*** | |
| Nature of statistically significant differences:<br>Effect size based on Pearson r: 0.22 | | Yes > No | | | | |
| **Number of South African wine associations that winemaker is a member of** | | | | | | |
| None (n=70) | 5.4 | 5.7 | 2.3 | 0.0 | 10.0 | F = 8.149<br>p < 0.05 |
| One (n=49) | 5.4 | 5.7 | 2.1 | 0.5 | 8.6 | |
| Two (n=26) | 7.2 | 7.1 | 1.4 | 3.3 | 9.5 | |
| Three to seven (n=32) | 6.7 | 6.7 | 1.2 | 4.3 | 9.5 | |
| ***Total (N=177)*** | ***5.9*** | ***6.2*** | ***2.1*** | ***0.0*** | ***10.0*** | |
| Nature of statistically significant differences:<br>Effect size based on Omega squared: 0.11 | | Three to seven > None<br>Three to seven > One<br>Two > None<br>Two > One | | | | |
| **Type of cellar** | | | | | | |
| Estate cellar (n=69) | 6.0 | 6.7 | 2.1 | 0.0 | 10.0 | F = 3.478<br>p < 0.05 |
| Independent cellar (n=62) | 5.8 | 6.0 | 2.0 | 1.0 | 9.5 | |
| Producer cellar (n=31) | 6.7 | 6.7 | 1.6 | 2.9 | 9.5 | |
| Producing wholesaler (n=5) | 6.8 | 6.7 | 0.9 | 5.7 | 7.6 | |
| Garagiste producer (n=13) | 4.2 | 3.8 | 3.1 | 0.5 | 9.5 | |
| ***Total (N=180)*** | ***6.0*** | ***6.2*** | ***2.1*** | ***0.0*** | ***10.0*** | |
| Nature of statistically significant differences:<br>Effect size based on Omega squared: 0.05 | | Producer cellar > Garagiste producer<br>Estate cellar > Garagiste producer | | | | |
| **Number of years making wine** | | | | | | |
| ≤5 years (n=42) | 6.1 | 6.2 | 2.1 | 0.0 | 0.0 | F = 2.937<br>p < 0.05 |
| 6-10 years (n=60) | 5.4 | 5.7 | 2.2 | 0.5 | 9.0 | |
| 11-15 years (n=28) | 5.8 | 6.0 | 2.1 | 1.9 | 9.5 | |
| 16+ years (n=46) | 6.5 | 6.7 | 1.8 | 1.9 | 10.0 | |
| ***Total (N=176)*** | ***5.9*** | ***6.2*** | ***2.1*** | ***5.6*** | ***6.2*** | |
| Nature of statistically significant differences:<br>Effect size based on Omega squared: 0.03 | | 16+ years > 6-10 years | | | | |
| **Age of winemaker** | | | | | | |
| <30 years (n=36) | 6.5 | 6.7 | 1.5 | 2.9 | 9.0 | F = 4.823<br>p < 0.05 |
| 30-39 years (n=62) | 5.4 | 5.7 | 2.2 | 0.5 | 9.5 | |
| 40-49 years (n=37) | 6.7 | 7.1 | 1.8 | 1.4 | 10.0 | |
| 50+ years (n=36) | 5.3 | 5.7 | 2.2 | 0.0 | 9.5 | |
| ***Total (N=171)*** | ***5.9*** | ***6.2*** | ***2.1*** | ***0.0*** | ***10.0*** | |
| Nature of statistically significant differences:<br>Effect size based on Omega squared: 0.06 | | 40-49 years > 30-39 years<br>Younger than 30 years > 30-39 years | | | | |

Closer scrutiny of the comparison of mean scores in Table 5.24, for local expertise, shows that there are both expected and unexpected results

- The expected results are the link between, on the one hand, local expertise and, on the other hand, being a member of SASEV and belonging to professional wine societies. The very fact of joining a local scientific society or a wine society is already "proof" of the value that a winemaker assigns to local technical and scientific expertise in his/her profession.
- The unexpected results appear in the pattern of responses related to age and years of experience. The relationship of these two variables with local expertise is not an exact linear relationship, as the averages on the measure of local expertise do not consistently increase or decrease as the age categories become mature or as the numbers of years of winemaking experience accumulate. Possible explanations for these unexpected findings will be explored below, by means of finer analyses.
- The finding that winemakers at producer cellars and producing wholesalers attach the greatest importance to local expertise can be explained in a number of ways. It could for instance relate to the fact that winemakers at producer cellars, on average, received the highest number of national awards for their wines in the past three years (14.9 awards if outliers are excluded – Figure 5.12). The underlying assumption thus is that local knowledge sources are valued by the producer cellars as it can contribute to their eventual success at national wine tastings and assessments. Also, producer cellars often sell their wine in bulk to producing wholesalers, which is therefore no surprise – in the light of the close association between these two wine producers – that both groupings value the same set of knowledge sources to almost similar degrees.

**Figure 5.12: Average number of national awards received in past three years, by cellar type**




That being said, both the expected results with regard to membership of SASEV and wine societies, and the unexpected findings pertaining to age and winemaking experience, still require some explanation. Tackling first the membership issue, it was thought useful to examine the overlap between the two membership categories, specifically in relation to scores on the measure of local expertise. Table 5.25 shows the results of this examination ("membership overlap" variable) and also includes the mean ages and years of experience of winemakers in each of the overlapping membership categories.

**Table 5.25: Overlap between membership of SASEV and wine societies, and the association thereof with the measure of the importance of local expertise, age and winemaking experience**

| Membership overlap | Number of respondents | Percentage of respondents | Mean scores | | |
|---|---|---|---|---|---|
| | | | Local expertise (score out of 10) | Age in years | Winemaking experience in years |
| Not SASEV and no wine society | 57 | 30% | 5.2 | 39 | 9 |
| Not SASEV but one wine society | 37 | 20% | 5.3 | 39 | 10 |
| Not SASEV but two or more wine societies | 29 | 15% | 6.8 | 37 | 12 |
| SASEV but no wine society | 16 | 9% | 6.4 | 43 | 19 |
| SASEV and one wine society | 15 | 8% | 5.4 | 38 | 14 |
| SASEV and two or more wine societies | 34 | 18% | 7.0 | 40 | 16 |

As can be seen, almost a third of respondents (30%) do not belong to either SASEV or any wine society. This subgroup also scored the lowest on the measure of the importance of local expertise (mean of 5.2 out of 10). The highest score was obtained by respondents who are members of both SASEV and at least two wine societies (7 out of 10). There is also a subgroup of winemakers (9%) who reported only membership of SASEV but nevertheless scored relatively high on the measure (6.4 out of 10). This appears to be a more mature group as they, on average, recorded the highest mean age (43) and mean years of winemaking experience (19). Moreover, as another set of analysis suggests (Table 5.26, third column), this particularly subgroup of winemakers also recorded the largest number of winemakers with university degrees, namely 71%. Of these 57% are university graduates and 14% postgraduates.

Overall, however, it appears from Table 5.25 that the mean scores on the measure of the importance of local expertise are highest in instances where winemakers belong to at least two wine societies, irrespective of whether or not they are also SASEV members (7.0 and 6.8 out of 10).

**Table 5.26: Highest relevant qualification completed by winemakers, by membership of SASEV and wine societies**

| Qualification | Not SASEV and no wine society (n=54) | Not SASEV but at least 1 wine society (n=65) | SASEV but no wine society (n=14) | SASEV and at least 1 wine society (n=49) |
|---|---|---|---|---|
| Bachelors degree in wine / agricultural sciences from SU (4 years) | 26% | 25% | 57% | 41% |
| Bachelors degree in agriculture / cellar technology from CIAT at Elsenburg (3 years) | 7% | 5% | 0% | 6% |
| Postgraduate degree in wine / agricultural sciences from SU (honours / masters) | 2% | 5% | 14% | 6% |
| Postgraduate degree from other SA / foreign institution | 2% | 2% | 0% | 0% |
| Higher certificate in agriculture from CIAT at Elsenburg (2 years) | 0% | 3% | 0% | 4% |
| Diploma in agriculture / cellar technology from CIAT at Elsenburg (1 year) | 24% | 39% | 21% | 25% |
| Diploma from Cape Wine Academy | 6% | 2% | 0% | 0% |
| Agricultural diploma from another SA institution | 2% | 0% | 0% | 4% |
| Diploma / bachelors degree from an international institution | 7% | 0% | 7% | 2% |
| Short courses | 13% | 5% | 0% | 0% |
| Incomplete (but relevant) studies | 2% | 2% | 0% | 4% |
| No relevant qualification | 9% | 15% | 0% | 8% |
| **Total** | **100%** | **100%** | **100%** | **100%** |

Table 5.27 examines the interaction between winemaker age and years of winemaking experience, and specifically how the interaction affects the scores on the measure of the

importance of local expertise. The mean scores are reported in the cells of the table. If one ignores the mean score of 8.1 because it refers to only two respondents and focuses only on the cells with the next highest scores, two groups of winemakers with an appreciation for local knowledge sources can be observed. The first is a group of relatively young winemakers (<30 years) with obviously little experience (<5 years). Their mean score is 6.9 out of 10. On the opposite end of the spectrum is a group of older winemakers (40-49 years) with plenty of experience who equally value local expertise (mean of 7.0 out of 10). The younger group tends to be well-qualified as 67% of them have completed degree qualifications of which 46% were completed at Stellenbosch University (Table 5.28). Thus, one could argue that although both groups value local knowledge sources they do so for different reasons. The younger group values local expertise because it makes up for their lack of experience, and any appreciation of knowledge is a natural consequence of their recently completed studies. On the other hand, one could argue that some older winemakers rely on local expertise to supplement and augment their already vast pool of winemaking experience.

**Table 5.27: Mean score (out of 10) on the measure of the importance of local expertise, by interaction between winemaker age and winemaking experience**

| Years of winemaking experience | Age | | | |
|---|---|---|---|---|
| | <30 years | 30-39 years | 40-49 years | 50+ years |
| ≤5 years | 6.9 (n=25) | 5.5 (n=5) | 8.1 (n=2) | 3.7 (n=7) |
| 6-10 years | 5.9 (n=11) | 5.3 (n=33) | 5.2 (n=7) | 4.7 (n=8) |
| 11-15 years | -- (n=0) | 5.6 (n=22) | 6.5 (n=5) | -- (n=0) |
| 16+ years | -- (n=0) | 2.6 (n=2) | 7.0 (n=22) | 6.5 (n=21) |

**Table 5.28: Three most prominent qualifications of each age group**

| Qualification | Age | | | |
|---|---|---|---|---|
| | <30 years | 30-39 years | 40-49 years | 50+ years |
| Bachelors degree in wine / agricultural sciences from SU (4 years) | 46% [1] | 36% [1] | 14% [2] | 25% [1] |
| Bachelors degree in agriculture / cellar technology from CIAT at Elsenburg (3 years) | 21% [2] | | | |
| Diploma in agriculture / cellar technology from CIAT at Elsenburg (1 year) | 18% [3] | 33% [2] | 50% [1] | 19% [3] |
| No relevant qualification | | 8% [3] | 11% [3] | 22% [2] |

Table 5.29 presents statistics for the demographical variables that are significantly associated with the next knowledge source component, namely the measure of the importance of international expertise (see again Table 5.23). There are three such

demographical variables: the percentage of cellar wine exported; whether or not the winemaker has ever worked in a cellar abroad; and the number of cellars that the winemaker has worked at before, including the current cellar.

**Table 5.29: Demographical variables associated with statistically significant differences in mean scores (out of 10) on the measure of the importance of international expertise**

| | Mean score | Median score | Standard deviation | Lowest score | Highest score | Significance |
|---|---|---|---|---|---|---|
| **% of wine exported to other countries** | | | | | | |
| 0% (n=26) | 2.7 | 2.9 | 2.1 | 0.0 | 5.8 | F = 5.410<br>p < 0.05 |
| 1-10% (n=27) | 4.5 | 5.0 | 2.1 | 0.0 | 8.3 | |
| 11-50% (n=72) | 4.5 | 4.2 | 2.4 | 0.0 | 10.0 | |
| 51-74% (n=31) | 4.2 | 4.2 | 2.1 | 0.0 | 8.3 | |
| 75%+ (n=27) | 5.5 | 5.8 | 2.2 | 0.8 | 10.0 | |
| ***Total (N=183)*** | ***4.3*** | ***4.2*** | ***2.3*** | ***0.0*** | ***10.0*** | |
| Nature of statistically significant differences: | | 75%+ > 0%<br>11-50% > 0%<br>1-10% > 0% | | | | |
| Effect size based on Omega squared: 0.09 | | | | | | |
| **Ever worked in a cellar abroad** | | | | | | |
| Yes (n=91) | 4.9 | 5.0 | 2.2 | 0.0 | 10.0 | t = 3.375<br>p < 0.05 |
| No (n=91) | 3.8 | 4.2 | 2.4 | 0.0 | 10.0 | |
| ***Total (N=182)*** | ***4.4*** | ***4.2*** | ***2.4*** | ***0.0*** | ***10.0*** | |
| Nature of statistically significant differences: | | Yes > No | | | | |
| Effect size based on Pearson r: 0.24 | | | | | | |
| **Number of cellars worked at (current included)** | | | | | | |
| One (n=36) | 3.3 | 2.9 | 2.8 | 0.0 | 10.0 | F = 6.149<br>p < 0.05 |
| Two (n=36) | 3.6 | 3.3 | 2.3 | 0.0 | 7.5 | |
| Three (n=28) | 4.3 | 4.2 | 1.8 | 0.0 | 7.5 | |
| Four (n=25) | 5.1 | 5.0 | 1.9 | 0.0 | 7.5 | |
| Five or more (n=60) | 5.3 | 5.0 | 2.2 | 0.0 | 10.0 | |
| ***Total (N=185)*** | ***4.4*** | ***4.2*** | ***2.4*** | ***0.0*** | ***10.0*** | |
| Nature of statistically significant differences: | | Five or more > One | | | | |
| Effect size based on Omega squared: 0.10 | | | | | | |

- The three significant results are more or less as expected. A larger proportion of wine earmarked for the international market means that a winemaker is also catering more for a global consumer base, which requires up-to-date knowledge with regard to international developments in the science and practice of winemaking. Thus, it is no surprise that the percentage of wine exported relates to the valuing of international knowledge sources.
- Also, winemakers who previously worked at an international cellar are more likely to have established international networks (e.g. winemaker friends in other countries) and also greater exposure to the international trade and scientific literature.

- Moreover, from previous results (see again Figure 5.6), we know that a strong and positive correlation exists between a winemaker's employment at an overseas cellar and the total number of cellars that he/she has worked at until date. It therefore makes sense that the higher the number of cellars that a winemaker worked at, the greater the importance attached to sources of international expertise.

It is also worthwhile to note that, based on the results of a separate analysis, the measure of the importance of international expertise was found to be significantly related ($r = 0.2$, $p<0.05$) to the number of international awards. Since it is a positive correlation it means that the higher the rating of importance of international knowledge the higher the number of international awards. However, the relation is relative weak (size of the correlation equals 0.2). The reason for singling out the number of international awards is because it can be regarded as a proxy for international considerations of quality. Thus, it provides some evidence that winemakers who strongly value global technical knowledge also produce internationally acclaimed wine products. The relationship is however not meant to be interpreted as causal.

As displayed in Table 5.23, only one demographical variable, namely the winemaker's age, is significantly associated with scores obtained on the measure of the importance of the practical knowledge of others. Table 5.30 highlights the pattern of results.

**Table 5.30: Demographical variable associated with statistically significant differences in mean scores (out of 10) on the measure of the importance of practical knowledge of others**

| | Mean score | Median score | Standard deviation | Lowest score | Highest score | Significance |
|---|---|---|---|---|---|---|
| **Age of winemaker** | | | | | | |
| <30 years (n=40) | 6.2 | 5.6 | 2.5 | 1.1 | 10.0 | F = 3.010<br>p < 0.05 |
| 30-39 years (n=65) | 5.8 | 5.6 | 2.0 | 0.0 | 10.0 | |
| 40-49 years (n=37) | 6.5 | 6.7 | 2.3 | 1.1 | 10.0 | |
| 50+ years (n=33) | 5.0 | 4.4 | 2.3 | 0.0 | 10.0 | |
| ***Total (N=175)*** | ***5.9*** | ***5.6*** | ***2.3*** | ***0.0*** | ***10.0*** | |
| Nature of statistically significant differences: 40-49 years > 50+ years<br>Effect size based on Omega squared: 0.03 | | | | | | |

The results do not reveal a consistent nor linear relationship between age of respondent and rating on the importance of practical knowledge. A three-way table that shows the mean score on the relevant measure for each possible interaction between winemaker age and years of winemaker experience sheds some light on these results (Table 5.31). It appears that it is not so much the age of the winemaker *per se* that is associated with the measure of

the importance of practical knowledge of others but the age of the winemaker when first making wine. As can be seen in Table 5.32, the highest scores on the measure are typically associated with winemakers who were in their early twenties when first making wine.

**Table 5.31: Mean score (out of 10) on the measure of the importance of practical knowledge of others, by interaction between winemaker age and winemaking experience**

| Years of winemaking experience | Current age of winemaker | | | |
|---|---|---|---|---|
| | **<30 years** | **30-39 years** | **40-49 years** | **50+ years** |
| ≤5 years | **6.2 (n=28)** | 5.8 (n=5) | 6.7 (n=2) | 3.7 (n=6) |
| 6-10 years | **6.3 (n=12)** | 5.6 (n=33) | 5.6 (n=6) | 5.7 (n=6) |
| 11-15 years | -- (n=0) | **6.0 (n=25)** | 4.7 (n=5) | -- (n=0) |
| 16+ years | -- (n=0) | 5.6 (n=2) | **7.2 (n=23)** | 5.2 (n=21) |

Highest mean scores appear in bold. The mean score of 6.7 is not highlighted because it is based on the responses of only two winemakers.

The age when winemakers first started to make wine was calculated by subtracting the number of years of winemaking experience from the current age of winemakers. In this way the age when each winemaker first started to make wine was calculated and grouped into three categories: younger than 25 years; 25-34 years; and 35 years and older. These categories were further disaggregated in terms of the years of winemaking experience. Mean scores on the measure of the importance of the practical knowledge of others were calculated for each interacting category – see Table 5.32 below.

**Table 5.32: Mean score (out of 10) on the measure of the importance of practical knowledge of others, by interaction between age when first making wine and years of winemaking experience**

| Age when first started to make wine | Years of winemaking experience | Number of respondents | Mean score (out of 10) |
|---|---|---|---|
| Younger than 25 years | 5 years or less | 26 | 6.3 |
| | 6-10 years | 30 | 6.0 |
| | 11-15 years | 20 | 5.8 |
| | 16+ years | 30 | 6.5 |
| 25-34 years | 5 years or less | 7 | 5.6 |
| | 6-10 years | 18 | 5.3 |
| | 11-15 years | 10 | 5.8 |
| | 16+ years | 15 | 5.9 |
| 35 years and older | 5 years or less | 8 | 4.4 |
| | 6-10 years | 9 | 5.9 |
| | 11-15 years | 0 | -- |
| | 16+ years | 1 | 3.4 |

According to Table 5.32 attachment of importance to the practical knowledge of others starts at a relatively young age. It is highest among those respondents who enter winemaking before the age of 25 years. What is interesting is that the number of years of winemaking experience, although relevant, does not count as heavily as the age of first winemaking does. Obviously those who started out relatively young had no experience at that time. They were therefore more reliant on family members and/or the tradition of the farm/cellar as well as on feedback by wine consumers. Moreover, it seems that this trust in the practical knowledge of others is sustained throughout the career of the winemaker. The reason for concluding so is because those who claimed more than 16 years of winemaking experience and who started before the age of 25, continue to place a relatively high premium on the practical knowledge of others (mean of 6.5 out of 10).

With regard to own practical knowledge, summary statistics for the two demographical variables that correlate significantly with the measure of the importance of such knowledge are presented in Table 5.33.

**Table 5.33: Demographical variables associated with statistically significant differences in mean scores (out of 10) on the measure of the importance of own practical knowledge**

| | Mean score | Median score | Standard deviation | Lowest score | Highest score | Significance |
|---|---|---|---|---|---|---|
| **Age of winemaker** | | | | | | |
| Younger than 30 (n=40) | 9.5 | 10.0 | 1.2 | 6.7 | 10.0 | F = 2.738 p < 0.05 |
| 30-39 years (n=66) | 9.2 | 10.0 | 1.3 | 5.0 | 10.0 | |
| 40-49 years (n=38) | 9.4 | 10.0 | 1.2 | 6.7 | 10.0 | |
| 50+ years (n=37) | 8.7 | 8.3 | 1.4 | 5.0 | 10.0 | |
| ***Total (N=181)*** | ***9.2*** | ***10.0*** | ***1.3*** | ***5.0*** | ***10.0*** | |
| Nature of statistically significant differences: Effect size based on Omega squared: 0.03 | Younger than 30 > 50+ years | | | | | |
| **Number of cellars worked at (current included)** | | | | | | |
| One (n=38) | 8.9 | 10.0 | 1.5 | 5.0 | 10.0 | F = 2.791 p < 0.05 |
| Two (n=36) | 9.3 | 10.0 | 1.2 | 6.7 | 10.0 | |
| Three (n=28) | 8.6 | 8.3 | 1.4 | 6.7 | 10.0 | |
| Four (n=26) | 9.2 | 10.0 | 1.5 | 5.0 | 10.0 | |
| Five or more (n=60) | 9.5 | 10.0 | 1.1 | 6.7 | 10.0 | |
| ***Total (N=188)*** | ***9.2*** | ***10.0*** | ***1.3*** | ***5.0*** | ***10.0*** | |
| Nature of statistically significant differences: Effect size based on Omega squared: 0.04 | Five or more > Three | | | | | |

The order of the mean scores on the measure of importance of own practical knowledge, per age category, corresponds to findings previously presented in Table 5.16. It needs to be asked why older winemakers appear to be less inclined to emphasise own practical knowledge as extremely important for their winemaking. At least three explanations are plausible. Firstly, personal knowledge is so much part and parcel of what older winemakers do in their daily routines that they, upon reflection, struggle to see it as a source of knowledge. Secondly, a few Garagiste winemakers are included among the group of mature winemakers and many Garagiste producers do not have any experience or background in winemaking. Thirdly, self-selection could also play a role. Given that the questionnaire was administered as a web-based survey, one segment of older winemakers who are generally more traditionalist in their approach and more experience-orientated and less technologically inclined, excluded themselves from the sample by ignoring the email request or delegating the task of completion to a younger co-winemaker at the cellar.

In terms of the second demographical variable, namely the number of cellars that the winemaker worked at, the significant result exclusively occurred because of those who reported three cellars. These winemakers attached the “least” value to own practical knowledge. However, the mean score achieved by this subgroup (8.6 out of 10 – Table 5.33) is still exceptionally high. Table 5.34, which inspects the relationship between the number of

cellars worked at and the two individual items comprising the composite measure of practical knowledge, reveals the same peculiarity with regard to three cellars. Since there is no special case to be made for having worked at three cellars, as opposed to having worked at, for instance, two or four cellars, the finding has to be interpreted as a random occurrence. The point to be made is that reliance on own practical knowledge, as indicated in the total score on the composite measure, is relatively high across all subgroups. Any significant differences that do occur are only at the upper end of the range.

**Table 5.34: Number of cellars that the winemaker worked at, disaggregated in terms of the two variables that comprise the measure of the importance of own practical knowledge**

| Rating | Number of cellars worked at (current included) | | | | |
|---|---|---|---|---|---|
| | One (n=38) | Two (n=36) | Three (n=28) | Four (n=26) | Five or more (n=60) |
| **Own experience (what has worked/ not worked before)** | | | | | |
| Of no importance | 0% | 0% | 0% | 0% | 0% |
| Of little importance | 3% | 0% | 0% | 0% | 2% |
| Of some importance | 21% | 22% | 43% | 19% | 13% |
| Of extreme importance | 76% | 78% | 57% | 81% | 85% |
| **Total** | **100%** | **100%** | **100%** | **100%** | **100%** |
| **Intuition / common sense / personal knowledge** | | | | | |
| Of no importance | 0% | 0% | 0% | 0% | 0% |
| Of little importance | 0% | 0% | 0% | 8% | 0% |
| Of some importance | 42% | 22% | 39% | 11% | 13% |
| Of extreme importance | 58% | 78% | 61% | 81% | 87% |
| **Total** | **100%** | **100%** | **100%** | **100%** | **100%** |

Summary

This concludes the presentation of results with regard to the knowledge sources of winemakers. Before moving on to a more general discussion, I will first summarise the salient findings regarding the knowledge sources of winemakers:

- *Wynboer* in the WineLand magazine is a knowledge source that represents documents as a source of knowledge, and is also the most frequently read document by winemakers. Altogether 74% read at least part of each monthly edition. However, although being frequently read, only 15% rated *Wynboer* as extremely important for their winemaking.
- The output of wine analyses by wine laboratories is the document regarded by most winemakers as extremely important for their winemaking (76% rated it as of extreme importance). Thus, “documents” that are orientated towards a particular task at hand,

rather than the general diffusion of knowledge, are regarded by winemakers as most important for their winemaking.

- In terms of people as a source of knowledge, there is no difference between the category of people that winemakers said they most frequently seek advice from and the category of people they regard as extremely important for their winemaking. In both cases these tend to be other winemakers in South Africa (46% of winemakers consulted them at least once a month and 57% rated them as of extreme importance for winemaking).
- The self as a source of knowledge is the most important in winemaking, as respectively 76% and 74% treated own experience and intuition/ common sense/ personal knowledge as most important for their winemaking. These two sources refer to own practical knowledge and is also the most pervasive knowledge component of winemakers.
- Resources that are codified and publicly available as reference sources, especially *Wynboer* in the WineLand magazine, the internet, and winemaking textbooks and manuals, tend to group together in terms of their ratings of importance. It constitutes a knowledge source component that is seen as the second most important by winemakers, after own practical knowledge.
- Publicly available reference sources are arguably the most “egalitarian” (in terms of accessibility) form of knowledge. This contrasts, on the one hand, with the two broad knowledge components of practical knowledge (own practical knowledge and that of others), which are more “privately owned” and embedded within individuals, and, on the other hand, with the components of local and international expertise, which tend to be structured in terms of certain “social capital” related variables (memberships, networks, age, etc.)

## 5.4 DISCUSSION AND CONCLUSION

Two broad categories of knowledge were selected for this study and provided a framework to classify the different knowledge sources of winemakers. The distinction by Ryle (1949, 1971) between factual knowledge (*know-that*) and practical knowledge (*know-how*) was applied with two objectives in mind. Firstly, to determine which knowledge-sourcing activities winemakers *most frequently engage in* (i.e. the frequency of activity) and which of these involve factual knowledge. Secondly, to determine which of the knowledge sources, either factual or practical, they regard as the *most important for their winemaking*.

In the literature study – presented in Chapter 3 – factual knowledge was interpreted as propositional knowledge, meaning that it is explicit and expressible as a proposition or statement (Pears, 1971), and derived from research and scholarship (Rycroft-Malone et al., 2004b). Factual knowledge is thus backed by research evidence or rather some degree of research evidence. The latter qualification is needed because new research will always generate more factual knowledge which, in turn, supports, contests, or sometimes even completely supersedes already existing factual knowledge (Haack, 1993).

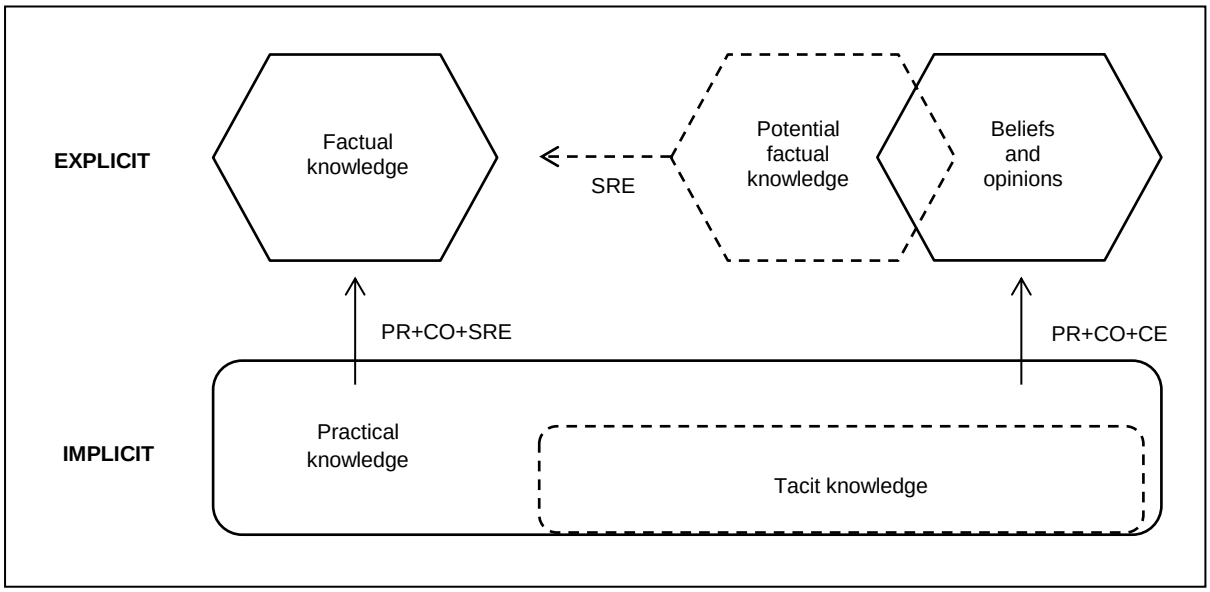
Scientific research generates factual claims but the attention of research obviously cannot be devoted to each and every conceivable concern. One could therefore argue that certain beliefs and opinions may very well have a potential scientific base but the research to demonstrate their "factuality" has not yet been conducted or, where the research does exist, has not explicitly and deliberately been linked to that belief. Thus, some beliefs and opinions fall in a "grey zone" as the verdict concerning their "factuality" can only be determined through research and scholarship once conducted or systematically sourced. In the absence of supporting scientific research evidence, a belief maintains its pervasiveness and "pseudo-factuality" through colloquial evidence. Colloquial evidence is "anything that establishes a fact or gives reason for believing in something" (CHSRF, 2005:3). These include, among others, evidence about resources, expert and professional opinion, judgement, values, habits and traditions, as well as the particular pragmatics and contingencies of the situation.

For that reason I have also introduced the category of potential factual knowledge, in addition to factual knowledge, to indicate beliefs/opinions where the claims have not yet been verified through scientific research. Although earlier in this chapter, in Table 5.11, the two categories were classified alongside practical knowledge, it does not imply a knowledge continuum ranging from factual knowledge through potential factual knowledge to practical knowledge. In fact, the range is from factual knowledge to mere belief/opinion, with potential factual knowledge occupying the middle ground as illustrated in Figure 5.13.

Whereas both factual knowledge and beliefs are explicit – as these can be articulated as propositions and eventually also codified (i.e. written up) – practical knowledge is implicit as it is evident in the act of doing. In some instances the implicitness of practical knowledge can also be made explicit, i.e. the underlying rules can be extracted through reflection, communication, etcetera, and presented as propositions. These propositions can then be classified as either factual knowledge or mere beliefs/opinions, depending on the degree of availability of scientific research findings to support the belief. In some instances the practical knowledge cannot be made explicit as it is inherently tacit. Such tacit knowledge, a

special sub-category of implicit practical knowledge, can be defined as knowledge that is acquired implicitly from everyday practice and which is very difficult, if not impossible, for the bearer thereof to articulate (Sternberg et al., 2000, in Taylor, 2005).

**Figure 5.13: Relationship between factual knowledge, potential factual knowledge and practical knowledge**




Notes: PR = Articulate as proposition; CO = Codify; SRE = Establish scientific research evidence; CE = Colloquial evidence

The results of this chapter unequivocally showed that practical knowledge is considered by winemakers as their most important knowledge source. Practical knowledge represents an *internal* knowledge source and the nature of such practical knowledge (e.g. intuitive knowing and knowing on the basis of sense-impressions) will be further explored in the next chapter that integrates insights from the winemaker interviews.

In terms of *external* knowledge sources (i.e. knowledge obtained from documents, people or events) the *most prominent knowledge-sourcing activities* are summarised in Table 5.35. This table uses the same three-variable structure (type of knowledge, broad source category, and level of codification) that was first introduced in Table 5.11. It also compares the knowledge-sourcing activities (which really are knowledge sources that winemakers most frequently engage in) to sources regarded by winemakers as *most important for winemaking*.

The most prominent knowledge-sourcing activities, presented in the upper half of Table 5.35, can be grouped in two broad categories. On the one hand, there are **initiatives by**

**intermediaries**, namely Winetech and Anchor Wine Yeast and, on the other hand, winemakers' **own efforts** to acquire relevant knowledge.

**Table 5.35: Most prominent knowledge-sourcing activities of winemakers and most important knowledge sources of winemakers, both classified in terms of type of knowledge, broad source category and level of codification**

| Broad source category | Type of knowledge | | |
|---|---|---|---|
| | **Factual knowledge** (Facts that are supported by research evidence) | **Potential factual knowledge** (Beliefs/information for which there may or may not be any research evidence) | **Practical knowledge** (Exhibited in practice) |
| **Most prominent knowledge-sourcing activities of winemakers** | | | |
| **Documents** | ALREADY CODIFIED<br>* *Wynboer* in the WineLand magazine (74%)[a]<br>* Textbooks and manuals (46%)[b]<br>* Outlook Gazette by Anchor Wine Yeast (42%)[a]<br>* Contributions in *New World Winemaker* (42%)[b] | — | — |
| | ALREADY CODIFIED<br>* The internet (78%)[b] | | — |
| **People** | ALREADY CODIFIED OR CAN BE CODIFIED<br>Opinions/advice obtained from:<br>* Staff from Wine laboratories (52%)[c] | CAN BE CODIFIED<br>Opinions/advice obtained from:<br>* Other winemakers in South Africa (81%)[c]<br>* Wine consumers (74%)[c] | — |
| **Events (documents x people)** | ALREADY CODIFIED OR CAN BE CODIFIED<br>* Information sessions/ seminars/workshops by Winetech/VinPro (46%)[d] | — | — |
| **Most important knowledge sources of winemakers** | | | |
| **Documents** | ALREADY CODIFIED<br>* Textbooks and manuals (45%)[e]<br>* Results of wine analyses from wine laboratories (74%)[e] | — | — |
| | ALREADY CODIFIED<br>* The internet (45%)[e] | | |
| **People** | — | CAN BE CODIFIED<br>Opinions/advice obtained from:<br>* Staff or colleagues at your cellar / winery / estate (58%)[e]<br>* South African winemakers in other cellars / wineries/ estates (57%)[e]<br>* Wine consumers (53%)[e] | |
| **Events (documents x people)** | ALREADY CODIFIED OR CAN BE CODIFIED<br>* Formal training received at college / university (50%)[e] | — | — |
| **Self** | — | CAN OR CANNOT BE CODIFIED<br>* Own experience (what has worked / not worked before) (76%)[e]<br>* Intuition / common sense / personal knowledge (74%)[e] | |

[a] % of winemakers who read every edition
[b] % of winemakers who read/consult the source at least once in 3 months
[c] % of winemakers who seek advice from source at least once in 3 months
[d] % of winemakers who attended event at least 3 times in the past
[e] % of winemakers who rated source as extremely important for winemaking

- The first intermediary, Winetech, can be considered an example of a strong intermediary in the light of a number of criteria listed by Galant (2005), such as the

fact that it operates in relative close proximity between knowledge producers and knowledge users, and combines a number of agencies, including funding, research management and dissemination. As an intermediary serving the entire wine industry (see again Section 2.4.1 in Chapter 2) it offers a form of commodity based extension (Nagel, 1997). Winetech sponsors the *Wynboer* section in the WineLand magazine by VinPro and also offers, in partnership with VinPro, information sessions, seminars and workshops.

- Anchor Wine Yeast, on the other hand, being a private firm, can be thought of as offering extension as a commercial service (Nagel, 1997). Extension services delivered by private firms, according to Nagel, can be part of the sales strategy of private firms that provide input supplies, where the cost of extension is included in the product price. Anchor Wine Yeast, in the context of this study, therefore also acts as an intermediary but primarily because of its non-commercial offerings to winemakers. These include the (then) Outlook Gazette that is posted to winemakers, and contributions that are posted on *www.newworldwinemaker.com*, the service-oriented website which disseminates relevant information to winemakers in new world wine producing countries.

- The own efforts of winemakers largely entail searching the internet; seeking advice from other winemakers in the country; obtaining feedback from wine consumers; seeking advice from staff at wine laboratories, and consulting textbooks and manuals.

Moreover, especially four of the nine knowledge-sourcing activities, presented in the top part of Table 5.35, have the potential of significantly influencing the knowledge of South African winemakers as they are the ones associated with the highest frequencies. The four activities are (1) seeking the opinions of other winemakers in the country, (2) searching the internet, (3) reading *Wynboer* in the WineLand magazine, and (4) obtaining the opinions of wine consumers. These four knowledge sources, given their prominence, are the ones most likely to shape the average winemaker's approach and expand the stock of generic winemaking knowledge. The "diffuse, undirected seepage" of external knowledge that Weiss (1978, 1980) refers to as "knowledge creep", and which subconsciously influences actions, most likely also occurs in relation to these frequently accessed knowledge sources. However, of these, only *Wynboer* in the WineLand magazine can be considered a clear source of factual knowledge as it disseminates knowledge that is grounded in scientific research. The other three (fellow-winemakers, the internet, and wine consumers) are, at best, sources of

potential factual knowledge. In other words, they may or may not be "upgraded" to factual knowledge, depending on whether scientific or colloquial evidence provides the necessary justification for the information obtained from those sources.

Therefore, if the winemaking industry – as represented by Winetech – would like to promote scientific evidence-based practice, it is not only a case of injecting more factual knowledge into the system by subcontracting more research or disseminating more research findings. Evidence-based practice also implies ensuring that existing sources, especially the ones most frequently consulted (fellow-winemakers and the internet), become less the carriers of opinions and beliefs and better grounded in research. Finally, a knowledge translation strategy is proposed in the final chapter (Chapter 7) which partly involves that both the scientific research and colloquial evidence bases of winemaker practices and beliefs be exposed and documented. The resulting knowledge product will provide winemakers with a resource to examine claims made by fellow-winemakers, as well as to contextualise their own beliefs. Obviously the internet would need to serve as one platform for disseminating and accessing this resource.

Turning again to Table 5.35, both similarities and differences can be observed between the external knowledge sources winemakers frequently engage in and those that they consider as extremely important for their winemaking. In terms of similarities, wine laboratories, fellow-winemakers, wine consumers and textbooks/manuals represent sources that winemakers regularly engage in and which are also seen as extremely important by large proportions of winemakers (≥40%). In terms of differences, *sources that are facilitated by intermediaries (Winetech and Anchor Wine Yeast) are not regarded as extremely important for practice by more than 40% of winemakers* and for that reason do not appear in the lower part of the table. However, this does not imply that the factual knowledge facilitated by intermediaries is irrelevant or non-useful or totally unimportant. What it does say is that, relative to a range of other sources, the knowledge disseminated by intermediaries is less often considered as extremely important.

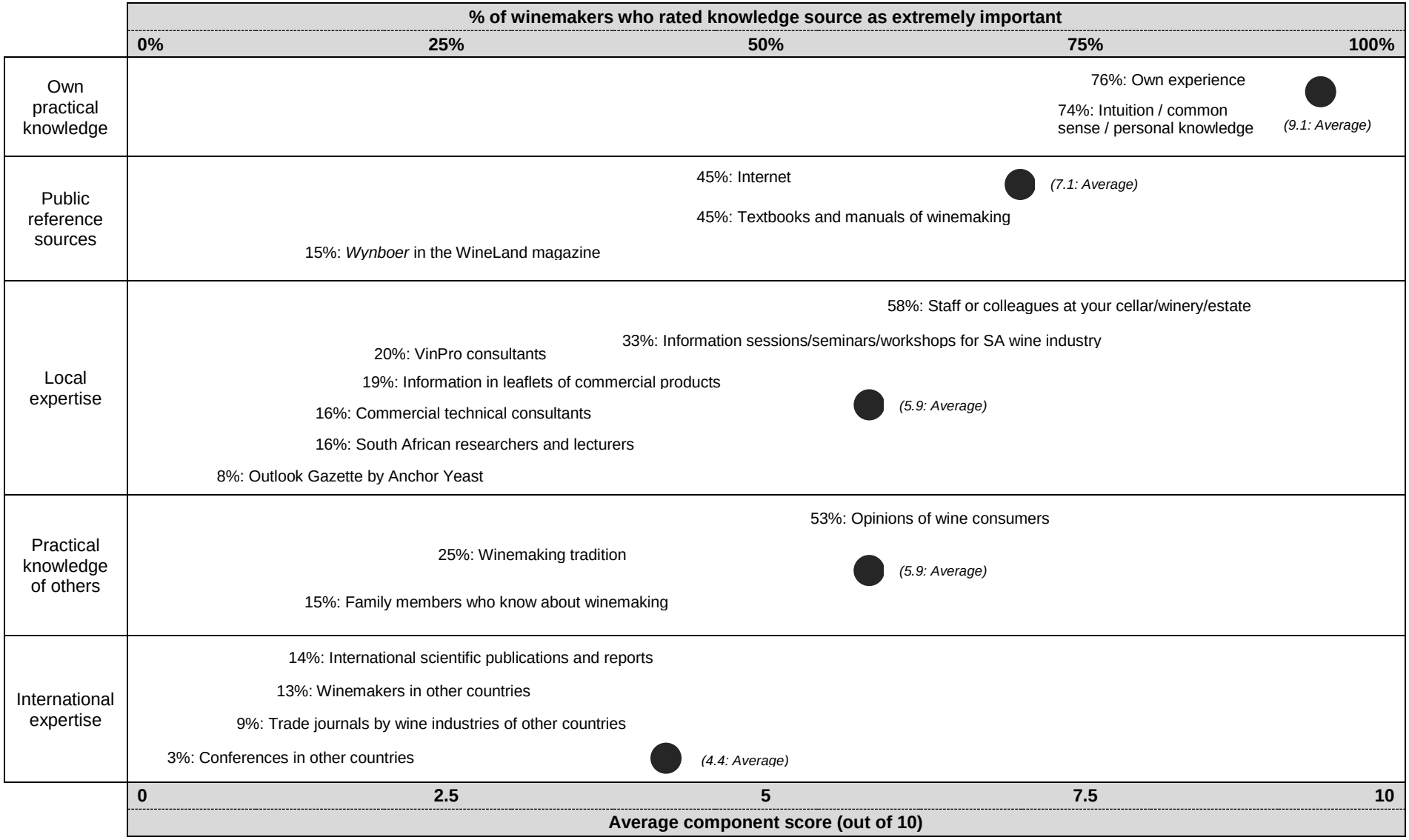
One explanation for this observation emerges if one considers Winetech as an example of an intermediary whose knowledge sources (e.g. information sessions/workshops and *Wynboer*) are frequently used but rated by most winemakers, in terms of importance, as ranging only between "of some importance" and "of little importance". Even so Winetech's approach to knowledge transfer includes elements from all main "ideal types" required for knowledge utilisation (Landry, Amara & Lamari, 2001b). For instance, the approach is user-driven (demand-pull) as research needs are identified at producer level and researchers are

commissioned to conduct research that addresses industry-specific needs. The approach also contains traces of the science-push model as researchers are allowed to submit project proposals for funding and Winetech places strong emphasis on funding high-quality research. Needless to say that key elements from the dissemination and interactive models are also intrinsically part of what Winetech does in its role as an R&D intermediary and knowledge transfer agency. However, Winetech, being an overarching R&D co-ordinating body in the South African wine industry, represents an entire system and therefore translates industry-specific needs into research programmes that would benefit as many user segments as possible. In contrast, winemakers experience problems that are highly contextualised, task-orientated and very often unique. Against this backdrop the analytical output by wine laboratories, for instance, would be seen as of much greater importance to practitioners than any Winetech resource, as the output sheds light on the micro-bacterial activity of a *specific* wine, which, in turn, presents a very *specific* diagnosis and course of action. Similarly, other contextually-based external knowledge, such as the opinions of staff at one's own cellar and those of fellow-winemakers at other cellars, are also important for winemaking as they all relate to micro-level activities and experiences.

Thus, given the focus on context-specific knowledge, it appears from Table 5.35 that there are, broadly speaking, at least two categories of external knowledge sources. Firstly, sources solicited with specific objectives or tasks in mind (e.g. results of analyses by wine laboratories to determine micro-bacterial activity). Secondly, there are sources that mainly expand the general knowledge of winemakers (e.g. the knowledge sources facilitated by intermediaries). The latter category of sources are most frequently used but not really seen as extremely important for winemaking because the focus is on challenges experienced by a wider audience. In addition it could be argued that some external knowledge sources (e.g. opinions of fellow-winemakers) serve both purposes, as they are not only most frequently used, thereby incrementally expanding a winemaker's knowledgebase, but also sources of rich context-specific knowledge.

Natural groupings of knowledge sources were also statistically determined by means of a multivariate procedure (PCA) which, based on ratings of importance, revealed five underlying knowledge source components. Figure 5.14 locates the averages of these components in relation to the ratings of extreme importance awarded to the individual items constituting a knowledge source component.

**Figure 5.14: Visual display of the five knowledge source components and their associated items**



It needs to be stressed that three items, pertaining to knowledge sources regarded by large proportions of winemakers as extremely important (Table 5.35), are excluded from the PCA on which the knowledge sources components are based. The three items are the results of wine analyses from wine laboratories, South African winemakers in other cellars, and formal training received. These were excluded because of statistical rather than conceptual considerations (see again Section 5.3.4). Notwithstanding, preliminary explorations of the PCA (see Table 5.18) show that one of the excluded items, namely the results of wine analyses by wine laboratories, groups together with local expertise, which makes perfect sense as both refer to domestic knowledge sources. However, less intuitive is the fact that winemakers from other cellars, as a source of knowledge, initially grouped with the knowledge items listed under public references sources and not also with local expertise. Although peculiar this is not totally uncommon. For instance, in a study by Yousefi-Nooraie et al. (2007) among health practitioners, the asking of colleagues clustered with clinical practice guidelines, which is another example of a public reference source. Thus, asking fellow-winemakers naturally belongs to the group of items that include consulting the internet, textbooks/manuals and *Wynboer* in the WineLand magazine. This closeness in the pattern of rating could be interpreted as implying (1) some tendency by those who access public reference sources to also rely on the opinions of fellow winemakers; or implying (2) that the knowledge solicited from fellow-winemakers is based on publicly available knowledge; or (3) that the knowledge obtained from the publicly available documents is assessed in terms of the practical knowledge of fellow-winemakers, or vice versa. The interpretation that the knowledge solicited from other winemakers is based on publicly available knowledge will be examined in the next chapter, where part of the foci is on the knowledge-sourcing activities of opinion leaders, a specific category of fellow-winemakers.

In terms of the association between selected demographical variables and knowledge source components, cellar type does not really play a role in the ratings of importance of knowledge sources despite anecdotal evidence that some estate cellars are more innovative than the other categories of cellars. For instance, it is argued that because certain estate cellars were among the first to make the shift from volume production to quality production they could also be considered more innovative (Brown-Luthango, 2007).

The age of the winemaker appears to be a better correlate of the importance attached to certain knowledge sources, as it is significantly related to three of the five broad knowledge source components. Basically, two age segments display an appreciation for both local expertise and the practical knowledge of others. On the one hand are graduates from university who are relatively young (<30 years). On the other hand are winemakers who are

older than 40 years but with plenty of experience. Although these two age segments are at least one decade apart, what they do seem to have in common is the making of wine since a relatively young age (<25 years). Thus, engagement in the actual practice of winemaking from an early age appears to be one factor that could cultivate an appreciation for the practical knowledge of others but also for the various sources of local expertise.

This concludes the presentation and discussion of findings from the web-based winemaker survey, specifically findings dealing with the knowledge sources of South African winemakers. The following summarises the conclusions reached with regard to the broad research questions posed at the start of this chapter.

| **Broad questions** | **Conclusions** |
|---|---|
| What are the sources of knowledge of South African winemakers?<br>What sources do they regularly engage in and which do they regard as most important for their practice?<br>Are there any natural groupings of knowledge sources? | A variety of knowledge sources were considered, including documents, people and events. The *most frequently consulted* sources are those facilitated by intermediaries (Winetech and Anchor Wine Yeast) as well as those approached by own initiative (e.g. asking fellow-winemakers).<br>However, the *most important* knowledge sources are not from intermediaries. The most important ones are predominantly internal (personal knowledge and own experience). A number of external sources are also regarded as very important but these are mainly task-specific and problem-orientated (e.g. results of wine analyses by laboratories and asking fellow-winemakers).<br>There are natural groupings of knowledge sources which highlight again the extreme importance of personal knowledge and, to a lesser extent, codified knowledge that is available in the public domain. |
| Can the knowledge sources easily be separated into, for instance, factual and practical knowledge? What types of knowledge characterise the knowledge sources of winemakers? | The knowledge sources cannot easily be divided into factual and practical knowledge without also introducing the category of potential factual knowledge. Practical knowledge is the most important knowledge source but the external sources include both factual and potential factual knowledge. The scientific research evidence base of potential factual knowledge sources needs to be established in order to render them as factual. Otherwise they represent opinions and beliefs. |
| What routes of knowledge transfer can be inferred from the knowledge sources? | The dissemination implied by some knowledge sources involves facilitation by intermediaries, and these sources are relatively frequently consulted. Research-driven sources are seldom consulted. There is also a group of knowledge sources that do not imply a particular route of knowledge transfer because winemakers obtain these as and when the need arises (those solicited by own initiative). |
| What cellar based and winemaker specific factors are associated with the different knowledge sources? | The type of cellar does not appear to be an important factor in terms of the valuing of certain knowledge sources. Winemaker age appears to play a role but it is not necessarily so that the valuing of certain knowledge sources increases or decreases with age. There is both a younger and older age segment that values the same grouping of knowledge sources. |

# Chapter 6

# ASPECTS OF KNOWLEDGE USE OF WINEMAKERS

## 6.1 INTRODUCTION

This chapter presents further findings from the winemaker survey but with a primary focus on the use of scientific research findings. It further incorporates data from the interviews that were conducted with six winemakers, two winemaking consultants and one technical consultant representing a wine yeast manufacturer.

The chapter aims to answer the following broad questions:

- What forms of utilisation or uptake are associated with scientific research findings as a representation of factual knowledge? What is the inter-relation between the different forms of utilisation of scientific research findings in winemaking?
- What cellar based and winemaker specific factors are associated with the different forms of utilisation of scientific research findings?
- What are the elements of practical knowledge in winemaking?
- What is the relation between the different knowledge sources in winemaking? What sources are first consulted and why?
- What other insights emerged with regard to the different sources of knowledge and their use?

The chapter starts with a discussion of different styles of knowledge application in winemaking, followed by a comprehensive analysis of the forms of utilisation associated with the uptake of scientific research findings. A discussion is devoted to intuition, sense-impressions and experience as elements of practical knowledge. The chapter also explores winemakers' preference for and order of use of knowledge sources, together with a profile of the knowledge sources of winemakers who are most frequently contacted by their peers for advice.

## 6.2 WINEMAKER APPROACH AND KNOWLEDGE APPLICATION

Two approaches to winemaking emerged from the interviews, which can be described as minimalistic and interventionist. These approaches refer to general practice orientations that constitute "practice spaces" within which a winemaker applies knowledge. This section

describes the two practice orientations in terms of analogies and images used by the interviewees, and also elaborates on its relation with factual and practical knowledge.

The first of these, the minimalistic approach, is typical of situations where the winemaker adds as little as possible to the wine, in order to preserve the image of wine as a natural product. Of course, a winemaker can also decide to add nothing at all but this is seldom the case as the adding of sulphur dioxide ($SO_2$) is intrinsic to winemaking, given that it prevents growth of harmful bacteria and rogue yeasts (Goode, 2005). Minimalistic winemakers will normally only add something to the wine if they believe that the failure to do so would compromise wine quality.

In the interviews some winemakers described the minimalistic approach as one where the winemaker acts like "a doctor on call" and "nurtures" the wine-in-the-making. In that sense it is somewhat related to the notions of primary and secondary health care. Normally a doctor steps in whenever a problem is experienced (primary), either serious or non-serious, and also acts to prevent problems that could potentially be experienced down the line (secondary). In the case of winemaking, it is more often about preventing problems. Healthy grapes are seen as resembling healthy patients and since healthy patients require less direct health intervention, the role of the winemaker (doctor) is to ensure that the wine-in-the-making (the patient) remains healthy at all times.

> *If you look back at the fundamentals, wine is the fermented juice of freshly gathered grapes. So, we turn those grapes and what happens is, we say, we turn them into wine but we don't really. I mean, I don't have the ability to do that. The yeast has the ability to convert the sugars into alcohol and $CO^2$ and obviously the vine has its chance to ripen in the fruit stage, which will hopefully in turn create different aromatic profiles. Now the technique is that you as a winemaker are trying to kind of make sure that all that happens. Now technically what happens without you being there is that it is very happy doing that … Orange juice ferments when it is in the fridge. It does not need me to inoculate. It just does because it is out of date and has been there for two weeks. Now, the thing is that is what wine will do. Your job as a winemaker is obviously, is to not modify that and try to make sure in cases where that doesn't happen, that you are there on call, essentially like a doctor. You are like a doctor to help them. Most of wines are very healthy, you know, the viticulture has done its job, you have great grapes and now carry on, they'll get on with it. Your job is there to make sure that wines are not doing what it is not supposed to be doing, and it's weird metabolism, metabolic rates and different fermentation rates and, you know, the biochemistry of fermentations are working properly. You are there to help it by making sure you have the right things. Now, that is technique as far as I am concerned. (Winemaker A)*

The perception of the winemaker as a doctor is also supported by references to wine treatment as medicine:

> *Let's say the grapes have a lot of sour rot and various things like that. Then you need to give it its … I almost want to say medicine. You give it its tannins and then it will not be too much affected by it. (Winemaker C; translated from Afrikaans)*

The prevention of problems and challenges, and the appropriate treatment thereof in instances where they do occur, heavily relies on winemaking technique. As indicated in the quote by Winemaker A above, technique is knowledge-based and involves a multiple of understandings. Some of these understandings relate to the biochemistry of fermentations, which clearly refers to factual knowledge (*know-that*) acquired through training and other sources of knowledge. However, technique also implies a particular skill or ability, which means the necessary *know-how* to do certain things.

> *Technique is also understanding the how to extract aromatics and how to use wood in a conducive manner, you know, to make sure that the fruits and the wood are within bounds. It is about learning about those things and applying those things, to the extent you are stopping problems so much …. And you are also stopping any microbial problems later down the line. (Winemaker A)*

Another winemaker uses the metaphor of a train along a track to describe the minimalistic approach to winemaking. Whenever the risk of derailment surfaces, the doctor on call needs to step in and start "nurturing" the wine.

> *Basically I see it as a train … you see your winemaking as a train along a track. If it is not doing well, don't leave it but look after it. It seems if there is a problem, it gets derailed, you then get to step in with … obviously you want to do as least as possible. You know when one is adding, let's say, a chemical to a wine, let's say, tannins or sulphate … You don't go and just hit it heavily, let's say, double the dosage. You know it's going to be affecting the wine; you know you're going to be stripping the wine of a lot of character. So you do things in steps, you don't do them all at once. You're sort of nurturing the wine. (Winemaker E)*

Wine treatment, when executed to restore the health of the wine-in-the-making, could have some side effects, similar to the effects that medicine has when administered to a patient. Hence, wine treatment needs to be administered with care and precision. Moreover, similar to when a doctor searches for the most appropriate dosage of medicine to match a particular patient, the winemaker also experiments with different treatment quantities until an appropriate dosage is found to best "nurture" the wine.

> *Just this week, I am doing trials on different tannins. I do, let's say, half a gram … a gram, two grams, three grams, and I'll see which one works. (Winemaker E)*

A winemaker who practises minimalism needs to ensure that the properties of the wine-in-the-making always fall within certain parameters, which underscores the preventative side of this approach. Both factual and practical knowledge come into play in a number of ways.

They generate the necessary insight as to whether or not the observed properties are still within bounds; identify potential problems and associated risks in instances where the wine properties appear to be out of bounds; and inform appropriate remedies for the problems encountered. Remedies typically entail only adding what is absolutely necessary to ensure wine quality.

Characteristic of the broader context within which the minimalistic approach is situated, to use the expression of the winemaker who is also a winemaking consultant, is that the winemaker often works towards the "bull's eye". According to this perspective the winemaker is both a rationalist and strategist as he/she plans the vinification process by steering it towards a target. Typically, the winemaker would use information from previous years' vintages to define the parameters within which wine is to be made from the current vintage. The specification of parameters happens before the actual harvest. To do so, the information of the past is used as a guide, and when the grapes come in and enter the process of vinification, it is continuously determined to what extent the wine-in-the-making deviates from the set parameters. Changes are then made to align the actual conditions of the wine-in-the-making to the ideal reflected in the specified parameters. Problems and challenges, in this context, are seen as cases that require fine-tuning to close the distance between the desired end-result (target) and the actual state of affairs.

> *You should be planning your vintage long before the grapes come to the winery. The way I see it, it's like, you know when … you shoot with a bow and arrow towards a target, you never know if you're going to hit the bull's eye but you must at least hit the target. You might be left of the bull's eye or right of the bull's eye but the arrow can't land in the ground, you know. And that is what you should be doing long before harvest. You should be speculating, sort of working on your previous years' information, saying, okay, I expect my Chardonnay to come in at … what yeast am I going to use, what temperature I'm going to ferment … and that's the way I've always done it in my career of winemaking, that when the harvest came, when the grapes actually landed at the winery, I could say to myself, okay, you've landed left of the bull's eye, so now it's just the case of perhaps some fine-tuning here and there, and then you are on the bull's eye. (Consultant A)*

The reference to "fine-tuning" also highlights the minimalistic aspect of winemaking. It is while working towards the "bull's eye" that the winemaker selects from her/his pool of personal knowledge, as well as from other external sources of knowledge, and implements what is deemed absolutely necessary.

The second winemaking approach, which can be labelled as <u>interventionist</u>, represents instances of a winemaker performing high manipulation in order to achieve a certain style. Style refers to the characteristics of a wine (e.g. texture, mouth-feel) that give it a certain

"personality". Interventionist is the opposite of minimalistic. It also calls for the application of techniques but in this case stylistic techniques, which often imply something more than a minimalistic intervention. Moreover, stylistic requirements, and thus the end-result to be achieved, are determined by consumer demand.

> *You get guys who are minimalistically part of the wine process. They just check that everything is following its normal course. Then you get the guys who are working towards a certain style. The market wants to drink a certain style of wine and there are certain techniques one could apply to get a wine like that. (Winemaker C; translated from Afrikaans)*

> *The difference is now with style that the consumers are coming to us and saying, actually, we want something where you do high manipulation or we want a sort of a soft fruity red wine but with a bit of residues sugar, we don't want any tannin in it. So much is there to use techniques, arguably, but stylistic techniques to change what I've already got into something that is stylistically more suited to them. You know, using oak staves, making sure I get rid of tannin with gelatine or other products, doing micro- or macro-oxygenation, short vacuum times basically, and obviously things like that, which create an impression … and kept a price point as well because stylistically they want a fresh pretty wine at fifty bucks or forty bucks a bottle. (Winemaker A)*

Moreover, stylistic interplays, as implied in the quote below, start once wine has been brought to a certain point where it is ready for such stylistic modifications. In some cases the techniques involved in bringing about that state have a strong factual knowledge base ("all the research" – Winemaker A below).

> *Style is simply what the consumers are wanting or think they want and technique is what … which winemakers should have, all the techniques, all the research to make sure that the wines get to that point correctly before we're going to start doing our stylistic kind of interplays really. (Winemaker A)*

Earlier on it was mentioned that the techniques involved in the minimalistic approach can have a factual knowledge base. But what knowledge underlies the stylistic techniques of the interventionist approach? According to Winemaker D, whose winery is part of a family business, her stylistic techniques are informed by "basic knowledge sources". These sources she later unpacks as being based on research, namely trials that have been published in national and international science journals.

> *Many times the people would say the wines are too hard; then one needs to use a certain "brey agent" for a certain style you want to achieve … You still use the basic knowledge sources to decide on the "brey agent" that will produce that manipulation but to know what the people want you first need to get that from the clients. Then you need to decide and say, okay, the type of style can be manipulated by means of egg white in the case of red wine or if it is white wine that needs to be softening a bit, then gelatine, what dosages, etcetera. Then obviously one needs to do a few samples. (Winemaker D; translated from Afrikaans)*

> *You look at what was done in the past, the wine techniques, you will get it for Stellenbosch and Robertson and Australia and America, and those trials that they've done, some of those you can more or less duplicate for your own wine and then decide which suit you best sensorially. Thus you combine the many trials already performed by others before you. (Winemaker D; translated from Afrikaans)*

Moreover, a winemaker's interpretation of desirable styles is very often also based on feedback directly obtained from consumers (e.g. during interactions with consumers at tasting events). In many instances, however, especially at producing wholesalers and large private cellars, there are dedicated marketing personnel who are in touch with their consumer base and whose task it is to inform the winemaking team about any stylistic modifications needed.

> *When you work in the bigger companies, you would have a marketing manager or a sales rep who would say to you, jis, you know, the market wants softer red wines or your Sauvignon Blanc is too acid, they want a less acidic Sauvignon Blanc. So, experience has always been that it would be those kinds of persons who would inform you of where you should be going. (Consultant A)*

Thus, two sets of knowledge content are needed for a winemaker to effectively conduct stylistic modifications. The first is knowledge of the consumer demand and the second is to have full knowledge of the range of techniques available to modify an existing product that could meet the consumer demand. Again, the range of techniques can be informed by factual knowledge (existing research) but also by practical knowledge for the simple reason that technique, as argued before, implies a particular skill (*know-how*).

To conclude: some of the winemakers interviewed made brief references to their use of scientific research findings, both within the minimalistic and interventionist approach. The next section explores the use of scientific research findings in winemaking in more detail and on a larger scale by presenting findings from the extensive winemaker survey. The focus is on the extent and nature of use.

## 6.3 USE OF SCIENTIFIC RESEARCH FINDINGS

### 6.3.1 General Overview

The use of scientific research findings in the winemaker survey was measured by presenting the respondents with 11 statements about the relation of scientific research findings to their winemaking, which they had to rate in terms of level of agreement (Table 6.1). The statements were informed by the body of literature that discusses knowledge utilisation in terms of a set of typologies. Of the 11 statements, four directly correspond to the four

utilisation types derived from the combined insights of Estabrooks (1999) and Weiss (1979), i.e. instrumental, conceptual, symbolic and persuasive. Figure 6.1 displays the percentage of respondents who agreed (i.e. “strongly agree”; “agree”) with the selected statements that comprise the four utilisation types (indicated as [#] in Table 6.1). Four more statements were added to supplement the utilisation types, e.g. a reference to becoming “more preventative” as another potential indication of conceptual utilisation, and “to do things differently” as another instance of instrumental utilisation (items marked as [‡] in Table 6.1). Three more items were also included to cover general perceptions about the suitability of scientific research findings for winemaking (items marked as [*] in Table 6.1).

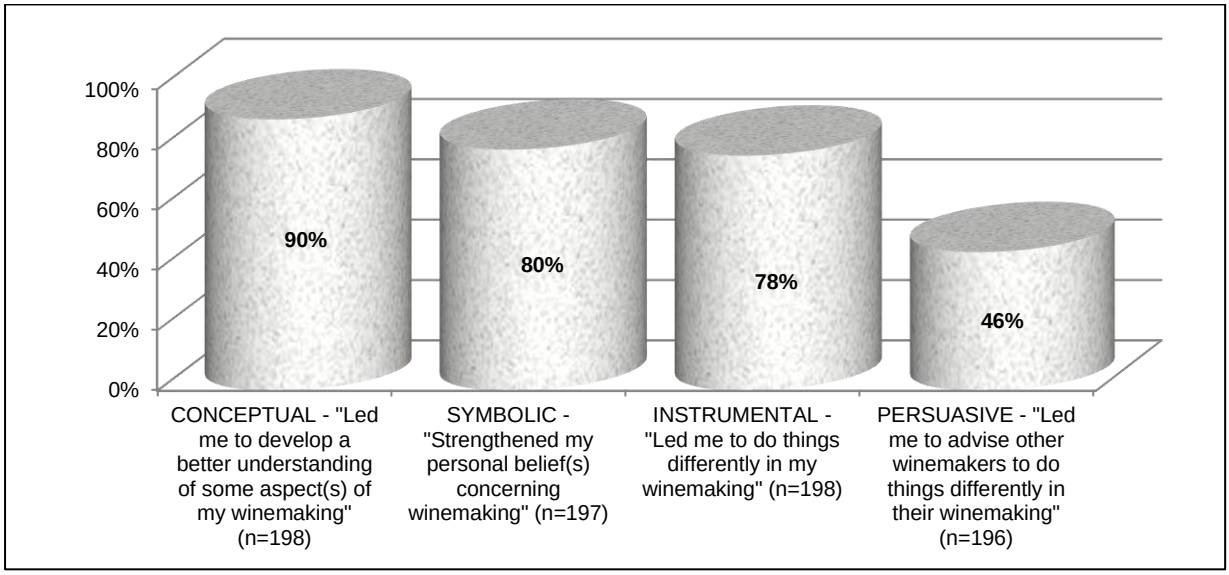
The breakdown of statement responses is shown in Table 6.1 below. In addition, Figure 6.1 visually displays the responses to the four utilisation types.

**Table 6.1: Responses to 11 statements concerning scientific research findings on winemaking**

| Scientific research findings on winemaking … | Rating | | | | | Number of respondents |
|---|---|---|---|---|---|---|
| | Strongly agree | Agree | Neutral | Disagree | Strongly disagree | |
| [#] Have led me to develop a better understanding of some aspect(s) of my winemaking | 31% | 59% | 7% | 2% | 1% | 198 |
| [‡] Have led me to become more preventive in my winemaking | 29% | 52% | 15% | 2% | 2% | 197 |
| [#] Have strengthened my personal belief(s) concerning winemaking | 22% | 58% | 15% | 4% | 1% | 197 |
| [#] Have led me to do things differently in my winemaking | 22% | 56% | 19% | 1% | 2% | 198 |
| [‡] Have caused me to change some aspect of my winemaking | 21% | 60% | 13% | 6% | <1% | 198 |
| [‡] Have led me to become more experimental in my winemaking | 21% | 52% | 19% | 6% | 2% | 197 |
| [#] Have led me to advise other winemakers to do things differently in their winemaking | 11% | 35% | 44% | 7% | 3% | 196 |
| [‡] Have not added any value to my winemaking (-) | 4% | 7% | 10% | 39% | 40% | 198 |
| [*] Only serve the interests of academics (-) | 3% | 9% | 24% | 37% | 27% | 197 |
| [*] Are too complex to be of use in my winemaking (-) | 3% | 8% | 23% | 41% | 25% | 196 |
| [*] Are too fragmented to be of use in my winemaking (-) | <1% | 14% | 26% | 40% | 20% | 195 |

(-) Negatively worded statement

**Figure 6.1: Percentages of winemakers who agreed with statements that represent the four utilisation types**




Note: “Strongly agree” and “agree” responses are combined.

According to Table 6.1 large proportions of winemakers are of opinion that scientific research does impact upon their winemaking.

- The first six statements in the table, which specify some influence on the winemaker’s own practice, all elicited agreement by at least 80% of respondents. Moreover, the first three of these statements, which represent the most prominent influences, relate to effects that are very much internalised and expressed in cognitive forms, such as increased insight, higher awareness and stronger belief.
- That being said, activity effects (i.e. changed activities) as a result of exposure to scientific research findings are almost equally important. This can be seen in Figure 6.1. Although conceptual changes are the most prominent utilisation type (90%), symbolic and instrumental utilisation (the latter being the activity effect) rank very close to one another in second and third place (80% and 78% respectively).
- Whereas the conceptual, symbolic and instrumental utilisation types are directed at the “self”, the fourth type, persuasive utilisation, is directed at the “other”. This explains the markedly smaller percentages of respondents (46%) who indicated that scientific research has led them to also try to persuade fellow-winemakers.

The main conclusion, overall, is that markedly large proportions of winemakers reported scientific research utilisation in one form or the other.

### 6.3.2 Relationship between the Four Utilisation Types and Selected Demographical Variables

The four statements that closest represent the four types of utilisation (Figure 6.1) were subsequently cross-tabulated with the same nine demographical variables used in Chapter 5, Section 5.3.5. For each statement only a small percentage of respondents (between 3%-10%) provided answers that reflect the relative absence of utilisation (i.e. "disagree" and "strongly disagree" responses). Hence, the "disagree" and "strongly disagree" responses were merged with the "neutral" responses. Similarly, the "strongly agree" and "agree" options were also collapsed so that, in effect, the responses to the statements constitute a dichotomy ("strongly agree / agree" versus "neutral / disagree / strongly disagree"). Since there are four utilisation types and nine demographical variables, a total of 36 cross-tabulations were performed. Table 6.2 presents a summary of the cross-tabulations in terms of statistical significance. As can be seen, none of the demographical variables are significantly related to the four utilisation types. Scientific research utilisation therefore appears to be relatively pervasive among winemakers, with little differences between sub-groups of winemakers. As previously shown in Figure 6.1, each of conceptual, symbolic and instrumental utilisation is reported by at least or close to 80% of respondents, and these relatively high figures demonstrate the pervasiveness thereof. Although only about half of respondents reported instances of persuasive utilisation, the fact that this type of utilisation does not differ with regard to any of the selected demographical variables, implies that similar percentages also apply to the different sub-groups of winemakers.

**Table 6.2: Table indicating demographical variables that are significantly related to the four types of utilisation**

| Demographical variable | Instrumental utilisation | Conceptual utilisation | Symbolic utilisation | Persuasive utilisation |
|---|---|---|---|---|
| Member of SASEV | X | X | X | X |
| Number of South African wine associations that winemaker is a member of | X | X | X | X |
| Type of cellar | X | X | X | X |
| % of wine exported to other countries | X | X | X | X |
| Ever worked in a cellar abroad | X | X | X | X |
| Number of cellars worked at (current included) | X | X | X | X |
| Number of years making wine | X | X | X | X |
| Age of winemaker | X | X | X | X |
| Highest relevant qualification completed | X | X | X | X |

Note: Statistical significance was determined by means of the Chi-square test. Fisher's exact test was used in cases where the Chi-square test was invalid because too many expected frequencies fell below the minimum statistical criterion.

A further question to be answered concerns the inter-relationship between the four types of scientific research utilisation. For instance, are those winemakers who do things differently because of scientific research also more likely to persuade others to do things differently? This calls for the computation of inter-correlations among the four utilisation types. Since the variable corresponding to each type has been dichotomized, a series of 2x2 cross-tabulations (six in total) were performed. Again statistically significant associations were determined by means of Chi-square and the magnitude or strength of the association by means of Cramer's V. The results are summarised in Table 6.3.

All six inter-correlations between the four utilisation types are statistically significant ($p<0.05$). The strongest correlation exists between conceptual and symbolic utilisation, as the value of Cramer's V exceeds 0.5. Both of these involve cognitive or mental forms of use. On the other hand, the weakest correlation is between conceptual and persuasive utilisation (Cramer's V = 0.187). Persuasive utilisation also has a weak-to-moderate correlation with symbolic utilisation (0.228). That being said, persuasive utilisation has an above-moderate correlation with instrumental utilisation (0.340), meaning that winemakers who do things differently on the basis of science are also more likely to persuade others to do so.

**Table 6.3: Statistically significant associations among the four utilisation types, together with measures of the strength of the associations**

| | Instrumental | Conceptual | Symbolic | Persuasive |
|---|---|---|---|---|
| **Instrumental** | -- | -- | -- | -- |
| **Conceptual** | Chi-square = 39.127<br>p < 0.05<br>Cramer's V = 0.445 | -- | -- | -- |
| **Symbolic** | Chi-square = 29.216<br>p < 0.05<br>Cramer's V = 0.385 | Chi-square = 50.366<br>p < 0.05<br>Cramer's V = 0.506 | -- | -- |
| **Persuasive** | Chi-square = 22.664<br>p < 0.05<br>Cramer's V = 0.340 | Chi-square = 6.829<br>p < 0.05<br>Cramer's V = 0.187 | Chi-square = 10.229<br>p < 0.05<br>Cramer's V = 0.228 | -- |

An alternative method to examine the inter-relationship between the four utilisation types is to calculate for winemakers who reported a particular form of utilisation, what percentage of that group also reported each of the other forms of utilisation. Thus, the inter-relationship is expressed as a series of shared percentages. This was done systematically for all pairs of utilisation types, and the results are shown in Table 6.4.

**Table 6.4: Inter-relationship between the four utilisation types expressed as a series of shared percentages**

| | Percent | N |
|---|---|---|
| % of all winemakers with instrumental utilisation who also reported conceptual utilisation | **97%** | 154 |
| % of all winemakers with instrumental utilisation who also reported symbolic utilisation | 88% | 154 |
| % of all winemakers with instrumental utilisation who also reported persuasive utilisation | 55% | 153 |
| % of all winemakers with conceptual utilisation who also reported instrumental utilisation | 84% | 179 |
| % of all winemakers with conceptual utilisation who also reported symbolic utilisation | 87% | 179 |
| % of all winemakers with conceptual utilisation who also reported persuasive utilisation | 49% | 178 |
| % of all winemakers with symbolic utilisation who also reported instrumental utilisation | 86% | 158 |
| % of all winemakers with symbolic utilisation who also reported conceptual utilisation | **98%** | 158 |
| % of all winemakers with symbolic utilisation who also reported persuasive utilisation | 52% | 157 |
| % of all winemakers with persuasive utilisation who also reported instrumental utilisation | 93% | 90 |
| % of all winemakers with persuasive utilisation who also reported conceptual utilisation | **97%** | 90 |
| % of all winemakers with persuasive utilisation who also reported symbolic utilisation | 90% | 90 |

The three largest percentages, which are highlighted in Table 6.4, indicate that conceptual utilisation is prior to any other form of utilisation or, differently put, none of the other forms of utilisation really occur in the absence of conceptual utilisation. Thus, the "better understanding" (insight) generated through scientific research is a necessary condition in order for one (1) to act and start doing things differently, or (2) to interpret the relevant findings as supportive of one's existing belief, or (3) to advise others to do things differently as well.

As Table 6.4 further shows, persuasive utilisation is not a necessary consequence of any of the other utilisation types, as only between 49-55% of respondents who reported each of the other three types also reported advising others to do things differently. The "higher" percentage of 55% nevertheless indicates some tendency among those who made some change themselves on the basis of research findings to also advise others to do so. Another way to interpret Table 6.4 is to say that persuasive utilisation does not necessarily follow when the other three utilisation types are reported. On the other hand, though, whenever persuasive utilisation is reported, it almost always includes the other three utilisation types.

These interpretations confirm some preliminary insights derived from an earlier attempt (Chapter 3, Section 3.3) to reconcile the six cumulative stages of knowledge utilisation (Landry, Amara & Lamari, 2001a) with the four primary utilisation types by Weiss (1980) and Estabrooks (1999). Already then it was implied that conceptual utilisation occurs prior to any

of the other three types of knowledge utilisation, and that persuasive utilisation only occurs during later stages once the other three types (conceptual, symbolic and instrumental) are also present.

### 6.3.3 Relationship between the Four Utilisation Types and Knowledge Source Components

The focus now shifts to an examination of the relationship between the four utilisation types and the five knowledge source components that were created in Chapter 5, Section 5.3.4. The utilisation types are dichotomies, as the underlying statement responses have been recoded into only two categories ("strongly agree" and "agree" combined versus "neutral", "disagree" and "strongly disagree" combined). The knowledge source components, on the other hand, are regarded as scale variables with scores ranging between 0 and 10. The appropriate procedure, therefore, is a series of comparisons of means, using independent t-tests to detect statistically significant differences in mean scores.

Altogether 20 independent t-tests were conducted as can be seen in Table 6.5. Half of these produced statistically significant results. Tables 6.6 to 6.9 below present the relevant statistics for the 10 instances of statistical significance.

**Table 6.5: Table indicating knowledge source components that are significantly related to the four types of utilisation**

| Knowledge source component | Instrumental utilisation | Conceptual utilisation | Symbolic utilisation | Persuasive utilisation |
|---|---|---|---|---|
| Local expertise | √ | √ | √ | X |
| International expertise | √ | X | √ | √ |
| Public reference sources | √ | X | √ | X |
| Practical knowledge of others | X | √ | √ | X |
| Own practical knowledge | X | X | X | X |

According to Table 6.6, winemakers who agreed with the statement about instrumental utilisation – compared to those who disagreed or remained neutral – obtained significantly higher scores on the measures of the importance of local expertise, international expertise and public reference sources. Thus, those claiming that scientific research findings have led them to do things differently in their cellar are more likely to stress the importance of these three knowledge source components. It could be argued that these three knowledge source components are largely responsible for exposing the winemakers to the scientific research findings that contributed to activity modifications. Practical knowledge, either one's own or that of others, is not significantly related to perceptions of instrumental utilisation.

**Table 6.6: Statistically significant differences in mean scores (out of 10) on three knowledge source components, by whether or not winemaker agrees with statement about INSTRUMENTAL utilisation**

| | Mean score | Median score | Standard deviation | Lowest score | Highest score | Significance |
|---|---|---|---|---|---|---|
| **Local expertise** | | | | | | |
| SA / A (n=147) | 6.2 | 6.7 | 2.0 | 0.5 | 10.0 | t = -2.667<br>p < 0.05<br>Effect size = 0.22 |
| SD / D / N (n=39) | 5.0 | 5.2 | 2.6 | 0.0 | 10.0 | |
| ***Total (N=186)*** | ***5.9*** | ***6.2*** | ***2.2*** | ***0.0*** | ***10.0*** | |
| **International expertise** | | | | | | |
| SA / A (n=152) | 4.6 | 5.0 | 2.3 | 0.0 | 10.0 | t = 3.302<br>p < 0.05<br>Effect size = 0.23 |
| SD / D / N (n=43) | 3.3 | 3.3 | 2.5 | 0.0 | 10.0 | |
| ***Total (N=195)*** | ***4.3*** | ***4.2*** | ***2.4*** | ***0.0*** | ***10.0*** | |
| **Public reference sources** | | | | | | |
| SA / A (n=150) | 7.2 | 7.8 | 1.9 | 0.0 | 10.0 | t = 2.536<br>p < 0.05<br>Effect size = 0.18 |
| SD / D / N (n=44) | 6.4 | 6.7 | 2.0 | 1.1 | 10.0 | |
| ***Total (N=194)*** | ***7.1*** | ***6.7*** | ***1.9*** | ***0.0*** | ***10.0*** | |

Note: SA = Strongly agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly disagree

Conceptual utilisation of scientific research, which relates to contributing to a better understanding of one's own winemaking, appears to be very much influenced by local knowledge sources. This is evident from the fact that those agreeing with the conceptual utility statement – compared to those who disagreed or remained neutral – scored highest on the measure of the importance of local expertise (Table 6.7). The same group also scored highest on the measure of the importance of the practical knowledge of others. Better understanding of one's own winemaking because of scientific research is therefore facilitated by local sources of expertise as well as by the practical knowledge of others. Different interpretations in this regard are possible. In some cases, for instance, the sources consulted can provide the relevant research evidence that enables clarification and better understanding of one's winemaking. It is also possible that discussions and interactions between the winemaker and the relevant knowledge can produce insights that clarify the relation of some research findings to practice, thus resulting in better understanding of one's own winemaking.

**Table 6.7: Statistically significant differences in mean scores (out of 10) on two knowledge source components, by whether or not winemaker agrees with statement about CONCEPTUAL utilisation**

| | Mean score | Median score | Standard deviation | Lowest score | Highest score | Significance |
|---|---|---|---|---|---|---|
| **Local expertise** | | | | | | |
| SA / A (n=171) | 6.1 | 6.7 | 2.0 | 0.0 | 10.0 | t = 5.252<br>p < 0.05<br>Effect size = 0.36 |
| SD / D / N (n=15) | 3.3 | 3.3 | 2.0 | 0.0 | 6.2 | |
| ***Total (N=186)*** | ***5.9*** | ***6.2*** | ***2.2*** | ***0.0*** | ***10.0*** | |
| **Practical knowledge of others** | | | | | | |
| SA / A (n=175) | 6.0 | 5.6 | 2.2 | 0.0 | 10.0 | t = 2.002<br>p < 0.05<br>Effect size = 0.14 |
| SD / D / N (n=17) | 4.9 | 4.4 | 1.7 | 0.0 | 6.7 | |
| ***Total (N=192)*** | ***5.9*** | ***5.6*** | ***2.2*** | ***0.0*** | ***10.0*** | |

Note: SA = Strongly agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly disagree

Those who agreed that scientific research findings have strengthened some of their beliefs about winemaking, compared to those who disagreed or remained neutral, attributed higher value to four of the five measures of the importance of knowledge (Table 6.8). The only knowledge component not featuring is own practical knowledge. This implies that external sources of knowledge, rather than internal sources, are required to back existing beliefs. Either the necessary supporting evidence is channeled through these external sources or the interaction with these sources provides insight as to what extent available research supports an existing belief.

**Table 6.8: Statistically significant differences in mean scores (out of 10) on four knowledge source components, by whether or not winemaker agrees with statement about SYMBOLIC utilisation**

| | Mean score | Median score | Standard deviation | Lowest score | Highest score | Significance |
|---|---|---|---|---|---|---|
| **Local expertise** | | | | | | |
| SA / A (n=151) | 6.2 | 6.7 | 1.9 | 0.5 | 10.0 | t = 3.704<br>p < 0.05<br>Effect size = 0.31 |
| SD / D / N (n=34) | 4.5 | 4.5 | 2.5 | 0.0 | 9.5 | |
| ***Total (N=185)*** | ***5.9*** | ***6.2*** | ***2.2*** | ***0.0*** | ***10.0*** | |
| **International expertise** | | | | | | |
| SA / A (n=155) | 4.5 | 5.0 | 2.3 | 0.0 | 10.0 | t = 2.386<br>p < 0.05<br>Effect size = 0.17 |
| SD / D / N (n=39) | 3.5 | 3.3 | 2.5 | 0.0 | 10.0 | |
| ***Total (N=194)*** | ***4.3*** | ***4.2*** | ***2.4*** | ***0.0*** | ***10.0*** | |
| **Public reference sources** | | | | | | |
| SA / A (n=154) | 7.3 | 7.8 | 1.9 | 0.0 | 10.0 | t = 2.901<br>p < 0.05<br>Effect size = 0.21 |
| SD / D / N (n=39) | 6.3 | 6.7 | 2.1 | 1.1 | 10.0 | |
| ***Total (N=193)*** | ***7.1*** | ***6.7*** | ***1.9*** | ***0.0*** | ***10.0*** | |
| **Practical knowledge of others** | | | | | | |
| SA / A (n=154) | 6.2 | 6.7 | 2.2 | 1.1 | 10.0 | t = 3.015<br>p < 0.05<br>Effect size = 0.21 |
| SD / D / N (n=38) | 5.0 | 4.4 | 2.2 | 0.0 | 10.0 | |
| ***Total (N=192)*** | ***5.9*** | ***5.6*** | ***2.2*** | ***0.0*** | ***10.0*** | |

Note: SA = Strongly agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly disagree

Persuasive utilisation, or the ability to persuade others to do things differently in their cellar, appears to be influenced by the winemaker's access to international knowledge sources (Table 6.9). In other words, those who stress the importance of international expertise as a source of knowledge, implying that they also interact with such sources, will be more likely to possess knowledge about international best practices and developments, thereby placing such a winemaker in a better position to persuade fellow-winemakers to do things differently.

**Table 6.9: Statistically significant differences in mean scores (out of 10) on one knowledge source component, by whether or not winemaker agrees with statement about PERSUASIVE utilisation**

| | Mean score | Median score | Standard deviation | Lowest score | Highest score | Significance |
|---|---|---|---|---|---|---|
| **International expertise** | | | | | | |
| SA / A (n=89) | 5.0 | 5.0 | 2.1 | 0.0 | 10.0 | t = 3.961<br>p < 0.05<br>Effect size = 0.28 |
| SD / D / N (n=104) | 3.7 | 4.2 | 2.4 | 0.0 | 10.0 | |
| ***Total (N=193)*** | ***4.3*** | ***4.2*** | ***2.4*** | ***0.0*** | ***10.0*** | |

Note: SA = Strongly agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly disagree

To conclude, in none of the above associations between utilisation type and knowledge source component does own practical knowledge seem to feature. It must be remembered that "type of utilisation of scientific research" refers to the uptake of knowledge – which can be either a mental or behavioural activity – whereas "knowledge source component" refers to the sources of information input. However, because own practical knowledge implies knowledge that is exhibited in practice, this particular knowledge source component is more than just an information source (input) because it also contains within itself the uptake component (action). Differently put, practical knowledge is a source of information that is "common sense" to the holder thereof and for that reason is also exhibited in action without even the slightest doubt about its appropriateness (Geertz, 1983). Being an integrated knowledge input/action construct, internalised practical knowledge can subconsciously serve as a reference against which the merit and eventual use of external knowledge is assessed.

### 6.3.4 Two Broad Measures of Utilisation

Up to now attention has almost exclusively been devoted to four statements that represent four utilisation types. As shown in Table 6.10, the survey included altogether 11 utilisation statements and all of these will now be considered. Specifically, a PCA was performed on the entire set of items to determine whether there are any natural groupings of items, based on the structure of their inter-correlations. As with the PCA performed on the knowledge source items in Section 5.3.4, these natural groupings – which correspond to underlying

components – were used to create new measures of utilisation. Each new measure is composed of items that significantly load on a particular component.

Three components were extracted during the first round of PCA, where the stopping criterion was specified as 'eigenvalue > 1' and an orthogonal rotation (VARIMAX) performed. The extracted components accounted for altogether 70% of the original variance in the set of items, as can be seen in solution 1 in Table 6.10. The shaded cells indicate component loadings greater than 0.50, which can be regarded as both practically and statistically significant loadings.

After inspecting solution 1 it was decided to drop one item from the analysis. The applicable item ("Have not added any value to my winemaking") was excluded because the absolute size of two of its loadings were deemed too close (0.58 and 0.43), thereby making this item factorally complex. A new PCA was therefore specified but this time with only ten items. This produced solution 2 in Table 6.10, which consists of two components and explains 62% of the variability in items. However, it was established that the percentage of explained variance could be increased to 67% if one of the items were to be removed ("Have led me to become more experimental in my winemaking"). The latter item was therefore dropped, which resulted in solution 3 being accepted as final.

**Table 6.10: Extracted components and their loadings per item, based on a PCA performed on 11 statements concerning scientific research findings on winemaking**

| Scientific research findings on winemaking … | Component solution 1 (70% variance explained) | | | Component solution 2 (62% variance explained) | | Final component solution (67% variance explained) | |
|---|---|---|---|---|---|---|---|
| | C1 | C2 | C3 | C1 | C2 | C1 | C2 |
| Have caused me to change some aspect of my winemaking | **0.75** | -0.14 | 0.36 | **0.83** | -0.16 | **0.83** | -0.17 |
| Have strengthened my personal belief(s) concerning winemaking | **0.80** | -0.11 | 0.17 | **0.80** | -0.12 | **0.81** | -0.12 |
| Have led me to do things differently in my winemaking | **0.73** | -0.20 | 0.29 | **0.78** | -0.22 | **0.79** | -0.22 |
| Have led me to become more preventive in my winemaking | **0.80** | -0.04 | 0.09 | **0.76** | -0.05 | **0.79** | -0.04 |
| Have led me to develop a better understanding of some aspect(s) of my winemaking | **0.79** | -0.24 | 0.15 | **0.77** | -0.25 | **0.79** | -0.25 |
| Have led me to advise other winemakers to do things differently in their winemaking | 0.27 | -0.17 | **0.73** | **0.55** | -0.22 | **0.52** | -0.24 |
| ‡ Have led me to become more experimental in my winemaking | 0.15 | -0.06 | **0.85** | 0.49 | -0.11 | | |
| # Have not added any value to my winemaking | **-0.58** | 0.43 | 0.01 | | | | |
| Are too fragmented to be of use in my winemaking | -0.10 | **0.91** | -0.16 | -0.14 | **0.92** | -0.13 | **0.92** |
| Are too complex to be of use in my winemaking | -0.09 | **0.90** | -0.10 | -0.10 | **0.91** | -0.10 | **0.91** |
| Only serve the interests of academics | -0.37 | **0.73** | -0.07 | -0.35 | **0.74** | -0.36 | **0.73** |

# Item deleted after inspection of component solution 1 ‡ Item deleted after inspection of component solution 2

Table 6.11 shows the labels that were assigned to the extracted components, based on an examination of the wording of individual items:

- Component 1 can be regarded as a measure of overall utilisation of scientific research findings in winemaking because it incorporates different utilisation types (conceptual, instrumental, symbolic and persuasive). Since six items are used to measure the same concept (utilisation) it makes sense that these items together better capture the nature of the concept than any item on its own. The newly created component therefore combines the different utilisation types in a single measure. Scoring, as soon to be explained, was executed in such a way that the maximum score on the measure indicates an individual who display all utilisation types.
- The three items on the next component highlight the relevance and suitability of scientific research in relation to winemaking settings. The focus is not on the actual use of scientific research findings but shifts to the winemaker's opinion about such findings and the extent to which they are suitable for use in winemaking practice (e.g. the findings are not too complex or too fragmented). Component 2 can therefore be regarded as an opinion-based measure of the suitability of scientific research findings for use. It will be scored in such a manner that a high score on the measure reflects a favourable opinion concerning the suitability of scientific research findings for use in winemaking.

Table 6.11 also reports the results of two sets of internal consistency reliability procedures, namely the computation of Cronbach's Alpha and item-total correlations. Both components demonstrate good internal consistency, as their Alpha coefficients and average item-total correlations either equal or exceed 0.80. Cronbach's Alpha coefficients of 0.70 are normally seen as indicative of acceptable reliability and the corresponding guideline for item-total correlations – which in reality are Pearson correlations – is 0.5.

**Table 6.11: Labels assigned to final components, together with statistics of internal consistency**

| Component | Item | Item-total correlation |
|---|---|---|
| Overall utilisation of scientific research findings in winemaking (Internal consistency: Alpha coeff. = 0.883) | Have caused me to change some aspect of my winemaking | 0.846 |
| | Have strengthened my personal belief(s) concerning winemaking | 0.817 |
| | Have led me to do things differently in my winemaking | 0.841 |
| | Have led me to become more preventive in my winemaking | 0.791 |
| | Have led me to develop a better understanding of some aspect(s) of my winemaking | 0.825 |
| | Have led me to advise other winemakers to do things differently in their winemaking | 0.673 |
| | ***Average item-total correlation*** | ***0.799*** |
| | | |
| Suitability of scientific research findings for use in winemaking (Internal consistency: Alpha coeff. = 0.854) | Are too fragmented to be of use in my winemaking | 0.914 |
| | Are too complex to be of use in my winemaking | 0.890 |
| | Only serve the interests of academics | 0.837 |
| | ***Average item-total correlation*** | ***0.880*** |

Total scores were subsequently computed for each component. The item scores originally ranged from 1 to 5 (where 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, and 5 = strongly disagree). In the SPSS dataset, the six items that constitute the first component were therefore reverse-scored, starting with zero as the lowest value. In other words, after reversal, 0 = strongly disagree, 1 = disagree, 2 = neutral, 3 = agree and 4 = strongly agree.

Since the three items that constitute the second component all had negative loadings on that component (because the items are negatively phrased), there was no need to reverse the scoring. Differently put, a “strongly disagree” response to any of the three negatively worded items actually implies a positive opinion about the fit of scientific findings for the winemaker’s setting. Thus, all that was required was for the scores to start in zero. This resulted in the following recoding procedure being implemented: 1 → 0; 2 → 1; 3 → 2; 4 → 3 and 5 → 4.

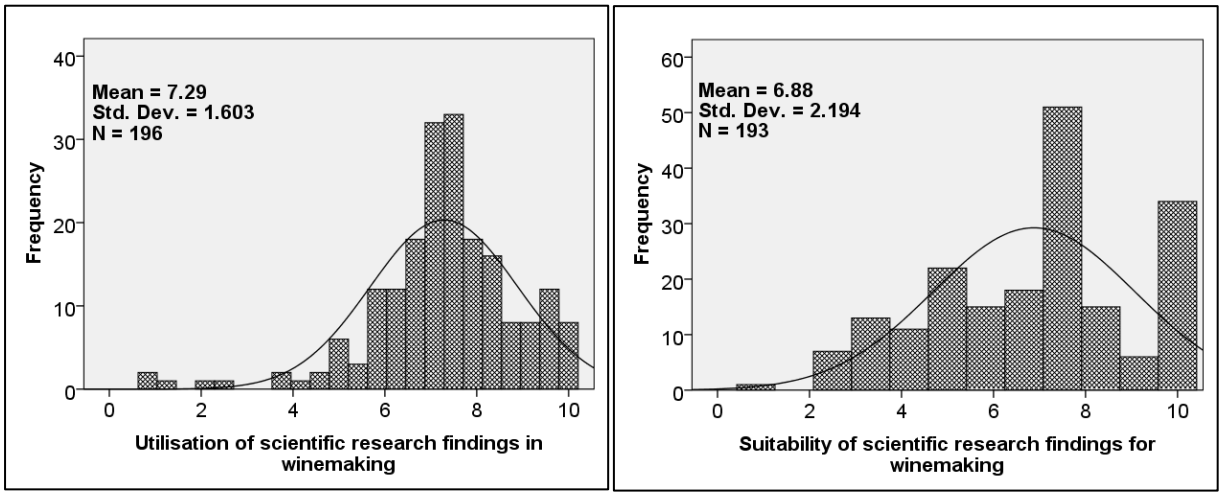
Total scores for the first component could therefore range, in theory, from 0 (i.e. 6 items x 0) to 24 (i.e. 6 items x 4). A high total score for this component (overall utilisation of scientific research findings) indicates that all instances of utilisation mentioned in the statements apply to the respondent. Similarly, total scores for the second component could vary between 0 (i.e. 3 items x 0) and 12 (i.e. 3 items x 4), with a high score indicating a very favourable opinion of the suitability of scientific research for the winemaker’s setting. However, since the respective maximum theoretical scores of the two components differ (24 versus 12), the component scores had to be standardized. This was done by converting all scores to counts out of 10. Thus, after standardization all component scores varied between 0 and 10.

Descriptive statistics for the two components are presented in Table 6.12. The average score obtained on the measure of overall utilisation is 7.3 out of 10, which is markedly above average. The average score on the measure of suitability for use of scientific research is slightly lower (6.9). Moreover, for each component there are respondents who achieved the maximum score possible (i.e. 10). In the case of the first component a score of 10 means that all forms of utilisation apply. In the case of the second component a score of 10 reflects a very positive opinion of the suitability of scientific research for use in winemaking. On the other hand, on neither component did any respondent achieve the lowest score possible, which is zero. Thus, no respondents said that the forms of utilisation do not apply or that scientific research findings are not suitable at all for their winemaking. The distributions of the two sets of component scores are depicted as histograms in Figure 6.2.

**Table 6.12: Descriptive statistics for the two components of research utilisation**

| Statistic | Overall utilisation of scientific research findings in winemaking | Suitability of scientific research findings for use in winemaking |
|---|---|---|
| Mean | 7.3 | 6.9 |
| Median | 7.5 | 7.5 |
| Mode | 7.5 | 7.5 |
| Standard deviation | 1.6 | 2.2 |
| Minimum score | 0.8 | 0.8 |
| Maximum score | 10 | 10 |
| Number of cases | 196 | 193 |

**Figure 6.2: Distribution of scores (0-10) on the two components of research utilisation**




The two utilisation components were subsequently related to each of the nine demographical variables that were used in Sections 6.3.2. This entailed the execution of 18 comparisons of means (see Table 6.13 below), involving either independent t-tests (in cases where the

demographical variable is dichotomous) or one-way ANOVA's (where the demographical variable is non-dichotomous). Only two of these comparisons are statistically significant. Scores on the measure of overall utilisation differed significantly by cellar type, and scores on the suitability measure by age of winemaker.

**Table 6.13: Table indicating demographical variables that are associated with significant differences in mean scores on the two measures of scientific research utilisation**

| Demographical variable | Overall utilisation of scientific research findings in winemaking | Suitability of scientific research findings for use in winemaking |
|---|---|---|
| Member of SASEV | X | X |
| Number of South African wine associations that winemaker is a member of | X | X |
| Type of cellar | √ | X |
| % of wine exported to other countries | X | X |
| Ever worked in a cellar abroad | X | X |
| Number of cellars worked at (current included) | X | X |
| Number of years making wine | X | X |
| Age of winemaker | X | √ |
| Highest relevant qualification completed | X | X |

Relevant statistics for the two statistically significant comparisons ($p < 0.05$) are summarised in Tables 6.14 and 6.15. The tables also provide information about the nature of the significant difference, i.e. which level of the demographical variable differs from which other level(s) of the same variable in terms of mean scores.

As can be seen, Garagiste producers scored lowest on the measure of overall utilisation although their mean score is only significantly below that of winemakers at independent non-estate cellars (Table 6.14). The highest scores are obtained by the five winemakers at the producing wholesalers, which is not surprising as these firms have in-house research divisions where scientific research information is readily available.

**Table 6.14: Demographical variable associated with statistically significant differences in mean scores (out of 10) on the measure of the overall utilisation of scientific research findings in winemaking**

| | Mean score | Median score | Standard deviation | Lowest score | Highest score | Significance |
|---|---|---|---|---|---|---|
| **Type of cellar** | | | | | | |
| Estate cellar (n=71) | 7.3 | 7.5 | 1.4 | 3.8 | 10.0 | F = 2.679 p < 0.05 |
| Independent cellar (n=64) | 7.5 | 7.5 | 1.5 | 2.5 | 10.0 | |
| Producer cellar (n=33) | 7.4 | 7.5 | 0.8 | 5.4 | 9.6 | |
| Producing wholesaler (n=5) | 8.3 | 7.5 | 1.4 | 7.1 | 10.0 | |
| Garagiste producer (n=16) | 6.4 | 7.5 | 2.3 | 0.8 | 9.6 | |
| ***Total (N=189)*** | ***7.4*** | ***7.5*** | ***1.5*** | ***0.8*** | ***10.0*** | |
| Nature of statistically significant differences: Independent cellar > Garagiste producer<br>Effect size based on Omega squared: 0.03 | | | | | | |

Furthermore, winemakers in the youngest and oldest age groups, respectively, obtained significantly higher scores on the measure of the suitability of scientific research, compared to winemakers in the 30-39 age group. It probably makes sense to assume that many of those younger than 30 years are recent graduates and therefore still in the habit of recognising and appreciating the value of what they've had studied (i.e. the scientific approach to winemaking). However, no obvious explanation exists as to why those in the oldest age group hold equally high opinions of the suitability of scientific research. One possibility is that experience – and mature winemakers tend to have plenty of that – can provide winemakers with the necessary lens by which to recognise the potential value of certain aspects of scientific results.

**Table 6.15: Demographical variable associated with statistically significant differences in mean scores (out of 10) on the measure of suitability of scientific research findings for winemaking**

| | Mean score | Median score | Standard deviation | Lowest score | Highest score | Significance |
|---|---|---|---|---|---|---|
| **Age of winemaker** | | | | | | |
| <30 years (n=39) | 7.4 | 7.5 | 1.9 | 2.5 | 10.0 | F = 3.822 p < 0.05 |
| 30-39 years (n=65) | 6.2 | 6.7 | 2.3 | 2.5 | 10.0 | |
| 40-49 years (n=37) | 6.9 | 7.5 | 2.4 | 0.8 | 10.0 | |
| 50+ years (n=37) | 7.5 | 7.5 | 2.0 | 3.3 | 10.0 | |
| ***Total (N=178)*** | ***6.9*** | ***7.5*** | ***2.2*** | ***0.8*** | ***10.0*** | |
| Nature of statistically significant differences: 50 years and older > 30-39 years<br>Younger than 30 years > 30-39 years<br>Effect size based on Omega squared: 0.05 | | | | | | |

Moreover, Pearson r correlations were performed to determine the relationship between the two measures of utilisation and the number of national and internal wine awards received, given that wine awards can be regarded as a proxy for both national and international considerations of quality. Only the measure of overall utilisation of scientific research findings is significantly related to the number of both national awards ($r = 0.188$, $p < 0.05$, N

= 145) and international awards (r = 0.164, p < 0.05, N = 150). Thus, although the correlations are relatively weak (both below 0.2), it nevertheless indicates that higher overall utilisation of scientific research tends to be associated with more quality wine products.

Lastly, correlations were also computed between the two utilisation measures and the five knowledge source components (Table 6.16).

**Table 6.16: Correlation between each of the two measures of scientific research utilisation and the five measures of the importance of knowledge**

| Knowledge source components | Utilisation components | |
|---|---|---|
| | Overall utilisation of scientific research findings in winemaking | Suitability of scientific research findings for winemaking |
| Local expertise | Significant<br>r = 0.466; p < 0.05 (N = 184) | Significant<br>r = 0.235; p < 0.05 (N = 181) |
| International expertise | Significant<br>r = 0.267; p < 0.05 (N = 193) | Significant<br>r = 0.242; p < 0.05 (N = 190) |
| Public reference sources | Significant<br>r = 0.318; p < 0.05 (N = 192) | Not significant<br>r = 0.130; p = 0.075 (N = 189) |
| Practical knowledge of others | Not significant<br>r = 0.067; p = 0.360 (N = 191) | Not significant<br>r = 0.056; p = 0.445 (N = 188) |
| Own practical knowledge | Not significant<br>r = 0.059; p = 0.410 (N = 196) | Not significant<br>r = 0.042; p = 0.560 (N = 193) |

The valuing of local expertise is the strongest correlate of the overall utilisation of scientific research (r = 0.466), followed by the valuing of public reference sources and international expertise respectively. Correlations between the suitability measure, on the one hand, and measures of the importance of local and international expertise, on the other hand, generated two significant results. Perceptions of the suitability of scientific research findings for winemaking therefore correspond with the degree of importance attached to both local and international sources of expertise. This is no surprise as it means that those who regard local and international expertise as important for their winemaking also recognise the suitability and applicability of scientific research findings.

In conclusion then, there are moderately strong correlations between the measure of overall utilisation of scientific research and the ratings of importance attached to factual and potentially factual knowledge (local and international sources of expertise and publicly available reference sources). Moreover, the statistically insignificant and weak correlation between the measure of overall utilisation and the measure of own practical knowledge should be seen against the backdrop of little variability in the ratings of own practical knowledge. The majority of respondents rated own practical knowledge as extremely important for their winemaking (see again Table 5.22 in Chapter 5). Measures displaying

homogeneous ratings typically produce weak correlations when correlated with other variables.

The focus on scientific research findings – or factual knowledge – will now shift to a discussion of practical knowledge, specifically the intuitive element of practical knowledge and its association with sense-impressions. The insights are based on the interviews conducted.

## 6.4 INTUITION, SENSE-IMPRESSIONS AND EXPERIENCE AS ELEMENTS OF PRACTICAL KNOWLEDGE

One expression of practical knowledge is intuition, often experienced as a gut feeling. The winemakers interviewed were asked when they normally experience such a sense of intuitive knowing. Four sets of insights concerning intuition emerged from the interviews. According to the first, intuition is similar to inspiration, i.e. the unique and subconscious flow of ideas and approaches that are characteristic of creative instinct. The second insight emphasises the role of the senses in knowing intuitively although sense-impressions (sensory knowledge) is not really a form of intuition (intuitive knowledge). Thus, the second insight concerning intuition calls for an examination of the relation between intuition and the senses. The third insight views intuition as immediate knowledge that springs from a link between past experiences and current events. Lastly, intuition is also seen as occurring when all the facts of a matter are considered and the missing pieces of the puzzle are filled in by sensory assessments.

The first insight, intuition as inspiration, implies that the practice of winemaking is both science and art, given that inspiration is often synonymous with the skilful performance of an artist.

> *Why I decided to swot oenology is because it really is the point where science and art interact. You cannot tell a guy, take this paintbrush and these bits of paint and, say, listen, now you must paint this scene because you cannot really tell him which colours … he will leave his own imprint or many times he'll impress his own personality on the wine. So you get your raw products, you get barrels and stainless steel tanks and the grapes and wherever you would go and buy it from, but the manner how you apply your techniques and the way you approach the grapes many times will become almost part of your personality. So that intuition, most of us more or less have very good background knowledge as to how to make wine, the basics we know, but how you actually connect*

*the things and what you … that is very much internal. (Winemaker C; translated from Afrikaans)*

The winemaker mentions the presence of background knowledge and raw products and materials, which are the building blocks of winemakers, the same way that paint and brushes comprise the tools of the artist. However, the way that everything is brought together to achieve the end-product (wine in this case), occurs intuitively, with the result that wine becomes an expression of the winemaker's "personality". Moreover, it is assumed that some of the actions and decisions involved would be non-codifiable, as creative instinct is highly internalised and a tacit form of "knowing what to do". The creative instinct characterising the work of a winemaking expert is like connoisseurship. It involves "a skill that works its results in practice" but this special skill lacks "both a comprehensive statement of method and a rationale for that method" (Ebitz, 1988:209).

The second insight concerning intuition, which emphasises the role of the senses in knowing intuitively, needs to be treated carefully as sense-impressions cannot only be thought of as a form of tacit knowing (Cannon, 2002) but, according to others (e.g. Pears, 1971), also as a different type of knowledge altogether. Knowledge of general things, like colour and taste which point to the state of things, constitutes for Pears (1971) an additional form of knowing that can best be described as acquaintance. According to Pears there is also some connection between acquaintance and factual knowledge, as being acquainted with the state of things on the basis of certain sensory sensations implies additional information about the object of acquaintance. Thus, when making an inference about the state of the wine-in-making on the basis of a visual or olfactory sensation, some piece of factual knowledge also comes to mind, for instance, that some aspect of the wine, when measured, will lie outside acceptable boundaries.

The human senses relate to the act of knowing in different ways. For instance, awareness of a particular sense-impression can trigger the winemaker's implicit knowledge. In Polanyi's (1966) terminology, through the senses, the winemaker has immediate recognition of the distal (the state of affairs) without having conscious awareness of the proximal (the particulars or rules that guide the diagnosis of the state of affairs). A different take on Polanyi's image of moving from the proximal to the distal, according to Cannon (2002), is that the sensory features operate as the proximal and the recognition of the state of affairs as the distal. Although the subject is consciously aware of the sensory features, it is the relation between the proximal and distal that is implicit and which can or cannot be made explicit. Cannon also views sense perceptions as clues to joint meaning and presents the

stretch between the "from" (proximal) and the "to" (distal) as a tacit stretch, a form of instant relational contact with the reality that is being perceived.

> Sensory appearance is a genuine appearance of the object, not separate from or additional to it but *a co-relation of a perceiver to it and it to a perceiver*. It is an access to the object that is finite, limited, and to some extent colored and shaped by (1) the perceiver's perceptual placement and orientation with respect the object, (2) the perceptual capacity of the perceiver, (3) the acuity of the perceiver's sense organ(s), (4) the attention of the perceiver, etc. But on Polanyi's account, the perceiver is not on the hither end of a causal chain of events stretching from the object to her brain, trying to imagine and infer what must have produced these effects. Rather, the perceiver goes right up to the object perceived, touching it, exploring it, examining it, indwelling it (Cannon, 2002:34).

The following quotes provide examples of a winemaker immediately recognising the state of affairs when experiencing the particular sense-impression – almost to the extent of "in-dwelling" it – resulting in the winemaker also knowing how to proceed.

> *But you know, a lot of the time in the morning when I walk into the cellar I smell … the smell of the cellar will tell me if there is a tank with a problem and thereafter you need to find which tank it is and normally I know the smell, what it needs, normally it will be a nutrient inefficiency. (Winemaker E)*

> *One can look at the wine, even before you test it you can tell whether it's got a high pH, like if I look at a wine… it's not always like it but a lot of time, if I look at the wine and it's got a slight touch of mould in it, for a young wine, I know it's going to have a high pH. I'm pretty sure if I did a pH on it, it's going to be up near four. And as soon as that happens then I realise I need to give it more sulphate. (Winemaker E)*

> *A big indicator for me is when I see my red grapes been poured into the tank. How the red, the pigment, stains the sides of the tank. If it doesn't stain at all, you know you've got a difficult year for colour. If it makes a red sort of, you know, sort of stain on the side of the tank, you know it is a good year for colour. And I think colour is, specifically in red … in white as well … colour is crucial, it's so important, that healthy colour. If I'm looking at a person, if you can see they look healthy and fit, you know, they're not gonna give you any* [trouble]*… a sickly kind of person, you know, they're not gonna last ... The appearance of a wine, I'm afraid, for me it is vitally important. That good, rich, deep sort of red colour in a red and then a nice green for young white, that green pinch I always think is a very good sign. (Winemaker E)*

Sensory perceptions, as a way of knowing by acquaintance, can therefore unlock a winemaker's intuitive knowledge. Intuitive knowing, as stated above, is a process whereby the state of affairs (distal) is instantly and consciously recognised on the basis of implicit and

subconscious knowledge of the underlying particulars (the proximal). Although the proximal, or the rules of knowing, is implicit, it can sometimes be reflected upon and expressed as propositions. Once implicit knowledge can be verbalised or expressed in one's mind as propositions it has the potential of being codified and thus becoming explicit knowledge. The following quote involves a situation where an experienced winemaker is asked by a younger winemaker to explain the underlying principles of immediate knowing on the basis of sense-impressions. The experienced winemaker could verbalise the signs or rules of knowing.

> *My* [an elderly family member who is also a winemaker]*, for instance, would pass a tank and then he would say, listen, this tank has a problem. And then I would ask, hell, how you know that and then he would respond that these and these and these are the signs. (Winemaker D; translated from Afrikaans).*

However, there are also instances of knowing intuitively (through the associated sense-impressions) where the underlying rules of knowing cannot be verbalised. In such instances the implicit knowledge remains inherently tacit.

> *When it comes to the finer things, you really cannot tell someone, okay, good, this is why so and so. You just had a sensing at a particular moment, yes, this might work better and it will be based on knowledge that you've already had or things that you've already experienced or people that you've already spoken to … So it is not an airy fairy kind of thing. It's definitely based on knowledge but some people's knowledge may not necessarily be the same as yours. (Winemaker C; translated from Afrikaans)*

For one interviewee, intuition needs to be scientifically justifiable in order to produce wines that meet basic criteria of quality ("fantastic wines"). He nevertheless admits that intuition without scientific foundation (such as "picking on feel") has some existence but only in the few instances where quality is determined by the eccentricity of the winemaker, as is the case with some top end wines (Ponte, 2007).

> *What I don't believe in, and this is actually quite important … I haven't got a problem with picking on feel, there are people doing that, I know a guy* [in another new world wine country] *doing that but he's only making top end wines where he can afford to make blunders and mistakes. But I don't believe on picking on a hunch or a gut feel when it comes to sugar levels and things like that. That is pure fantasy and, you know, there is no room for that ... If you are not technically or chemically based, I don't believe you can actually make the most fantastic wines. (Winemaker A)*

Moreover, some interviewees are also not convinced that winemakers really rely on intuition, as they believe that intuition springs from an underlying knowledgebase that incorporates experience. They even doubt whether the word "intuition" captures the essence of the process of instant recognition and implicit knowing. For them it is more the case of a reinforced link between past experiences and certain sense-impressions, which results in "sharpened senses". Thus, instant recognition occurs where a close association has been established between a past event and a sense-impression, and if the winemaker now smells (or sees or tastes or feels) that very same thing in the present, it will remind him/her of the corresponding event in the past. In the words of one of the winemakers, the moment the connection is made, "little bells will start ringing inside you".

> *A few basic things pertain to winemaking, a few basic things such as your sense of smell. If you were to pick up some strange smell or a pleasant smell, little bells will start ringing inside you. There are one or two basic analyses, if you look at the analysis, then the analysis will tell you a few things. I think it is most probably that which winemakers tend to interpret as intuition. Intuition, I don't think it is some sort of gut feel where they say, ah, I've got something here. There is something that makes them think they get the gut feel. So I think the word is a bit misused but again, with experience it is so that the more experience you have, the fewer of those things you need to derive at a conclusion or to take a particular course of action without having doubt. I think the word intuition is a little bit diluted. (Consultant B; translated from Afrikaans)*

> *It is from years of experience that one gets that intuition, in any stage of winemaking, from the beginning. I mean, if the grapes coming in are too hot, then you know you need certain steps because … past experience told you these and these problems will emerge… I think it is more … it's less intuition and more past experience, knowledge, and transferred knowledge than anything else, in my personal opinion. And, additionally, it also has a lot to do with the senses, I mean, smell and taste, which can tell you … I mean, If you have a good sense of smell and a good sense of taste you can … You can say it's intuition but in fact it is just your sharpened senses. (Winemaker D; translated from Afrikaans)*

The above interviewee therefore argues that knowing through the senses is not an example of intuitive knowing. It is simply based on good uses of the senses. This underscores the commonly accepted juxtaposition between intuition and the senses. Intuition is often seen as mysterious, non-scientific, speculative and even irrational, whereas sensory perceptions are based on empirical reality and sensory data, and for that reason regarded as scientifically acceptable.

Intuitive knowing furthermore involves a process of pattern recognition based on past experiences. Past situations are stored in one's memory as individual exemplars or some aggregation of exemplars, and new situations are continuously matched against these exemplars (Norman, Young & Brooks, 2007). Thus, representations of past experiences form part of the knowledge stock of winemakers. Winemakers unwittingly tap from this stock when confronted with challenges in their winemaking. As a result, the different elements of a challenge are often instantly clear in the mind of experienced winemakers, as implied by the following individual who has more than 20 years of winemaking experience.

> *If I sense a problem, 80, 90 percent of the time I'll have a good idea why, from experience. (Winemaker E)*

Winemakers, upon reflection, also intentionally match aspects of their current situation to similar situations encountered in the past. In that way, recollection of past events can direct them to exhibit greater awareness, prevention and pro-activity in the present. Some winemakers interpret the insight sparked by the matching of past and present events as another instance of intuition.

> *So I think experience has a big part to play … like the tank that tends to get stuck, often tends to be the same grapes each year. So your intuition would say, hang on, we won't want to look at those with crappy yeast, we'll try maybe to give it a decent one to help it on its way. Your intuition would tell you to do that. (Winemaker A)*

> *So it is experience, and I think it relates to experience over years, during which he* [family member who is an experienced winemaker] *has built that knowledge, that's why one gets that intuition … Or he would taste the wine and say, listen, you need to filter it immediately otherwise it is going to develop a problem. Then I would say but I still don't get any VA* [volatile acidity] *or other fault and he would say, no, just wait, you'll see. Then I would do the analyses, just to discover, hell, it is busy picking up slowly. I think it is the result of years of experience. (Winemaker D; translated from Afrikaans).*

> *Look every vintage is different. It is like watching a game of cricket or rugby. Same rules, it is the same game, but every game you watch is different. You can say it is a similar game to that or it is a similar vintage to that vintage ... That's what I do as a winemaker, when the season starts, I said, okay, what is this season like … which years does it remind me of? Okay, in that year we had a problem with acids … so I must keep an eye on that. (Winemaker E)*

Normally the network of exemplars and inter-connective knowledge parts becomes more dense and populated with experience (Stolper et al., 2010). If, for some reason, the elements of a new challenge cannot be successfully matched to anything similar within this dense network, either subconsciously or consciously, it can easily lead to confusion and strain, even among the most experience winemakers.

> *I've been making wine for twenty one years now. So I mean if something crops up and I don't know what it is and I can't worked out why it happened I get very nervous very quickly and often I get desperate. (Winemaker E)*

So far we have elaborated on three insights pertaining to intuitive knowledge, namely that intuition is similar to inspiration, that sense-impressions can unlock or trigger intuitive knowledge, and that intuition springs from instant recognition of a link between previously and currently experienced events. However, a fourth insight also emerged from the interviews, whereby intuitive knowledge – interpreted in this context as immediately knowing the state of affairs and how to proceed – results from the consideration of the relevant facts and the filling of any blanks with sensorial assessments. Thus, sense-impressions, according to this perception, serve to complement available information and data. One winemaker clearly brings the point across.

> *What your job is as the winemaker is to have absolute understanding … You've got all the information, the block that the vineyard is growing on, the rootstock, the clone, the aspects, the closeness to the sea, the terroir, the soil, the climate exchange … you know all of those things, what effects those things will have on the wine, okay … When you bring it in* [the grapes] *… you have an idea, maybe call it a hunch but you have a pretty good idea of what it should be ... It's still about having a recipe certainly but it is trying to have as much information as possible. You know, you want as many pieces of the jigsaw to technically get what is possible and you need to fill in the blanks with the sensorial qualities … So, you need to have that information but you need to have as much backing as possible, that's really what I would say otherwise you can't … you can't make the better of the judgement … It's like any profession. You have as much information as possible, you never have everything otherwise it would never be a decision … But you need to have everything to make that decision or as much as you can. (Winemaker A)*

> *You are going to see very quickly what are the … traits, and of course, you have a very good idea already before you pick …. If you are doing that, and that's another factor, you know, if you're doing that, than you … you will have a good idea and then you will get a gut feeling of what to do in the winery, yes. (Winemaker A)*

A similar insight is shared by the winemaker who renders services as a winemaking consultant.

> *It could be intuition but it's also based on actual data. You should know what happened in your winter, you should know what happened in your spring, you know, things like how it affected budding, how it affected flowering, how it affected the actual formation of berries and the whole built up towards ripening, you know, because that will all give you clues as to what you could expect and you might not … You know, you might not hit the jackpot, but you're going to be very close. (Consultant A)*

Having all the relevant facts therefore contributes to "absolute understanding" of what is about to be achieved and acts as a springboard for intuition and gut feeling. The relevant information is consciously gathered and registered at all stages, from the vine to the wine, and is also strongly related to an envisaged end-product. It is therefore not surprising that one winemaker, when asked during what stage intuition becomes most prominent, has no hesitation in linking the emergence of intuition to "day one".

> *Day one … I almost want to say as from the day that the little stick is planted in the soil, the rootstock, clone, you know, those kinds of things ... Look we know certain clones, it has been proven by research and also in practice … certain clones generate certain aroma characteristics. So when you plant the vineyard you have a certain end goal in mind … I mean, you're not just going to plant something for the sake of planting. You're going to plant it for a reason. Whether it is for brandy of for a top class Chardonnay, or whatever, you're planting it for that goal. And then you will select your soil, the location, etcetera, etcetera, you will do it all accordingly … And I think at the end of the day when you've planted it, when you have established it and you harvest your grapes, from that day onwards you should know in what direction it is going, and then you must try to steer it in that direction, if I can put it that way. (Winemaker B; translated from Afrikaans).*

The above quote, with its reference to "steer it in that direction", reminds of the rationalistic style of knowledge application encountered in Section 6.2, where the winemaker works "towards the bull's eye". In that context the winemaker regularly assesses the condition of the wine-in-the-making. Decisions are taken to close the gap between the actual condition and some ideal reflected in a set of parametres defined before the harvest, on the basis of previous years' information. Sense-impressions, as stated in a previous quote, can "fill in the blanks" and, specifically in this broad context of application, provide an indication of the direction that the wine is taking and to what extent it deviates from the ideal. The colour and

size of grapes at the time of harvest provide a good example of how a particular sensorial assessment can help to judge the direction of vinification.

> *You need to look at the colour of the grapes and if you have smaller berries – specifically with red – smaller berries with a dark colour, then you know you're gonna get a more prominent colour and aroma extract. So that will give you an idea of what to do with it later on … how long skin contact should be, whether you … if you're going to put it in barrels at a later stage, ferment it with chips or whatever. You know, those things* [the sensorial features] *will give you an indication of what to do. (Winemaker B; translated from Afrikaans)*

Also with regard to the main approaches to winemaking – where a winemaker respectively "acts as a doctor" and "performs manipulations to achieve style" – sensorial assessments are decisive. The quote below highlights an extreme case of the winemaker-as-doctor scenario, which goes beyond the minimalistic approach, as a crisis in a winery is experienced and the help of a specialist (in this case the winemaker acting as a winemaking consultant) is called in. Even in this scenario, which requires crisis intervention, sensorial assessment is indispensable as the specialist winemaker first insists on tasting all the wines in order to separate "terminally ill wines" from those with a more positive prognosis.

> *I went there and I tasted every single wine. I told* [the client] *I am not starting on a contract … unless I have tasted every single wine in the winery. Tasted it, report, and basically tell him what all the skeletons in the cupboard are. You know, basically give him an allocation of wines that are still okay, wines that must be fixed and wines that must be destroyed. (Consultant A)*

Tasting assumes an equally significant role during the process of manipulating wine to achieve desirable styles. For instance, in the case of the winemaker whose winery is run as a family business, the whole family participates in the tasting of wine samples derived from different manipulations. The final manipulation to be decided upon is therefore very much determined by the human palate.

> *We normally get the family together, that they can taste the different samples prepared in small quantities, and then we decide which manipulation we would implement. (Winemaker D; translated from Afrikaans)*

> *I believe very much in tastings, where you go out in the market, you see what is successful, and you bring it back and you taste it again against your own wine and you*

> *see where you fit in, you know. Because the worst mistake you could make is to work in a bubble, thinking you make this wonderful wine that everybody loves and you know you haven't consulted anybody. (Consultant A)*

What the above quote by the winemaking consultant reveals, is that tasting – even if not performed to evaluate the results of some kind of manipulation – can provide a sense of how one's own wines, and specifically the styles associated with it, compare with those that have achieved commercial success. In that way tasting can influence the route that one eventually decides to take with one's own wines, in terms of style, as well informing any manipulations flowing from that decision.

This concludes the discussion of intuition, sense-impressions and experience as elements of practical knowledge. The use of scientific research findings, which represent factual knowledge, was already covered in a previous section. A question still remaining is about the relation between and the preferred order of use of factual and practical knowledge. This is the topic of the next section, which opens with a discussion of the comments of winemakers and consultants regarding the knowledge sources commonly used in their winemaking practice.

## 6.5 WINEMAKER PERCEPTIONS ON KNOWLEDGE SOURCES AND THEIR USE

### 6.5.1 More about the Knowledge Sources that Winemakers Use

This section is devoted to a brief discussion of the comments of winemakers and consultants on the knowledge sources that characterises their winemaking practice. As said, the particular order in which the knowledge sources (factual and practical) are used, which hints at the relative importance of knowledge sources, is the topic of discussion in Section 6.5.2. The focus for now is on comments relating to the knowledge sources only.

*Wynboer* in the WineLand magazine is a source of knowledge referred to by many winemakers in the survey. In the interviews it was the Garagiste producer who stressed the relevance of the publication for his practice, emphasising the fact that it comprises a good "source of reference".

> *In those magazines, you know, there is always a good article that one uses or can use. You know, even if only in respect to some technical … of course, you also get examples of equipment and, you know, items that one can practically use in the cellar ... Look, in*

> *the Wynboer there are indeed research articles also, which, for me, makes it a well-balanced magazine. And there you can get it* [the results] *much more … I almost want to say much more processed. I don't get the other magazines* [SASEV journal] *but I comfortably use Wynboer, you know, as an easy source of reference. (Winemaker F; translated from Afrikaans)*

The independent winemaking consultant explains the appeal of *Wynboer* to Garagiste producers, by linking the non-complexity of article content to the producers' interest in winemaking as a side activity.

> *For them* [Garagiste producers] *winemaking is almost a hobby, meaning they don't have the background knowledge. They never really had any background in that regard. They are not looking for any complexity. They just want to know what it is that they must do. (Consultant B; translated from Afrikaans)*

The independent consultant is a skilled author himself who publishes in WineLand. He appears to be in touch with the magazine's readership, when emphasizing that the presentation of information should be stripped to the bare essentials, which, in his case, means mainly building a user-friendly discussion around the conclusions and recommendations of a typical scientific article.

> *If you look at WineLand specifically, and the technical component* [Wynboer], *if you look at the articles that they publish, then the experience of the magazine is that the moment you come with an article that runs over one page, the tendency is that it will not be read. So you need to make it as short and concise as possible, that's the first point. The second is that readers don't like to be exposed to ten graphs and tables, and pages that are full of data. They won't read it. All they want is the conclusion or they want to see the results. They are not interested in the method used in the research, etcetera, etcetera. They just want to know what it says. That's what I focus on. I never write an article of more than one page. In other words, about 700, 800 words and I also illustrate my points. That the people will read. But if you come with two, three, four pages with lots of scientific data, forget it. Nobody will bother to read. (Consultant B; translated from Afrikaans)*

<u>Manuals and textbooks</u> represent another easily accessible reference source to winemakers. One winemaker describes how she regularly consults manuals and textbooks in order to familiarise her time again with tasks falling on the outskirts of her normal routine.

> *Every week. With many of the trials and small little things that … hell, it was just yesterday that I was busy with the dressing of brandy, when I quickly had to look up again about brandy, just to review everything again, exactly how to do it, from the tedious calculations to the legal aspects because if you don't do it on a regular basis, you quickly need to look up those little things again. (Winemaker D; translated from Afrikaans)*

The same winemaker also underscores the value of scientific articles in her practice ("I read many articles") but claims that the reductionist nature of science – the controlling for and exclusion of external factors – often alienates the contents of scientific articles from reality. Also, the methods used in trials reported in scientific articles at times rely on expensive equipment or materials that are not readily accessible to the average cellar. To generate the same effects without the applicable equipment, especially when some high manipulation is required to achieve style, the winemaker needs to fall back on personal knowledge to find alternatives.

> *Most scientists have never made wine per se. They come out of university and they carry on with their science activities. They do trials that were previously performed by others and those are not necessarily executable in a practical environment, I mean, in a cellar environment. It's all fine to make wine in buckets, on an experimentally small scale, but when you actually need to do it on big tanks and machines that are standing there, it is not always possible. So you always need to adjust for those situations, with knowledge that you have acquired through the making of other plans. This is the only big problem, you have these wonderful … I mean, ideals in the scientific world. There are many external factors that scientists have cut which they cannot cut in the real world. This is where personal knowledge of environment obviously plays a big role, and of your own situation, what you have at your disposal in your cellar. I mean, if you do not have a micro-oxygenation machine, then you can do what you want unless you can get that amount, I mean, produce a few million Rands, you need to find a different way to do a certain manipulation. You need to look at what you have at your disposal because you don't always have everything at your disposal. (Winemaker D; translated from Afrikaans)*

The winemaker is implying that the worlds of science and practice are two very different "worlds". They are like different realities, with different rules applying. This reminds of the two-communities metaphor by Caplan (1979), which is based on a culturalistic conception of knowledge utilisation, stressing the distinctiveness and separateness of the knowledge production and utilisation domains. Most of science is also done according to reductionism, meaning "the splitting down of a system into its component parts, and then studying these bits in isolation" (Goode, 2005). In the world of science, factors that are external or

peripheral to a particular study are normally excluded whereas, in practice, the making and drinking of wine is a holistic experience. Thus, although the above winemaker respects the knowledge that is produced in the world of science, it is certainly not the be all and end all as far as she is concerned.

The same winemaker also places a high premium on tradition or knowledge that is passed on through generations. It involves "intimate" knowledge pertaining to both the cellar and the vineyard. The knowledge is also codifiable as it can be expressed as verbal propositions although it has not been documented.

> *We are a family business. So much of the knowledge is transferred from generation to generation and, I mean, the sources of knowledge that my father and grandfather had are fantastic … I mean, it is incredible knowledge of the area that one would not necessarily read in a book. (Winemaker D; translated from Afrikaans)*

Moreover, it appears that whenever documented knowledge is lacking for whatever reason (e.g. the over-representation of certain regions like Stellenbosch in the scientific literature) there is a greater reliance on traditional knowledge as a source of information.

> *A lot of the information that one reads in books is based on either Stellenbosch or Robertson, with very little information available for the Little Karoo. So, I mean, it is very good to get from the farmers and people who have been farming for so many years, specifically on the vineyard side, to get knowledge about the soil, what works, and things that one never even imagined would work in terms of irrigation, things that they over the years discovered actually work. And even in the cellar, I mean, there is so little information about port, for instance, and because they have been experimenting with port for so many years now in this region, it actually helps. (Winemaker D; translated from Afrikaans)*

> *Because we are in the Little Karoo we have to rely so much more on our experience and those things than for instance people in Stellenbosch, because most of your research is conducted at Nietvoorbij or wherever. So, yes, I think experience will play a much greater role. (Winemaker B; translated from Afrikaans)*

Traditional knowledge, which is embedded in oral culture, is thus highly valued among certain segments of winemakers. It represents local knowledge that is based on experience, and "physically stored in the hands and minds of practitioners" (Eyferth, 2010:202). Since local knowledge is embodied in winemakers who are region-based (e.g. the Little Karoo) but

at the same also mobile and part of generations/communities of winemakers, local knowledge can be seen as both spatially and temporally embedded. Also, whereas scientific knowledge typically moves through codification (as text in materials), the corresponding method for local, experiential knowledge is a cognitive map that is "almost entirely mental with little material manifestation" (Turnbull, 1997:556). Reliance on this mental map, which consists of intimate knowledge of environment and context, appears to be most prominent in instances where scientific evidence is less well-documented.

Another source of knowledge that some winemakers commented on relates to the various short courses presented by Winetech and other industry stakeholders. Again the impression is created that the Stellenbosch area is a hub for scientific knowledge, resulting in those at the periphery sometimes having to make extra effort to acquire knowledge.

> *I also think a lot of these short courses and similar presentations. Since I am in the Little Karoo one cannot always attend all those things because it is very expensive to travel to Stellenbosch because that's where everything is presented. We try as far as possible to attend those things … there is always something that one picks up from those sessions that one can also apply. (Winemaker B; translated from Afrikaans)*

However, the same winemaker, being advanced in terms of age, is of opinion that the essence of the science of winemaking has remained the same ("the wheel is already designed") and that the short courses that he attended two decades ago are equally valid today.

> *You know we have had many short courses. Every now and then one would pull closer some of the stuff and see what the guys said in those years and is it still valid and … and I will tell you what they said 20 years ago is still valid today. Many of those things are. Many things have been added since but the wheel is already designed and cannot be redesigned. (Winemaker B; translated from Afrikaans)*

One winemaker also highlights the meetings organised for members of professional wine societies, which often involve presentations by international experts. Such meetings can have positive spin-offs, as it exposes members to different perspectives on the way of doing things. The winemaker in question also emphasises the socialisation with fellow-winemakers at these meetings, as it provides opportunities for the sharing of valuable experiences.

> *It's good to get together the guys who are strong in a particular field and then afterwards you share a cup of coffee or wine or so, and then you chat about things that you've*

> *experienced as difficult or easy or which worked for you or did not work for you. So, it's basically to get all the guys … every guy is just in his own little cellar and very much apart. The socialisation and exchange of ideas gives you a good idea … and also, many times they get guest speakers from overseas and that also inspires you to think differently or to read wider, or just to sharpen your brain a bit, because that will spark some ideas. (Winemaker C; translated from Afrikaans)*

Moreover, although winemakers most often seek advice from fellow-winemakers (according to the survey results), there are also other categories of individuals that they turn to for information. Technical consultants from wine yeast companies represent one such category of individuals.

> *I will ring up a couple of trusted winemakers who I have as friends but I often tend to ring up the yeast companies because the yeast companies will be getting a lot of report back. (Winemaker A)*

> *Many times I* [the technical consultant] *will be their first point of contact but many times they have already consulted other people as well who had given them advice and which didn't work, and now they want to hear my advice. (Consultant C; translated from Afrikaans)*

The technical consultants are normally consulted around the time of harvest but also after the harvest in cases where winemakers experience a specific problem with their wine. Obviously the challenges are yeast related, such as stuck fermentations. The yeast product from the company is supported by a fact sheet that specifies the conditions of use. According to the technical consultant that was interviewed a product catalogue exists with instructions as to how to apply and use the different yeast products. These are examples of what one could term "technical knowledge and advice"

> *We give them a manual, a product catalogue that recommends yeasts for particular styles that they want to produce. So each … you know, let's say for Cabernet there are two or three kinds of yeast that can be used, one promotes a particular style more than the other. It also depends on your fermentation conditions, in other words, how are your grapes, how high is the sugar, which limits you with regard to what you want to use. So yes, every yeast company has a complete product catalogue that includes a manual of what can be used where. (Consultant C; translated from Afrikaans)*

The product catalogue and yeast fact sheets, although informative, do not always provide answers to all possible product related queries that a winemaker could have. Sometimes

clarifications by technical consultants are needed, which implies direct contact between supplier and user. One winemaker sees contact with technical consultants as an opportunity to access feedback from other cellars as well, given that the yeast companies cover the industry "quite extensively". This allows the winemaker to better contextualise the fermentation problem that is being experienced, i.e. whether the problem is yet another manifestation of a broader industry-wide problem (e.g. an artefact of a particular harvest), or something that can be uniquely ascribed to his cellar.

> *They are selling the product, they have the technical people and they could tell you what is actually happening … There are a number of yeast companies, four or five. I used probably two of them …. So, they've got very, very good knowledge and they do tend to cover the industry quite extensively. So they are the best place for technical people ... Obviously you've got parameters in your yeast, fact sheets or protocols, but you still have to ring up and ask, listen do you have any info … So I will actually ring them up, just to say, listen guys, I've actually got … to some place where I've got a wine that's 15 degrees and it hasn't finished fermenting, I'm not sure whether it's going to work and they say, we're not sure either, so let's see what's going to happen. So we both learn as well. So that is how they get their information, I suppose they do from industry. (Winemaker A)*

> *I will always ring up. I often ring up anyway just to see whether there isn't any latest information or something. Because often you've got a lot of wineries that maybe have the same problem, so it could be something that's just related to the harvest. (Winemaker A)*

The interaction between the winemaker and technical consultant benefits both. The information that they exchange and the discussion around it – what happens in a particular cellar versus the general trend in the industry – becomes parts of both individuals' pool of personal knowledge. More exemplars are stored in memory, meaning that the base against which new incoming information is compared is also broadened, thus enabling faster matching of incoming against existing information, i.e. faster pattern recognition, which, in turn results in better informed problem solving and decision-making.

> *And actually what you do is, you know, next year and have that information too. So that's what you tend to do. I've done that in the past and I've used that knowledge to the fullest. (Winemaker A)*

> *By now I seem to know what works and what does not, and I can listen to a guy's situation and give him advice, whether or not he can fix the matter in any way, you know. (Consultant C; translated from Afrikaans)*

Thus, based on the last quote, the technical consultant's personal knowledge is also increased through the yeast company's feedback initiatives. In fact, feedback about products is systematically collected and discussed, whereafter it is codified by the company.

> *Once we have released a new product, after that season we will phone everyone who had used the product for the first time, and we will go and visit them. We will taste the wine, we will get samples of the wine and we will discuss it, as it helps us to plough back to the industry that information in the following year and to say this is the feedback, so that those guys who didn't use it can hear straight from the horse's mouth how it worked and do not have to listen to sales representatives only. So we give back to the industry in this manner and it's all in our harvest book. Feedback of the past five new products or so, new findings of existing products, we publish it and then send it to winemakers. (Consultant C; translated from Afrikaans)*

An impression is thus created that technical knowledge acquisition, where wine yeast manufacturing companies are involved, follows the principles of knowledge exchange. Knowledge acquisition is represented as a collaborative process – nearly like research sometimes is. Publications by the wine yeast company represented in the interviews therefore also capture the practical experience of winemakers to some extent, as it incorporates their feedback.

Questions about actual winemaking – the whole vinification process – are generally referred to winemaking consultants. These are individuals with sufficient experience in winemaking who often also possess relevant degree qualifications, thereby earning the label of oenologist. The technical consultant from the wine yeast company, whenever sensing that the problem is no longer yeast related, also refers winemakers to winemaking consultants, where appropriate.

> *Many of the decisions that the guy needs to take are oenological by nature, where I can say I think this is what you should do but I suggest you contact a winemaking consultant about the matter. You know, when they come with specific winemaking questions, I know what needs to be done but I don't want to pose as … because I feel they should rather speak to an expert … an expert in that domain. (Consultant C; translated from Afrikaans)*

Winemaking consultants, as a source of knowledge, are becoming increasingly popular in the wine industry. According to the technical consultant from the wine yeast company, the phenomenon of consultants no longer only applies to exceptional cases where winemaking expertise is lacking.

> *You know, I've come to realise it is a very common phenomenon nowadays. I always thought it is only those tiny little cellars … where the owner didn't study oenology or something like that and then they get consultants. But now it seems that even some of the larger cellars are using consultants. They have their own winemaker who is a recognised and good winemaker, there is no flaw or the guy is not too young or something like that but then they still also use the services of an older consultant. So it is a bit … it's good to see, I think, because one needs … it just provides that double assurance that one is doing the right thing. (Consultant C; translated from Afrikaans)*

Surely, instances do exist where the service of a winemaking consultant is required because the winemaker and cellar support staff lack technical expertise, or because a cellar is in its infant stage. However, as Costandius (2009) points out, there are also other instances where a consultant is required by more established winemakers and winery owners, such as when a cellar is experiencing problems with wine styles that do not fit with market demands, or is experiencing serious technical problems, or the cellar wants to be highly competitive in the international wine market and therefore needs external expertise to "up its game". Especially in relation to the latter scenario it is essential that winemaking consultants regularly travel abroad in order to further their knowledge.

That being said, one of the older winemakers believes that winemaking consultants best serve the needs of young and inexperienced winemakers. The reason stated is that older winemakers, through many trials and errors in the past, have accumulated sufficient experience to guide their winemaking.

> *I am from the old generation. I don't have much faith in consultants. They … but there's a place for them as well. These young guys who lack experience they're the ones who must make use of them. Our old guys listen to what they have to say and then you take it with … we rely on what we have learned. We ourselves have made many flops before, you know. (Winemaker B; translated from Afrikaans)*

The tendency of some older winemakers to sometimes ignore the advice of others is confirmed by one of the winemaking consultants. Their ignorance is not limited to listening to

winemaking consultants but also extends to interactions with other knowledge sources, such as the reading of articles.

> *A source of concern, and this especially applies to your older winemakers, they are not particularly fond of … how can I put it … they are not fond of reading or listening to others. You will see for instance, articles in magazines, those people will not read it at all. They most probably would not be web friendly. It is somewhat tragic to see the little effort they have made from their side to acquire new knowledge. They mainly rely on historical knowledge or experience. (Consultant B; translated from Afrikaans)*

> *I think your younger winemakers have a greater inclination towards listening than your older winemakers have. Your older winemaker, and this probably is not limited to winemaking but also applies for someone in society, as you get older, you think you have a monopoly of wisdom, right? You don't listen to others that readily anymore. So I think it is a relatively common phenomenon that not necessarily only applies to winemakers. (Consultant B; translated from Afrikaans)*

Thus, the belief still persists – at least among older winemakers – that winemaking consultants provide experience-based opinions and solutions in instances where experience is lacking. That being said, from the interviews with the two winemaking consultants it emerged that their expertise is not only rooted in experience but also in an expanding scientific knowledge base. The knowledgebase often involves scientific textbooks as well as articles that appear in science journals or presented at science conferences. Their knowledgebase then, at its very core, involves factual knowledge that has been verified through scientific research, and which has also been codified. These are often combined with other sources, sometimes sources of which the scientific foundations are unsure, such as the internet and conversations with fellow-winemakers.

> *A bit of everything, you know. If it is something very theoretical that I don't understand, that I have forgotten since university, I would certainly go to my handbooks. I have, I believe most, if not all of the must have textbooks that you should have in your book rack, you know, on winemaking and oenology. I would definitely go there. I would also go on sites on the internet, just to think of, one like 'newworldwinemaker', and things like that. I don't subscribe to all the international magazines purely because it is so expensive and I think you can get the same information in a number of other places. Then I would also consult fellow-winemakers. (Consultant A)*

> *It's a combination of conferences, scientific, that have been attended, and then SAWIS obviously also has a very comprehensive source of literature, so I continuously get their*

*information. Any international articles, if there is an article, I will get the list of articles and will then go through it to check whether there is a certain topic that I would like to know more of. (Consultant B; translated from Afrikaans)*

Consumers constitute another category of information. However, consumers contribute little to a winemaker's operational knowledge and technique in terms of "pure winemaking". Their contribution primarily lies therein that they can express preferences for particular styles of wine.

*The consumer, as far as the consumer goes, in terms of pure winemaking, that is … they of are less relevance because it's mostly conjecture which is basically based on the limited knowledge that most consumers have because basically they don't have a lot of wine knowledge. They may ask you questions but generally, I mean, I don't learn anything from them. I learn it from reading and speaking to professionals. As far as winemaking style goes that's a different question. Obviously if you are making a wine you have to stylistically represent it to your clients or consumer base, in which case you listen to your consumers … like someone talks about Chardonnay as being slightly less wooded or they want slightly high residues sugars on red wines or lower alcohols or whatever happens to be, then you are taking notes of that. (Winemaker A)*

As implied by the above quote, the winemaker takes note of consumer preferences and uses this knowledge of the desired end-product to determine which stylistic modifications to implement in order to achieve the desired style.

### 6.5.2 Preference for and Order of Use of Knowledge Sources

In this section the focus is on the order in which knowledge sources are solicited and used, as discussed by four winemakers. One of the winemakers provides a description that, at first glance, seems confusing. At closer reading, however, the interactivity of three broad sources – self, people and documents – is revealed.

*Because I read many articles and everything, it remains at the back of your head, so it is … actually it starts with talking and then I would say I consult books, and then also winemakers, because it is so much easier if you don't get what you're looking for and you know other winemakers have done it, then you can phone a few winemakers. But it starts with personal knowledge and family-based knowledge obviously and from there you just widen your net. (Winemaker D; translated from Afrikaans)*

> *I would not say that I prefer one above the other. In the end one normally has a combination of things that are all mixed. One winemaker would say, I have just read this article, or will forward it to me, or the trials that the guy did, just quickly take a look at it, and those kinds of things. So I would not say that I prefer one per se, it's more a combination of everything. Because somewhere someone must have received the knowledge that is now being forwarded ... (Winemaker D; translated from Afrikaans)*

The "self" as a source of knowledge, which implies personal knowledge, is central for this winemaker as utilisation "starts with personal knowledge". The winemaker's continuous reading of articles and conversations with family members and fellow-winemakers all contribute to a pool of personal knowledge that "remains at the back of your head". This personal knowledge is tapped into during decision-making or when a challenge is experienced. Weiss' (1978) concept of "knowledge creep" is also applicable here as no source of knowledge can be singled out. Everything that enters the mind of the winemaker – solicited or not solicited, consciously or subconsciously – becomes part of "a combination of things that are all mixed". However, where available personal knowledge is insufficient to address a particular problem, the order of soliciting knowledge is as follows: family members (people), textbooks (documents) and other winemakers (people).

Another winemaker, who is the oldest interviewee and from the "old generation" that heavily relies on personal experience, is very clear about who he will approach for advice when confronted with a problem: a fellow-winemaker. Should the latter not be able to help, more winemaker opinions are solicited.

> *When you get to a situation where you have hit a hard rock and you don't know left or right, then you just phone. That's the first thing that I do. I phone a guy whom I think has experience in that area … and if he cannot help, then you go further, you search. The first thing that I do is I phone a guy who I think will know. (Winemaker B; translated from Afrikaans)*

Perceptions of the experiences of others comprise the only criterion by which the first winemaker to be approached is selected. It does not necessarily refer to experience in terms of the number of years involved in winemaking but also in terms of whether or not a similar situation was encountered by the other. Thus it is the experiences and personal knowledge of others that are valued. Moreover, a number of opinions can be collected and then the "most acceptable" is tried out. Occasionally the opinions of winemaking consultants and technical consultants at wine yeast companies are also sought. The "most acceptable"

opinion implies some subjective norm against which opinions are judged, and in this case it appears to be the winemaker's own experiences and personal knowledge.

> *You phone the guys and … let's say you phone five guys and then you decide which guy's stuff sounds the most acceptable and then you try it. Because you don't always find the stuff on the internet or in textbooks or wherever. You ask because many times … your fellow-winemakers, many times the guy has also experienced something similar before. And that's not to say that it needs to be an older guy or a senior guy, it can also be someone junior. Many times they have also encountered similar things in their life. (Winemaker B; translated from Afrikaans)*

> *You listen to what the guys tell you, what the consultant or manufacturers have to say, but then you always return to what your experience is telling you. Is it really that yeast strain, for instance, will it give you those characteristics? It is not to say that a yeast strain that you use in Stellenbosch will give you the same characteristic in* [town in Little Karoo]. *(Winemaker B; translated from Afrikaans)*

It needs to be added that this winemaker is located in the Little Karoo, which means that the scientific literature does not cover his region to the same extent as that it covers, for instance, Stellenbosch. Thus, in the absence of appropriate codified knowledge in the public domain, the "privately-owned" personal knowledge of others is emphasised.

In our third illustration, the winemaker also solicits information from other winemakers but in contrast to the previous winemaker in the above example, does not do so in response to a challenge or crisis. Winemaker opinions are regularly solicited and, together with consistent exposure to international scientific developments (overseas publications and conferences abroad) and experience, comprise his pool of personal knowledge.

> *If you're making wine correctly and with all the things, then the sources that I go to generally are things that I've seen overseas, I'd attended to, or overseas publications … I use quite a lot of the Australian Grape Grower & Winemaker and I do a lot of research as well online, not online but, well some of those are online but basically I subscribe to a few things. That is for my winemaking knowledge and obviously experience and chatting to other winemakers. (Winemaker A)*

This winemaker's focus is on "making wine correctly". The desire for technical flawlessness, as well as the fact that his cellar exports about 85% of its wine (based on survey information), can explain the winemaker's inclination towards accumulating international

technical knowledge. Knowledge of international developments with regard to the science and practice of wine thus forms part of his personal knowledgebase. However, additional knowledge is sought whenever this personal knowledge, which also includes knowledge based on experience, fails to provide an effective solution to a winemaking challenge. The sources of the additional knowledge solicited during a challenge, namely textbooks and "knowledge places" such as universities and wine yeast manufacturers, imply that the knowledge is primarily scientific by nature.

> *You've got two tanks of red wine and the one ferments on the skins to dryness, it comes off the skins, no problem at all. Now, essentially, there you've just got a straightforward easy wine. There's little input from me … But I've got another wine that basically isn't really going through fermentation properly. There's a problem with it, we don't know what it is … What we need to do is to establish what the problem is. Now, to start with, we use tried and trusted experience to sort that out. That's your real technique. Say, if it's starting to stick, we add some more oxygen to see, maybe if the yeast is down on oxygen … If that's not working we'll maybe add some nutrient because maybe they need some more nutrient ... Now, that may work, maybe that technique. That's experience. Then we find it's not really working so what we do is we inoculate it … Then we find it's still not really working, then we decide, okay, maybe what we should really be doing, first, before we even re-inoculate, we can use our experience to find out whether it is a … problem in the wine, there is maybe too much food taste in the wine. We can send that off to the lab, it can come back and … we carry on from there. Now, say after all that time it is just doing nothing, and we used all our experience what we then need to do is to go to our books but preferably we can ask and go and find out whether there are other problems, maybe, there's a problem in the vineyard, perhaps too many or there was a spray too close to the harvest picking … So you got, you've got techniques though at your disposal but obviously if you are getting nowhere with it then obviously you have to go then to the university or you go to somebody who's … you go to the knowledge places like, you go to* [a wine yeast company] *because they've got a knowledgebase of yeast because that's their job, and you further your information. (Winemaker A)*

The winemaker therefore actively searches for solutions that are backed by scientific evidence. Also by enquiring – presumably from the viticulturist – whether spraying occurred too close to the harvest, expresses an attempt by the winemaker to first familiarise him with all the facts of the matter. What also emerges from the above description is that scientific and technical experts are only consulted once all else has failed – when the personal knowledgebase has been fully exploited and all the relevant facts collected and considered.

The fourth illustration highlights the knowledge preferences and order of use of a winemaker employed at a producing wholesaler. Obviously the infrastructure and resources of such a large company play a role in a winemaker's knowledge search strategy. The company houses an in-house research division, which represents a logical starting point for the winemaker whenever information is required.

> *Because I work at a* [producing wholesaler]*, we have our own* [research division]*, and there are a number of guys who have been making wine long before me, so it's easy to get a few answers from them if it is really needed. Or we will send it to our* [research division]*. (Winemaker C; translated from Afrikaans)*

> *I tend to rely strongly on the knowledge of others, who already did the research. There are guys who have been appointed to fiddle and search and who have figured out things through years of experience ... So, we will come many times with new ideas and then the one guy will say, listen guys, this and this and this will happen and so and so and so. I tend to rely on those people's feedback to adjust my decisions to some extent. (Winemaker C; translated from Afrikaans)*

However, where available company structures (research division and winemaking co-workers) cannot provide the winemaker with the desired information, winemakers from outside the company are also approached. The latter are individuals who are part of the winemaker's network.

> *But say there is something that we don't know anything about, then I would say we will first find out more from other winemakers, above and below and left and right. (Winemaker C; translated from Afrikaans).*

> *It is mostly friends and colleagues whom you have acquired over the years, people who have swot* [studied] *with you etcetera, and also people who are acquainted with them, whom you have also met. (Winemaker C; translated from Afrikaans)*

Only once the company structures and winemakers in the interviewee's network cannot provide an answer, the winemaker embarks on his own search strategy. This involves consulting easily accessible resources, namely past study materials and the internet.

> *If you are still not sorted out, then you go and check your old notes, university notes included, and lately it is also nice to check on the internet. You Google and see what comes up. (Winemaker C; translated from Afrikaans)*

Moreover, the opinions of fellow-winemakers appear to be imperative for this particular winemaker. For instance, information collected from the internet is tested against the knowledge and experiences of peers, in order to verify certain claims being made.

> *If I want to read something about* [a wine yeast company] *… it's the website of* [that company]*, then they will give me good information but they will be relatively one-sided. So then it is best just to cross-verify the information with a few guys who, say, also used the same yeast, to get their opinion. That may be a bit more of a reliable opinion. (Winemaker C; translated from Afrikaans)*

The winemaker's own experiences and knowledge also serve as a measure against which to assess incoming claims. He mentions a situation where his experiences have been internalised (similar to the notion of "in-dwelling" by Polanyi, 1966) and expressed as a feeling in his "gut", resulting in him immediately knowing as to whether or not a claim has any merit. This notion of intuition was also addressed in Section 6.4.

> *You must be comfortable with the kind of information that you get, you need to trust it. You get rather spooky stuff from the industry. This guy explains to you about that thing, yes, what he has heard or read or whatever, but it needs to coincide with your gut and with your intuition also. If it doesn't make sense to you in your gut, based on what you know of winemaking … If someone for instance would say to me … let's again use Sauvignon Blanc as an example, and he hyper-oxidises the stuff because he will get a greater mouth sensation or something like that, it is not going to sit well with what I know of the cultivar … So, some of it is gut feel but it is also because of experience, if you know what I mean. (Winemaker C; translated from Afrikaans)*

The above quote presents an example of how different knowledge sources have to cohere. It supports a coherence theory of truth, which stipulates that new knowledge claims are tested, not necessarily against reality, but against one's own existing, already accepted set of knowledge claims. The set of knowledge claims against which incoming knowledge is tested, can be seen as based in either facts or in a set of beliefs, according to different epistemological arguments for coherentism (Young, 2008). However, it is often based in beliefs as people cannot "get outside" their set of beliefs to compare incoming knowledge claims to objective facts.

Moreover, what the above four illustrations also show is the pervasiveness of fellow-winemakers as a source of knowledge. Whether peers are the first or the last to be approached in the winemaker's quest for information, the fact remains that they always show

up in one way or the other. Sometimes their input is less explicitly solicited and only casually collected but it nevertheless contributes to the continuous expansion of a winemaker's pool of personal knowledge. Other times the input of fellow-winemakers is actively solicited and valued as the preferred source of knowledge to tackle a problem. The reliance on the peer as a source of knowledge can often result in opinion-based winemaking, where the advice of winemaking experts, which tends to be more scientifically informed, is ignored. The following quotes from the two winemaking consultants illustrate this point.

> *You can often run into problems there and then it happens that they start asking other people their opinions as well and then you find tomorrow that they haven't done it because so and so said that. (Consultant A)*

> *You will find somebody who said I have read this and this there and this is what they say but what do you say about it? I find it is not so much what they have read. I am much more often confronted with what they have heard from someone else in a conversation. Not necessarily what they have read in a book or on the internet. (Consultant A)*

> *It is true that winemakers have certain preconceived ideas that they, for one reason or another … many times they don't necessarily even have a good reason for that … they probably have heard from an older winemaker that something works if you do it like this, or maybe he saw somewhere from someone else that the wine displays beautifully and the guy did this and this, and now I am going to do the same. So there are definitely certain preconceived ideas. The downside, and I say this with respect, is that those set ideas are often not very scientific. It is more a belief in love than in actual science! (Consultant B; translated from Afrikaans)*

The prioritisation of the knowledge of fellow-winemakers – as well as one's own knowledge – over the knowledge generated by science is in no way peculiar, according to Heiskanen (2006) who considered the relation between scientific knowledge and everyday life from the perspective of the user. Practitioners, in their everyday context, rely on heuristics and shared practices to guide their activities. This is very much pragmatic as practitioners' time and resources are limited and they need to make decisions in the act of working, on the basis of available information, whilst simultaneously having a strong sense of confidence in the appropriateness of the action decided on. Experienced-based techniques such as a "rule of thumb" or intuitive judgement provide the necessary heuristic to effectively deal with the particular situation. Moreover, since the situation that necessitates a decision or action is localised and context-specific, similar "ordinary" people and local conventions are seen as reliable sources of information.

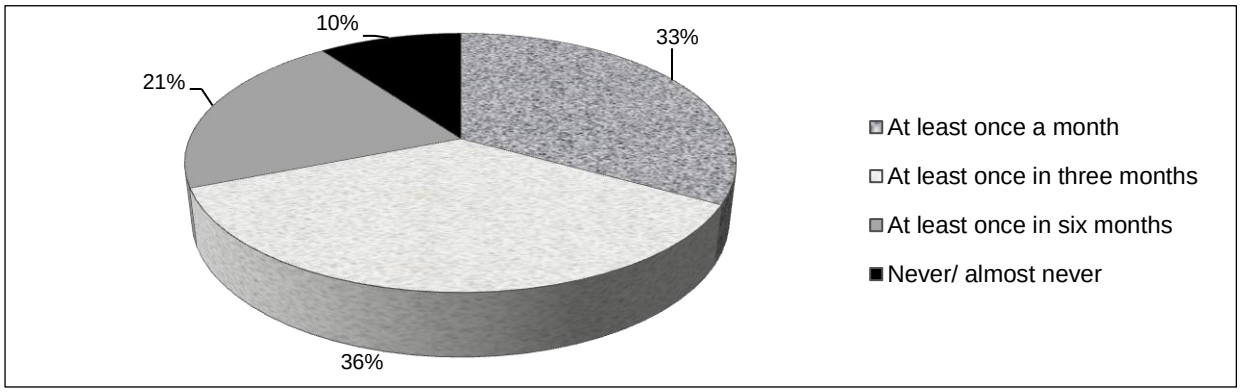
Knowledge produced by scientists, acts as another heuristic that could be used in everyday practice. However, because scientific knowledge is aimed at universalism, it means that "specific characteristics of everyday situations and … the diversity of local experiences" are factored out of the results (Heiskanen, 2006:5). Variables identified for scientific studies are therefore not the only ones operating in practice, meaning the practical relevance of such variables is limited. Moreover, the fact that the knowledge produced by scientists is objective and empirically verifiable and tends to reflect the best of current evidence does not necessarily mean that it best serves the needs of practitioners who deal with contextualised situations. In fact, when confronted with a choice between abstraction (science) and contextualization (own local knowledge and that of fellow-winemakers), practitioners generally prefer the latter as the perceived risk associated with its implementation is lower.

Given the relative significance of fellow-winemakers as a source of knowledge, it was considered worthwhile to include – in the next section – an analysis of the knowledge of winemakers who are most frequently consulted by others for information and advice. The purpose of the analysis is to determine where frequently consulted winemakers get their knowledge from. This is an important consideration, as the contents of these knowledge sources are carried over to those winemakers who approach the frequently consulted winemaker for information and advice.

## 6.6 PROFILE OF WINEMAKERS WHO ARE FREQUENTLY CONSULTED BY THEIR PEERS

A winemaker who is frequently consulted by her/his peers can be regarded as an opinion leader. According to Rogers (2003:27) an opinion leader refers to "an individual [who] is able to influence other individuals' attitudes or overt behaviour informally in a desired way with relative frequency". Opinion leaders, as discussed by Rogers, tend to operate at the core of communication networks, which makes them important actors in the dissemination of knowledge. One indicator of opinion leadership relates to the question as to how often the respondent is approached by peers for information and advice. In the survey about a third of the respondents can be regarded as opinions leaders as they are approached at least once a month by fellow-winemakers for information/ advice (Figure 6.3).

**Figure 6.3: How often fellow-winemakers contact respondent for information/ advice (N = 208)**




The key question to be answered is what underlies the knowledge of opinion leaders. Table 6.17 includes 17 of the 28 knowledge-souring activities that were originally presented in Section 5.3.2. Eleven knowledge-sourcing activities have been excluded as more than 50% of respondents indicated that they never or almost never performed that activity (see again Table 5.12). What Table 6.17 shows is the percentage of respondents who indicated that they *frequently* perform each of the 17 knowledge-sourcing activities. “Frequently” can mean various things, depending on the knowledge source concerned. In Table 6.17 it has been interpreted as to mean one of four things: (1) the reading of every edition of a particular publication, (2) the reading of other kinds of documents at least once in three months, (3) the seeking of expert advice from a certain group of individuals also at least once every three months, and (4) attending a number of information sessions at least twice in the past. Moreover, in Table 6.17, figures as to how frequently a knowledge-sourcing activity is performed are not presented for the entire pool of winemakers but for four sub-groups of winemakers. These groups correspond to the four response categories as to how often a winemaker is approached by her/his peers.

In order to facilitate both the reading and interpretation of Table 6.17 two examples will be given:

- Of the 70 respondents who said that fellow-winemakers approach them at least once a month for advice, 74% stated that they read each addition of *Wynboer* in the WineLand magazine. However, an almost similar percentage (71%) of the 21 respondents who are never or almost never approached by other winemakers stated that they also read each addition of that magazine. Thus, although *Wynboer* is read by a large proportion of opinion leaders the reading thereof does not sufficiently discriminate between them and non-opinion leaders.

- About 84% of opinion leaders stated that they frequently consult consumers for feedback about the quality of wine products. In contrast, only 43% of non-opinion leaders stated that they also frequently perform this activity. Thus, obtaining regular feedback from wine consumers strongly discriminates between opinion and non-opinion leaders.

Other knowledge sourcing activities that are regularly performed by more than 60% of winemakers and which appear to set opinion leaders and non-opinion leaders apart, are the three sets of wine information events. These are information sessions/seminars/workshops by Winetech/VinPro (76% versus 48%), information sessions/seminars/workshops by Anchor Wine Yeast (64% versus 14%) and workshops and short courses by SASEV (63% versus 19%).

**Table 6.17: Frequent use of knowledge sources – opinion leaders and non-opinion leaders compared[25]**

| Knowledge source | How often fellow-winemakers seek advice/information from respondent | | | |
|---|---|---|---|---|
| | At least once a month (n=70) | At least once in 3 months (n=74) | At least once in 6 months (n=43) | Never / almost never (n=21) |
| **% of respondents who read each edition of the following** | | | | |
| *Wynboer* in the WineLand magazine | 74% | 74% | 74% | 71% |
| Outlook Gazette by Anchor Wine Yeast | 56% | 42% | 29% | 24% |
| South African Journal of Enology and Viticulture | 46% | 30% | 22% | 30% |
| **% of respondents who read / consult the following at least once in 3 months** | | | | |
| Textbooks and manuals of winemaking practice | 60% | 38% | 40% | 52% |
| Contributions in New World Winemaker (www.newworldwinemaker.com) | 53% | 41% | 38% | 20% |
| Trade journals by the wine industries of other countries | 30% | 32% | 17% | 5% |
| **% of respondents who seek expert advice from the following at least once in 3 months** | | | | |
| Other winemakers in South Africa | 86% | 88% | 68% | 67% |
| Staff from wine laboratories responsible for wine analyses | 53% | 58% | 41% | 52% |
| VinPro consultants | 41% | 21% | 24% | 24% |
| Technical consultants from other yeast manufacturing companies | 20% | 18% | 10% | 14% |
| Technical consultants from Anchor Wine Yeast | 14% | 5% | 0% | 5% |
| **% of respondents who do the following at least once in 3 months** | | | | |
| Search the Internet for information on issues related to winemaking | 84% | 78% | 69% | 71% |
| Obtain feedback on the quality of wine products from wine consumers | 84% | 84% | 59% | 43% |
| **% of respondents who attended the following at least twice in the past** | | | | |
| Information sessions/seminars/workshops by Winetech/VinPro | 76% | 58% | 55% | 48% |
| Information sessions/seminars/workshops by Anchor Wine Yeast | 64% | 46% | 38% | 14% |
| Workshops and short courses by the South African Society for Enology and Viticulture | 63% | 45% | 43% | 19% |
| The annual conference of the South African Society for Enology and Viticulture | 40% | 38% | 21% | 10% |

[25] Opinion leaders are those who are very frequently approached by their peers for information and advice ("at least once a month") and non-opinion leaders those who are very rarely approached ("never / almost never").

How often a winemaker is consulted by others for information/advice has also been correlated with the five broad knowledge source components.[26] Only one of the knowledge components, namely the measure of the importance of international expertise, is significantly related to the frequency of consultation (Table 6.18). Specifically, the highest mean score (5.3 out of 10) on the measure of importance attached to international expertise was recorded for those most consulted by their fellow peers, and the lowest mean score (3.8) by those least consulted. Thus, a winemaker who attaches relatively high importance to international expertise is therefore more likely to be approached by others for advice.

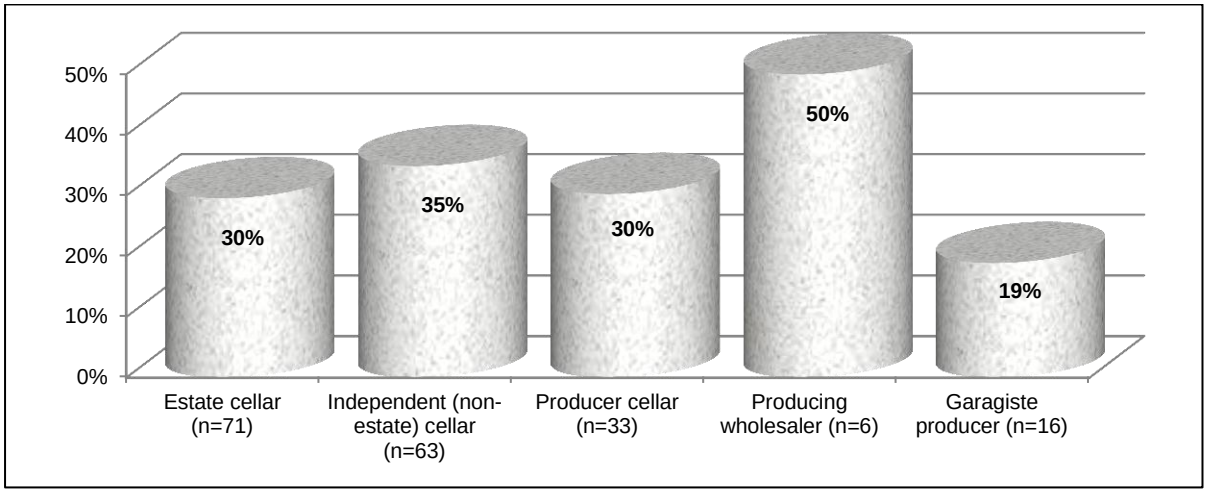
**Table 6.18: Mean scores (out of 10) on the measure of the importance of international expertise, by how often a winemaker is approached by fellow-winemakers for information/advice**

| How often approached | Mean score | Median score | Standard deviation | Lowest score | Highest score | Significance |
|---|---|---|---|---|---|---|
| At least once a month (n=69) | 5.3 | 5.0 | 2.4 | 0.0 | 10.0 | F = 6.848<br>p < 0.05 |
| At least once in 3 months (n=73) | 4.2 | 4.2 | 2.1 | 0.0 | 8.3 | |
| At least once in 6 months (n=42) | 3.4 | 3.3 | 2.4 | 0.0 | 8.3 | |
| Never / almost never (n=21) | 3.8 | 3.3 | 2.8 | 0.0 | 9.2 | |
| ***Total (N=205)*** | ***4.4*** | ***4.2*** | ***2.4*** | ***0.0*** | ***10.0*** | |
| Nature of statistically significant differences: At least once a month > At least once in 3 months<br>At least once a month > At least once in 6 months<br>Effect size based on Omega squared: 0.08 | | | | | | |

Moreover, according to Figure 6.4, more or less similar percentages of opinion leaders are encountered in the different cellars: 30-35% in the three largest categories (private estate and non-estate cellars and producer cellars). The number of winemakers at producing wholesalers (six in this case) is too small to place any special emphasis on the 50% of opinion leaders in that cellar group.

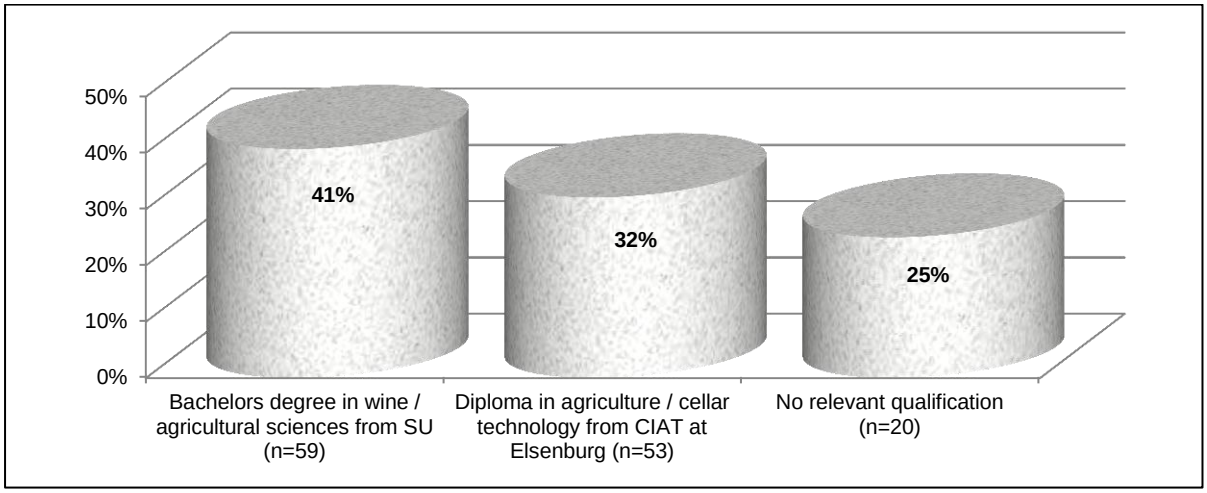
[26] It must be remembered that the knowledge source components are based on ratings of the perceived importance of certain knowledge sources for own practice and not on the frequency of use of knowledge sources.

**Figure 6.4: Percentages of winemakers in each cellar type who are very frequently ("at least once a month") approached by fellow-winemakers for advice**




Opinion leadership seems to correspond with higher or more prestigious levels of qualification (Figure 6.5). More respondents who completed a BScAgric degree from Stellenbosch University are regarded as opinion leaders (41%) than those who completed a diploma at the CIAT in Elsenburg (32%). Opinion leadership is not necessarily lacking in the case of respondents without any relevant qualification, although only about 25% of such respondents are regarded as opinion leaders.

**Figure 6.5: Percentages of winemakers – in three qualification categories – who are very frequently ("at least once a month") approached by fellow-winemakers for advice, by highest relevant qualification achieved**

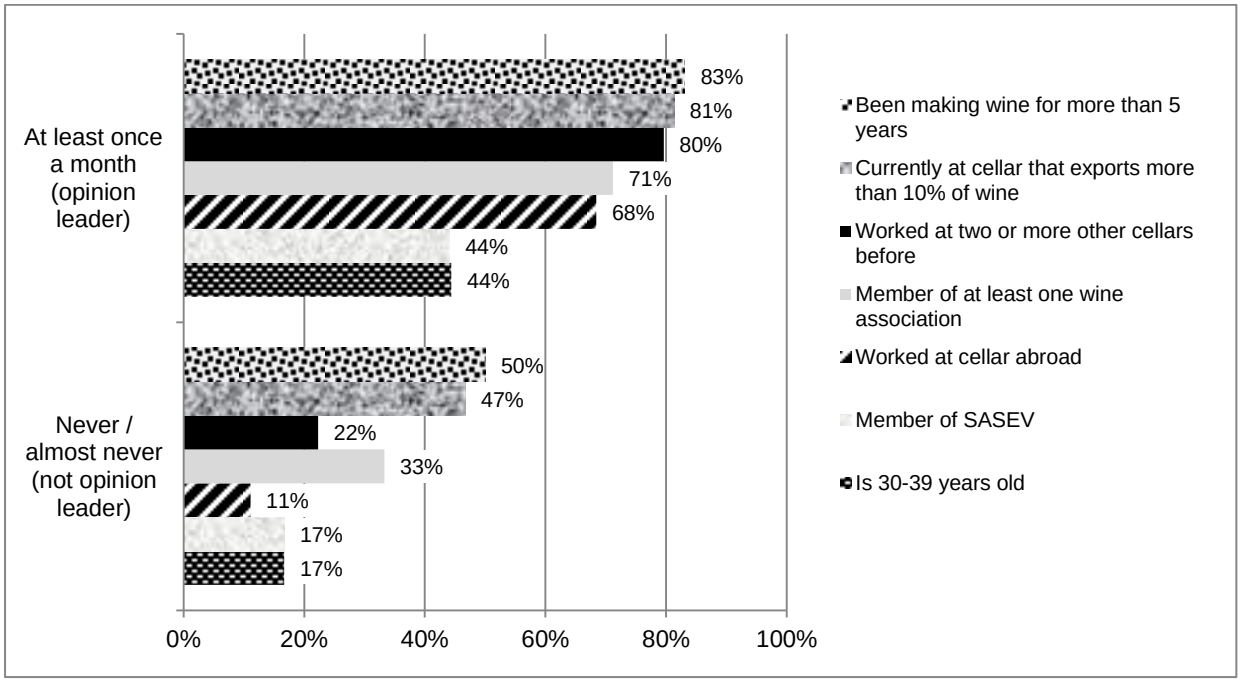



Fisher's exact test = 14.33; $p<0.05$; Cramer's V = 0.25

Figure 6.6 presents a number of additional variables that discriminate between opinion leaders and non-opinion leaders. Particularly five of them contribute towards profiling the "typical" opinion leader, namely someone who has been making wine for more than five years and has worked in at least two other cellars of which one is located abroad, and who

currently prepares wine for exporting and is a member of least one wine association. To a lesser extent membership of SASEV is also a discriminator, as well as falling in the 30-39 age group. The typical opinion leader therefore appears to be someone with experience, which encompasses international cellar experience and exporting experience, together with specialised knowledge links as evident by membership of select wine associations.

**Figure 6.6: Comparison of the activities and conditions of winemakers who are very frequently ("at least once a month") and very rarely ("never / almost never") approached by fellow-winemakers for advice**




Note: The number of respondents in the "at least once a month" category range between 54 and 59 and respondents in the "never / almost never" category between 15 and 18.

Lastly, since persuasive utilisation, meaning the ability to persuade other winemakers to do things differently in their winemaking (see Section 6.3.1), is also an indicator of opinion leadership, one would expect a correlation between persuasive utilisation and how often the winemaker is approached by others for information and advice. Responses to the statement about persuasive utilisation[27] were therefore cross-tabulated with responses to how often winemakers are approached by their peers (Table 6.19).

[27] As a reminder, the statement is: *Scientific research findings on winemaking have led me to advise other winemakers to do things differently in their winemaking*.

**Table 6.19: Relationship between statement about persuasive utilisation and how often the respondent is approached by fellow-winemakers for information/advice**

| Statement about persuasive utilisation | How often fellow-winemakers seek respondent for information / advice | | | | | Statistical significance | Effect size |
|---|---|---|---|---|---|---|---|
| | At least once a month | At least once in 3 months | At least once in 6 months | Never / almost never | Total | | |
| SA / A | 62% | 47% | 27% | 33% | 46% | Chi-square = 13.659 $p < 0.05$ | Cramer's V = 0.265 |
| N / D / SD | 38% | 53% | 73% | 67% | 54% | | |
| **Total** | **63** | **72** | **41** | **18** | **194** | | |

Note: SA = Strongly agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly disagree

The results show that winemakers who are more frequently approached by fellow-winemakers for advice are also more likely to report persuasive utilisation. Specifically, close to two-thirds of winemakers who are most frequently approached by their peers reported persuasive utilisation, compared to only a third of those who are never or almost never approached by fellow-winemakers (62% of 63 respondents versus 33% of 18 respondents). However, the fact that respectively 33% and 27% of respondents with weak ("never/ almost never") or relatively weak ("at least once in 6 months") linkages also reported persuasive utilisation, could mean that such persuasion occurs on the basis of social interaction, which is not typically interpreted by winemakers as instances of being asked for advice.

Overall, then, this section showed that there are a number of demographical variables that set opinion leaders in winemaking apart from non-opinion leaders. The knowledge sources used by opinion leaders are particularly relevant for this study as it gives an idea of the knowledge that is indirectly conveyed to fellow-winemakers who consult these opinion leaders.

## 6.7 DISCUSSION AND CONCLUSION

This chapter presented further results from the web-based survey, focusing on the underlying patterns in the data with regard to aspects of knowledge use. The survey results were supplemented by interview data, which generated qualitative opinions of issues surrounding the knowledge sources and winemaker approaches, as well as a more in-depth exploration of the elements of practical knowledge. The interviews also provided more insights with regard to some of the knowledge sources that the winemakers interact with, which can be people related (other winemakers, consultants, consumers, etc.), document related (textbooks, articles, internet, etc.) or a combination of people and documents (short courses that are presented, etc.).

What needs to be emphasised is that winemakers seldom have the luxury of time to deliberate on each and every decision that they make. It is the same as in clinical practice where the practitioner is confronted on a daily basis with a number of client symptoms. Quick decisions need to be made. Such diagnoses in clinical settings are often reached on the basis of intuition and sense-impressions (e.g. a sense of alarm indicating that something is wrong). In that way a reliance on intuition helps with the management of complex situations as well as assisting the practitioner to effectively get through the day (Stolper et al., 2009a).

> *In a cellar … you are pretty rushed, you're pretty rushed, you are … you make up pretty quick decisions and then you sort of back it up when you've got more time, you're testing it, getting samples and that thing. (Winemaker E)*

The quick decisions based on intuition and sense-impressions are tapped from a winemaker's personal knowledge, which, among others, involves experience and a collection of knowledge that was gathered from different sources, either consciously or subconsciously. The different sources can fulfill a dual role in relation to a winemaker's personal knowledge. On the one hand, they can supplement and "tighten" a winemaker's already dense network of personal knowledge. On the other hand, they can serve as an aid, given that additional knowledge is deliberately sought in instances where a winemaker's personal knowledge appears insufficient to effectively deal with a particular situation or problem.

Moreover, winemakers – like any other category of practitioners and potential science consumers – can be skeptical about research-based knowledge for various reasons. For instance, practitioners are aware of the changing nature of science, that new research only constitutes the best of current evidence and for that reason, at least in theory, will always be augmented and even superseded by new research. The reductionist nature of scientific research can also contribute to skepticism, as research studies do not include all variables that are relevant to a particular winemaker's setting. Skepticism can sometimes also arise not only because of the exclusion of all relevant real-life variables in a particular study but because of the extent to which available research studies represent all real-life scenarios. In the interviews it was implied that topics in South African wine research are largely concentrated in geographic regions closer to the centre of science (Stellenbosch/Paarl), thereby leaving the periphery (e.g. Little Karoo) to be more reliant on practical and traditional knowledge.

In addition, winemakers have their own mental models of how their world of work operates. Science to them represents just another kind of information that consumers are daily bombarded with. Any incoming information is interpreted within the boundaries of the mental model, whether and how it fits the model, as well as how practically relevant the incoming information is against the backdrop of that model. The mental model is reminiscent of the "mindlines" of clinicians encountered in the medical health literature, referring to "collectively reinforced, internalised tacit guidelines" (Gabbay & Le May, 2004). The sources of such a mental model involve brief reading of relevant documents but mostly include the conveyed opinions and experiences of others combined with the practitioner's own experiences and past training.

A "mindline" is evoked during practice and is orientated towards action. The order of the use of knowledge sources by winemakers occurs in relation to the "mindline", and is best understood with reference to a three-fold typology of physicians' use of drug resources by Boerkamp et al. (1996). The first is *habitual decision-making* where a physician makes a decision without considering any alternatives. The second is *decision-making based on an internal search*, i.e. where the physician makes a choice by using knowledge from her or his memory. The third is *decision-making based on an external search*, where a variety of information sources can be used. Although habitual decision-making is subconscious and decision-making based on an internal search mostly conscious, both are grounded in a winemaker's own personal knowledge. It is especially with regard to habitual decision-making that personal knowledge can find expression as a skill that has become "in-dwelled" by the winemaker, resulting in moments of common sense and intuitive knowing of how to go about. Moreover, since habitual decision-making occurs subconsciously, the underlying personal knowledge represents an implicit component of the "mindline", which is exhibited as practical knowledge and which one may or may not be able to make explicit, depending on the inherent "tacitness" of that component of the "mindline". However, the greater the extent of reflection on the knowledge embedded in the "mindline", which is being tapped into, the more explicit the knowledgebase becomes. Decision-making based on an internal search therefore implies that one can formulate a proposition in one's head that something has worked before and under what conditions and why, and use this explicit information to search among alternatives.

Both habitual decision-making and decision-making based on an internal search represent the application of knowledge claims from a winemaker's internalised "mindline". Decisions based on an external search, on the other hand, involve the assessment of external knowledge claims against those of the "mindline". These externally collected claims are

accepted and converted to action only if they cohere to the already accepted truth of the internalised knowledge claims.

As the survey has shown, winemakers in other cellars are one of the most frequently used external knowledge sources of winemakers, similar to medical practitioners who heavily rely on medical colleagues as a knowledge source (e.g. Covell, Uman & Manning, 1985). Asking colleagues is often the quickest way for busy practitioners to acquire applicable information and provides a sense of reassurance or direction in instances of uncertainty. It also allows a practitioner instant access to the context-specific personal knowledge of others, which involves practical knowledge that has been expressed as propositions.

Moreover, although knowledge was viewed in this study through the lens of either practical or factual, the reality is that knowledge – from the point of view of the winemaker – does not come with clear demarcations. Also, documents and people as sources of knowledge, together with the self as knowledge source, cannot be easily separated as the one could be embedded in the other. This relates to the concept of the "nestedness" of knowledge sources. One of the winemakers interviewed alludes to this when stating that "*somewhere someone must have received the knowledge that is now being forwarded.*" The concept is diagrammatically represented in Figure 6.7, where any knowledge source (self, a document or a person) is seen as composed of different layers of knowledge sources.

**Figure 6.7: The "nestedness" of knowledge sources**

<table>
<tr><td rowspan="3">Knowledge source</td><td>Layer 1</td><td colspan="8">Self1 (winemaker using knowledge)</td></tr>
<tr><td></td><td colspan="4">Person1</td><td colspan="4">Document1</td></tr>
<tr><td>Layer 2</td><td colspan="4">Self2a</td><td colspan="4">Self2b</td></tr>
<tr><td></td><td colspan="2">Person2a</td><td colspan="2">Document2a</td><td colspan="2">Person2b</td><td colspan="2">Document2b</td></tr>
<tr><td>Layer 3</td><td colspan="2">Self3a</td><td colspan="2">Self3b</td><td colspan="2">Self3c</td><td colspan="2">Self3d</td></tr>
<tr><td></td><td>Person3a</td><td>Document 3a</td><td>Person3b</td><td>Document 3b</td><td>Person3c</td><td>Document 3c</td><td>Person3d</td><td>Document 3d</td></tr>
</table>

According to Layer 1 in Figure 6.7, a winemaker can rely on his/her personal knowledge (Self1). Such knowledge, in turn, can contain traces of information gathered from some documentation (Document1), and/or information that was verbally communicated by someone else or picked up from interaction with that person (Person1). A winemaker's personal knowledge (Self1) at the time of exposure to new external knowledge sources also acts as a filter in determining what knowledge from either the documentation (Document1) or other people (Person1) would become part of the (then) pool of personal knowledge, based on the extent of coherence between the already internalised knowledge claims and the external knowledge.

Similarly, if the winemaker in Layer 1 utilises knowledge conveyed by another individual (Person1), the latter individual's knowledge obviously implies personal knowledge (Self2a). However, personal knowledge can be based on information from other people (Person2a) and/or documentation (Document2a). Again the existing personal knowledge of the relevant individual (Self2a), at the time of first exposure to the external sources, would have operated as a filter in determining what knowledge from the documentation and other people were allowed to enter the individual's (then) pool of personal knowledge (Self2b).

Also in Layer 2, information based on documentation (Document1) can involve the personal knowledge of the author of the document (Self2b), which in turn, can be derived from other documentation (Document2b) and/or through the author's interaction with other individuals (Person2b). Again it is assumed that the personal knowledge of the author (Self2b) determined what external knowledge – from either the documents (Document 2b) and/or other individuals (Person 2ba) – should become part of the (then) pool of personal knowledge and be reflected in the document that the user in Layer 1 consulted.

The same reasoning applies to Layer 3 and any subsequent layers, meaning that the nestedness of knowledge sources can quickly become an infinite regress. On the basis of this reasoning one could probably argue that practical knowledge (exhibited by self/person) also contains traces of the factual (e.g. science-based document).

Lastly, a summary is provided of the broad questions posed at the start of this chapter, together with the conclusions reached on the basis of the findings from the survey and interviews.

| **Broad questions** | **Conclusions** |
|---|---|
| What forms of utilisation or uptake are associated with scientific research findings as a representation of factual knowledge? What is the inter-relation between the different forms of utilisation of scientific research findings in winemaking? | The forms of utilisation are conceptual (90%), symbolic (80%), instrumental (78%) and persuasive (46%) Conceptual utilisation, which refers to better understanding of winemaking on the basis of scientific research findings, is conceptually prior to any of the other three forms – in more than 97% of cases where any of the other three forms are reported, conceptual utilisation would also be present. |
| What cellar based and winemaker specific factors are associated with the different forms of utilisation of scientific research findings? | None of the demographical variables used in the study are significantly related to any of the four types of utilisation, which confirms the pervasiveness of these utilisation types among different subgroups of winemakers.<br>A broader measure of overall utilisation of scientific research findings was also created (i.e. a composite measure consisting of nine items) and scores on this measure differ significantly according to cellar type. Specifically, Garagiste producers reported the lowest overall utilisation and producing wholesalers the highest. |

| Broad questions | Conclusions |
|---|---|
| What are the elements of practical knowledge in winemaking? | The study considered intuition, sense-impressions and experience as elements of practical knowledge. Four sets of insights emerged from the interviews. Firstly, intuition is similar to inspiration, i.e. the unique and subconscious flow of ideas and approaches that are characteristic of creative instinct. Secondly, the senses play a role in knowing intuitively although sense-impressions (sensory knowledge) are not really a form of intuition (intuitive knowledge). Thirdly, intuition is immediate knowledge that springs from a link between past experiences and current events. Lastly, intuition is also seen as occurring when all the facts of a matter are considered and the missing pieces of the puzzle are filled by sensory assessments. |
| What is the relation between the different knowledge sources in winemaking? What sources are first consulted and why? | The "self", which implies personal knowledge, is first "consulted" and this implies habitual decision-making or decision-making based on an internal search.<br>Thereafter external sources are consulted and this tends to be fellow-winemakers as first choice, although winemakers at large cellars (i.e. producing wholesalers) would first consult the in-house research division.<br>A winemaker's own experience and personal knowledge also serves as a reference against which to assess external knowledge claims. Different knowledge sources have to cohere.<br>Peers are often first consulted because the situation that necessitates a decision or action is localised and context-specific, meaning that similar "ordinary" people with similar experiences are seen as reliable sources of information. |
| What other insights emerged with regard to the different sources of knowledge and their use? | Winemakers claiming instrumental utilisation, i.e. doing things differently on the basis of scientific research findings, are also significantly more likely to stress the importance of local expertise, international expertise and public reference sources in their winemaking.<br>Conceptual utilisation, i.e. better understanding because of research, appears to be very much influenced by local knowledge sources.<br>External knowledge sources (local and international expertise, public reference sources and the communicated practical knowledge of others), where all of these have a scientific research base, are used to strengthen personal beliefs about winemaking (symbolic utilisation).<br>Persuasive utilisation, or the ability to persuade others to do things differently, is very much influenced by access to international knowledge sources.<br>There is both a younger and older age segment (younger than 30 years and older than 50 years) that emphasised the general suitability of scientific research findings for winemaking.<br>Winemakers who are frequently consulted by their peers can be regarded as opinion leaders. The knowledgebase of opinion leaders set them apart from non-opinion leaders, as the knowledgebase involves significantly more reliance on feedback from wine consumers and more attendance of wine information events organised by Winetech and other stakeholders for the wine industry.<br>A number of additional variables also discriminate between opinion leaders and non-opinion leaders. Particularly five of them contribute towards profiling the "typical" opinion leader, namely someone who (1) has been making wine for more than five years |

| Broad questions | Conclusions |
|---|---|
| | and (2) has worked in at least two other cellars of (3) which one is located abroad, and (4) who currently prepares wine for exporting and (5) is a member of least one wine association.<br>Traditional knowledge, which is embedded in oral culture, is highly valued among certain segments of winemakers. Winemakers in the periphery (e.g. Little Karoo) are reported to be more reliant on practical and traditional knowledge, as codified South African wine research tends to be based on geographic regions closer to the centre of science (Stellenbosch/Paarl). |

# Chapter 7

# TOWARDS A MODEL OF KNOWLEDGE TRANSLATION FOR WINEMAKERS

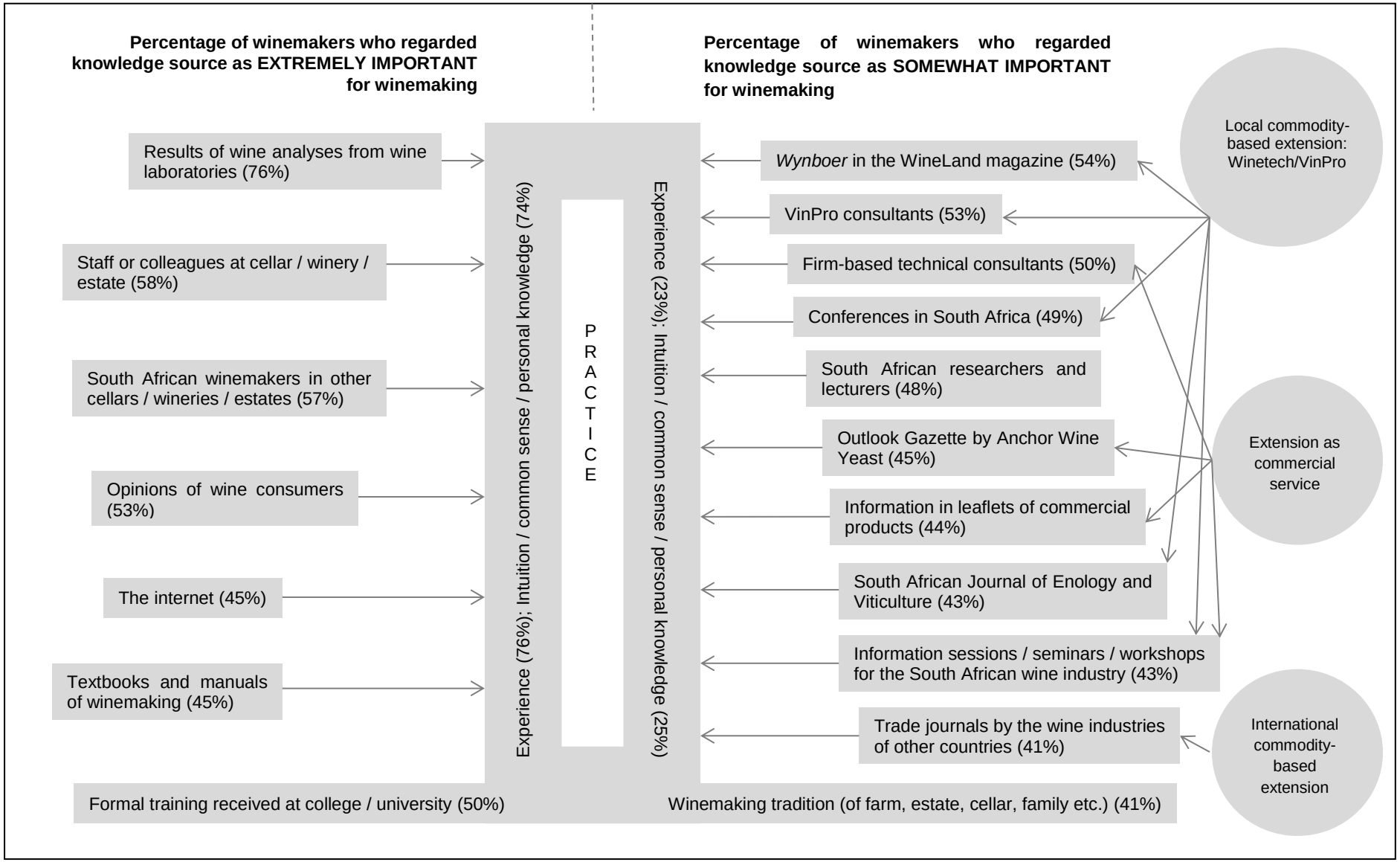
## 7.1 INTRODUCTION

The concluding sections of the last two chapters included summaries and discussions of the main findings of the study and also contextualized these in terms of the broad questions originally posed in Chapter 1. The detailed individual findings will therefore not be repeated here. The purpose of this chapter is to present a model of knowledge translation for the South African wine industry, specifically for winemakers. Some high-level findings, together with elements taken from the literature on and models of knowledge translation (KT) – presented in Chapter 3 – will be listed here as these contributed to the development of the model. The proposed model is normative and prescriptive as it aims to suggest a solution as to how both practical knowledge and research-based factual knowledge can be combined in a single knowledge product destined for uptake by winemakers, in order to close the knowledge-to-practice gap.

<u>High-level findings from the current study that informed the KT model for winemakers:</u>

- In terms of knowledge sources, practical knowledge emerged as very important for a winemaker's practice. Practical knowledge normally finds expression in the form of habitual decision-making. Figure 7.1, which provides a visual summary of the survey results as far as the winemakers' ratings of importance of knowledge sources for winemaking are concerned, illustrates the centrality of practical knowledge. According to this figure, respectively 74% and 76% of winemakers rated experience and intuition/ common sense/ personal knowledge as extremely important for their winemaking.
- The various foundations and elements of practical knowledge, e.g. experience, common sense, intuition and gut feeling, can also act as filters in the sense that they determine the potential relevance of any incoming external knowledge, as is indicated in Figure 7.1. External knowledge claims are tested against one's own existing already accepted knowledge claims, which is internalised as practical knowledge. Consideration of practical knowledge and its various manifestations should therefore be a key ingredient in the KT model for winemakers.

**Figure 7.1: Relative importance of external knowledge sources and own knowledge in the practice of winemaking**



- The most important external knowledge sources, seen from the perspective of the winemaker, are not necessarily those produced by extension services (Winetech/VinPro, wine yeast manufacturers, consultants, etc.). According to Figure 7.1, the knowledge sources produced as part of commodity-based extension initiatives, either local or international, are at best regarded as only somewhat important for winemaking. External knowledge sources perceived as extremely important are analytical outputs produced by wine laboratories, advice from fellow-winemakers, opinions of wine consumers, formal training received, and public reference sources such as the internet and textbooks/manuals.
- Two of the external knowledge sources in Figure 7.1 are particularly relevant for the development of an appropriate KT strategy for the South African wine industry. The first pertains to the fact that fellow-winemakers are viewed as one of the most important external knowledge source for winemaking and the second to the relative importance attached to public reference sources, particularly the internet and textbooks/manuals.
- The knowledge elicited from fellow-winemakers is part of their pool of personal knowledge and experience, and for that reason predominantly implicit and not codified. However, the fact that the knowledge is communicated to others implies that it is not inherently tacit but can be expressed as propositions or knowledge claims and therefore also written up and codified. Thus, the knowledge elicited from others represents implicit knowledge that can be made explicit. As a starting point, then, an appropriate KT strategy could focus on the codification of such implicit knowledge. Moreover, given the significant amount of importance attached to the internet and manuals as sources of knowledge, both types of documentation can serve as appropriate transfer media for the dissemination of the newly codified knowledge within the winemaking community.
- Overall the study produced evidence of the widespread use of scientific research findings, particularly conceptual use of research. The latter refers to a better understanding of certain aspects of winemaking that is based on scientific research. However, conceptual utilisation implies a “diffuse, undirected seepage” of scientific knowledge in general (Weiss, 1978, 1980) and not the targeted uptake of a knowledge product, which is the focus of the planned change conception that underlies most KT models.

Elements from the KT literature and existing KT models that informed the KT model for winemakers:

- Although the KT movement also underscores the translation of findings of individual studies into practice, it is increasingly recognised that the findings of individual studies are seldom appropriate for uptake. Individual studies are only appropriate for uptake when the target for KT involves other researchers and research funders. However, in instances where the target for KT involves practitioners (among consumers and policy-makers), a collective body of research findings appears to be more appropriate as the unit of translation (Grimshaw et al., 2012). This means that the results of individual studies should be interpreted and synthesised within the context of global evidence when a KT strategy is attempted.
- Knowledge synthesis is a sub-domain of activity within KT that is concerned with the contextualisation and integration of the findings of individual research studies within a larger body of knowledge. The purpose is to determine what is already known on a particular topic and where the knowledge gaps are (McLean et al., 2012).
- The knowledge product to target the behaviour of practitioners (mostly health professionals) normally involves some form of guidelines for practice. In the case of policy-makers, who are not the target audience of this study, other products may be better suited such as auctionable messages and policy briefs (Grimshaw et al., 2012).
- The “messenger” in the transfer of knowledge can be an individual, group, organisation or even a broad system. The appropriate messenger is determined by the target audience and the nature of the knowledge product/research message being transferred. In health, endorsement of practice guidelines by fellow-practitioners appears to be a crucial factor in the eventual uptake thereof (Grimshaw et al., 2012).
- Better uptake of guideline recommendations is reported where these are based on scientific evidence, are non-controversial and compatible with current values, precisely and correctly described, and not demanding changes in existing routines or habits (Foy et al. 2002; Grol et al., 1998). To these one can add insights by Rogers (2003) from his Model of the Diffusion of Innovations, according to which an innovation is more likely to be adopted if it has a relative advantage, is compatible to the values and experience of potential users, lacks complexity, and can be experimented with on a limited basis before implementation.
- Assessment of potential barriers and facilitators that could affect the uptake of knowledge is important for a KT strategy to succeed. Such a view is maintained by

both the Ottawa Model of Research Utilisation (OMRU) (Logan & Graham, 1998) and the Knowledge-to-action model (Graham et al., 2006). The Stetler Model of Research Utilisation (Stetler, 2010) also stipulates that potential users need to be conscious of external and internal factors that can influence the use of research findings. External factors refer to factors unique to the organisational setting and broader environment whereas internal factors refer to personal considerations, such as existing beliefs and attitudes.

- It is increasingly realised that practitioners are "creatures of habit" (Nilsen et al., 2012). Habit is seen as a critical variable in practice change, and could be interpreted as a barrier as most of a practitioner's daily activities tend to be habitual. Habitual behaviours are most likely to remain unaffected by new interventions as they are not spontaneously reconsidered. Habits do not so much represent repeated behaviours than they represent automaticity, i.e. they are "automatic in the sense that they are enacted without purposeful thinking, largely without any sense of awareness" (Nilsen et al., 2012: no page). Habits are reminiscent of the common sense and intuitive knowing aspects of practical knowledge.
- In the PARiHS Framework for KT (Rycroft-Malone et al., 2004b), it is suggested that practical knowledge should be articulated and made explicit and be subjected to public scrutiny and assessment in order to be verified as evidence. It is therefore suggested that the notion of evidence, apart from including knowledge based on research, be broadened to also include knowledge from users and their local context.

With the above insights from the KT literature and empirical study in mind, a model of KT that combines both factual and practical knowledge was developed, in order to bridge the knowledge-to-practice gap in winemaking.

## 7.2 PROPOSED MODEL OF KNOWLEDGE TRANSLATION FOR WINEMAKERS

The proposed normative model of KT for winemakers consists of five stages.

- *Stage 1: Selection and codification*. This refers to the identification of areas of winemaking where practical knowledge and winemaker opinions and beliefs still prevail to a large extent. Relevant knowledge contents that are already explicitly known should be systematically documented. Where the knowledge operates at an implicit dimension, which is typically the case with practical knowledge that is exhibited in practice, an attempt should be made to codify such knowledge.

- *Stage 2: Verification*. The verification process involves a dual procedure. Firstly, the codified knowledge is verified and assessed within the global body of research evidence. This implies an investigation into the degree of available scientific evidence for the codified knowledge. Secondly, the codified knowledge should also be assessed in terms of the availability of colloquial evidence deemed relevant by winemakers. In other words, pragmatic considerations, professional opinions and beliefs, values, habits, traditions, etc., should all be considered as potential support for the codified knowledge.
- *Stage 3: Presentation*. A user-friendly knowledge product is created that consists of two components. The first component follows the example of current practice guidelines by recommending practices that are supported by available research of sufficient rigour. In the second component all winemaker practices and beliefs are listed, together with the degree of scientific evidence and the nature of the colloquial evidence. The latter demonstrates to winemakers sensitivity for their norms and values.
- *Stage 4*: *Dissemination*. The knowledge product is disseminated through certain channels, including *Wynboer* in the WineLand magazine, the internet, consultations and workshops, among other strategies.
- *Stage 5: Adoption and use*. Targeting opinion leaders is suggested as one strategy to facilitate adoption of the knowledge product by winemakers. However, the focus is on continued and sustained use of the knowledge product, adding value to winemaking practices, and for that reason a *monitoring and evaluation* framework should be part of the proposed KT strategy.

The different stages are now discussed in more detail.

<u>Stage 1: Selection and codification</u>

Winemaking is a multi-faceted activity, consisting of various components, processes and approaches that very much depend on the state and characteristics of the raw product being used (grape variety), as well as the envisaged end-product. Within this multi-faceted context it is proposed that one or more “snapshots” of winemaking be selected for intervention by means of a KT strategy. A “snapshot” refers to any stage in winemaking (e.g. clarification or fining/stabilisation), any topical area (e.g. wine quality or optimal wine characteristics), any wine ingredient (e.g. yeast) or any wine product (e.g. Chenin Blanc).

Typically, in the field of health, it is formal, explicit scientific research that is being translated for adoption in practice (Kothari et al., 2012). KT typically starts with the identification of a problem or area in need of change, which subsequently requires the introduction of high-quality research evidence. Thus, once a certain problem or area in need of intervention has been identified, relevant empirical evidence is selected to address the problem or, where empirical evidence does not exist, relevant research is commissioned. However, in the case of the KT strategy for winemakers an alternative point of departure is proposed. The suggestion is not that a problem be identified but rather one or more winemaking "snapshots" where operations are still very much defined in terms of winemaker opinions and practical knowledge.

Practical knowledge, as indicated in the literature chapter (Chapter 3, Section 3.4.3), is defined as internalised expertise-based knowledge that is habitual, implicit and typically exhibited in practice. Implicit knowledge is accumulated over time from different sources and experienced by the winemaker in the forms of common sense, a gut feeling or intuition during certain performances. The sources involve personal experience, past formal training and a variety of information collected from documents and people, involving both factual and potential factual knowledge. Thus, a winemaker's own practical knowledge, or rather pool (reservoir) of personal knowledge, can involve factual and non-factual information that has been internalised through practice and which, combined with experience, generates an implicit knowledge dimension. In other words, information that was once explicitly known to a winemaker can also become implicit over time through repetitive practice. When a winemaker provides advice to fellow-winemakers, and in the process reflects on her/his practices, the implicit dimension is accessed. The articulations that follow could then become part of the pool of personal knowledge of others and, depending on the extent to which such information is internalised by them, could also be exhibited in their practices.

What is therefore proposed is that "snapshots" of winemaking be identified where it is believed that practical knowledge to a large extent prevails. The "snapshots" should also include instances where winemaker opinions and beliefs are more explicitly known. For instance, in the case of wine yeast being selected as a "snapshot", the technical consultant who was interviewed at the yeast manufacturing firm already mentioned two instances where winemaker opinions and beliefs tend to create certain expectations regarding yeast performance. These respectively relate to alcoholic conversions and the role of glycerol and, in both cases, the beliefs happen to lack a scientific evidence base.

> *Winemakers firmly believe that certain yeasts produce more alcohol and when their wines, say, end up above 15 or 16 percent of alcohol and their bosses are not pleased, they blame the yeasts. And it is actually far removed from the truth. It has always been the way of thinking in the past until recent research … it was conducted about three, four years ago, and since then was mentioned far and wide, that there is no immense difference between yeasts and their alcoholic conversions. It is more the difference in the sugar levels of grapes that matters. You know, the guys pick riper grapes, that's why the alcohol is higher but they don't want to hear it. (Consultant C; translated from Afrikaans)*

> [Winemakers] *believe that if they … the more glycerol they have in their wine the higher the quality and … you know, that they must seek out yeasts with higher levels of glycerol. The reality is that the difference in concentrations in wine, the human palette cannot detect the difference. There is no correlation between glycerol and quality … So it is a total misconception and it is extremely difficult to get that idea out of peoples' heads. (Consultant C; translated from Afrikaans)*

The identification of the relevant "snapshots" should be a joint effort between all stakeholders and their representatives, including winemakers, winemaking consultants and technical consultants at firms that service the wine industry. Moreover, once the "snapshots" have been identified and a selection has been made, more in-depth contextual information should be collected from winemakers, such as under what conditions they hold certain opinions and how these manifest in their practice. Existing platforms of knowledge dissemination, such as Winetech workshops, can be used to elicit dominant winemaker perceptions and facilitate further elaborations concerning the selected "snapshots".

All of the above implies that winemaker perspectives are *communicated*, which means that the information that they convey can be written up and codified. Moreover, since winemakers are required to reflect on actual practices, it could be argued that the information extracted is an explication of their implicit knowledge. As emphasized before, this study distinguishes between two types of implicit knowledge: on the one hand, implicit knowledge that can be articulated and hence codified in written form and, on the other hand, implicit knowledge that is inherently tacit and thus not capable of being codified. What is extracted is implicit knowledge of the first type, as well as knowledge that is already more explicitly known by the winemaker.

A number of techniques have been suggested to elicit implicit knowledge, i.e. to document what is known implicitly (Kothari et al., 2012; Nonaka, 1994). One technique for eliciting implicit knowledge that deserves consideration in the KT strategy is that of the critical

decision interview method, which involves a semi-structured interview protocol based on the critical incident technique (Taylor, 2005).

> In the critical incident technique, respondents are asked to provide specific examples, with detailed contextual and behavioral information, of situations that they consider to be important and relevant to good or poor performance in the area under question. Thus, the critical incident approach focuses on *what* actions the respondents took, rather than on *why* they decided on a certain action in a specific situation, and so helps to reveal respondents' actual practice rather than their theories of action (Taylor, 2005:29).

In essence, the critical decision interview method involves a respondent being encouraged to tell the story of a specific incident (which could easily be replaced by a particular "snapshot)", without any interruptions. This is then followed by a series of more structured probe questions to determine, for instance, "critical cues that form the basis for judgement decisions" (Taylor, 2005:29). Klein, Calderwood and MacGregor (1989), who used a critical decision method to model tasks in naturalistic environments, regard cognitive probing as a method to encourage respondents to reflect on particular practice situations. One of their categories of probes relates to "cues", which includes questions such as what were you seeing, hearing or smelling. Other probe types relate to knowledge (What information did you use in making this decision and how was it obtained?); analogues (Were you reminded of any previous experience?); goals (What were your specific goals at this time?); options (What other courses of action were considered by or available); basis (How was this option selected/other options rejected? What rule was being followed?); and experience (What specific training or experience was necessary or helpful in making this decision?).

The narratives generated by the critical decision interview method need to be recorded and transcribed and submitted to a process of content analysis. In the context of the proposed KT strategy for winemakers, the resulting content categories will capture the practical knowledge of winemakers. These codifications of the practical knowledge of winemakers (organised and structured in terms of content elements), together with more explicitly known winemaker opinions and beliefs, then provide the input for the next stage in the KT process, namely verification.

<u>Stage 2: Verification</u>

Whereas selection and codification occur in the user/practice domain (as these processes can be executed by user representatives such as Winetech), the process of verification is predominantly related to the domain of science/research. Verification involves determining to what extent a scientific evidence base can be established for the codified practical knowledge and associated opinions and beliefs. This implies an extensive study of all

available research on the identified “snapshots” and the codified practical knowledge and opinions within those “snapshots”.

Essentially the strength of the available empirical evidence needs to be rated. Borrowing from the EBM literature, this can for instance be achieved by assigning “level of evidence scores” to the individual studies (Boissel et al., 2004), which could then be combined in a body of evidence to provide aggregate evidence scores for specific content elements and opinions. More qualitative ratings (e.g. strong, medium, weak, non-existent) of the degree of empirical evidence in relation to a particular “snapshot” also need to be generated. Both the quantitative and qualitative ratings serve to underscore that it is not so much about whether or not empirical evidence exists (absolutes), but rather to what degree empirical evidence exists (relativeness). Also, as Straus, Tetroe and Graham (2009) suggest, available scientific evidence should be considered in its totality, rather than the findings of individual studies only.

Moreover, Rycroft-Malone et al. (2004b) noted that practical knowledge, or professional craft knowledge as they call it, is seldom destined for transfer beyond a particular practice setting. Once articulated, however, as is proposed here, the practical knowledge can be “debated, contested and verified through wider communities of practice” (p. 83). This implies a secondary kind of verification, not in terms of scientific evidence but in terms of sets of evidence that are considered relevant by communities of practices, in this case the community of winemakers. Users tend to rely more on colloquial evidence, which is “anything that establishes a fact or gives reason for believing in something” (CHSRF, 2005:3). These include, among others, evidence about resources, expert and professional opinion, judgement, values, habits and traditions, as well as the particular pragmatics and contingencies of the situation. The establishment of colloquial evidence can occur in two ways: firstly, the interview transcripts should already provide some specifications in this regard and, secondly, a process of user engagement can be initiated (e.g. a limited number of additional interviews or discussions at Winetech workshops). However, irrespective of the approach followed, user engagement in the verification process needs to be actively sought, in order to identify salient barriers and supports that could eventually influence the uptake of the knowledge product (Logan & Graham, 1998).

Lastly, in cases where the colloquial evidence for certain beliefs or practices turns out to be pervasive but the scientific evidence base relatively weak or even lacking, scientific research should be commissioned to clarify the scientific foundation of those beliefs/practices.

Stage 3: Presentation

It is suggested that information from both the user/practice domain (i.e. winemaker opinions and codifications of their practical knowledge together with the necessary colloquial evidence) and the science/research domain (quantitative and qualitative ratings of the degree of empirical evidence) be presented in the knowledge product to be created. That being said, the first section of the product should list only practices and beliefs that are supported by empirical evidence of sufficient rigour (i.e. practices and beliefs that are associated with ratings of strong scientific evidence). Since this first section represents the high-quality science base component of the knowledge product, it corresponds to the conventional notion of a practice guideline and is strongly recommended for use. Explicit references to scientific evidence are made because it has been found to promote the eventual uptake of practice guidelines (e.g. Burgers et al., 2003; Grol et al., 1998).

In a second and more comprehensive section, all practices and beliefs relevant to the "snapshot" are listed, together with the degree of scientific evidence and the nature of the colloquial evidence. Thus, this second section gives winemakers the "entire picture", allowing for recognition of one's own beliefs and practices among those of others, as well as for an examination of the extent to which the practice/belief is backed by both empirical and colloquial evidence. Since the practices represent current behaviours and beliefs, it demonstrates to winemakers a sensitivity for their norms and values (Foy et al., 2002), which could eventually facilitate adherence to the recommended practice guidelines contained in the first section of the knowledge product. Such co-presentation of codified practical knowledge and factually-based scientific research evidence, signals a strong degree of recognition for the personal knowledge of winemakers. In this regard co-presentation of both practical and factual knowledge is reminiscent of the neo-populist approach to development, as it is assumed that practitioners will find their own workable solutions when presented with both types of knowledge.[28]

[28] Different models of rural development and environmental management differently engage with local knowledge against the backdrop of scientific and technological developments produced by natural resource R&D (Blaikie et al., 1997). The classical approach to rural development, which until the mid-1970s dominated the transfer of technology to developing areas as well as extension and training services for uptake among farmers, views local knowledge as "non-scientific, defective, irrational and even superstitious" (Blaikie et al., 1997:220). Against this backdrop local knowledge is seen as part of the problem. In order words, real development cannot occur or become pervasive because of the dominance of tradition. The general perspective is that the modern science should override existing practices. The neo-liberal approach, on the other hand, recognises local knowledge as being rational and that it is important to understand disincentives to the adoption of new developments. It however falls short of expressing a genuine appreciation for local knowledge but does not disparage it like the classical approach.

The third model, the neo-populist approach to rural development, emphasises respect for local knowledge and hence encourages participation by practitioners of local knowledge in any development initiatives. The degree of engagement in problem identification, finding or producing a solution and the implementation thereof can be presented on a continuum. At the one end of the continuum it is argued that technologies developed at external locations should be adapted through a process of local participation. Those occupying the middle ground of the continuum argue that practitioners of local knowledge have their own resource-use systems and the potential vitality or relevance thereof is best understood by researchers through extensive dialogue. The focus is on the development of culturally appropriate solutions through dialogue. The other end of the spectrum,

As far as the format of the knowledge product is concerned, a "plain-language booklet" (Kramer & Wells, 2005:431) is suggested, available in both English and Afrikaans. However, following the framework by Gagliardi et al. (2011) regarding the implementability of practice guidelines, one should also consider more formats for different sub-groups of users, as well as paying attention to the ease of navigation, and the use of narratives, bullets, tables and text boxes, to mention a few. To determine an optimal presentational format/structure, direct input is required from potential users, which, in the case of winemakers, could take different forms. For instance, a stakeholder reference group can be established at inception to tailor the knowledge product with the target audience in mind, or a prototype of the knowledge product can be developed and piloted among a sample of winemakers representing different market segments (age groups, cellar types, regions, etc.). Such user engagement will help to identify factors of presentation that could either facilitate or obstruct uptake of the knowledge product.

Stage 4: Dissemination

Active dissemination of the knowledge product is required, which should fully exploit the fact that *Wynboer* in the WineLand magazine is well read by winemakers and that the internet is seen as a valuable source of knowledge. Extracts from and discussions about the knowledge product need to become a regular feature in *Wynboer*. The knowledge product ("plain-language booklet") should also be downloadable from the internet. It is further proposed that a dedicated website be designed for the knowledge product, linked to the websites of WineLand, Winetech and VinPro, with a refined search engine and online navigation system. A web-based facility is thus required for winemakers to access the information "in-time" and also to comment and provide feedback online.

Moreover, hard copies of the booklets can be distributed by those who regularly consult with wine producers, namely VinPro consultants, private wine consultants and technical consultants. Specific outreach visits to promote the knowledge workshops among winemakers in different regions need to be initiated as it produces awareness and use of the knowledge product (Grol, 2001). Existing Winetech workshops could serve as an additional platform of user engagement to create product awareness, and to eliminate potential barriers to eventual use.

which is also advocated in the proposed KT strategy for winemakers, argues that if practitioners of local knowledge are given access to the full range of technological developments they will experiment and find their own solutions.

Stage 5: Adoption and use

Adoption, according to Rogers (2003:177) is the "decision to make full use of an innovation as the best course of action available". For many individuals the decision to adopt is informed by the results of a small-scale trial that the user first introduces before committing to full-scale implementation. However, depending on the nature and contents of the knowledge product concerned, a small-scale trial or incrementally introduced changes are not always possible. For that reason change agents, i.e. those who wish to initiate planned changes within a network or system, sometimes place excessive emphasis on the few peers who have already adopted, as evidence of adoption by others is a good substitute for self-introduced small-scale trials. Change agents often prioritise opinion leaders for first adoption, through special outreach efforts, as opinion leaders are well-respected and influential nodes in a social network, who can alter the attitudes and behaviours of others in that network. The prioritisation of opinion leaders as first adopters is also the strategy proposed here. The identification of such individuals should be informed by the results of the survey. According to the survey, opinion leaders are winemakers who have been making wine for at least five years, who export more than ten percent of their cellar's wine, who belong to one or more wine associations, and who have previously worked at two or more cellars, of which at least one in another country. Adoption, if successfully facilitated, is normally followed by implementation which means that the innovation, in this case the knowledge product, is put to use.

Use, however, is an anticipated outcome of the KT initiative and for that reason comprises both a final step in the translation initiative as well as a key evaluative focus in the broader monitoring and evaluation framework.

Monitoring and evaluation

Monitoring and evaluation (M&E) has become an essential component of models of KT (e.g. Graham et al., 2006; Logan & Graham, 1998; Stetler, 2010) but is seldom presented as an encompassing activity that, ideally, should start at the time of conceptualisation of the intervention, run concurrent to the intervention, and extend beyond the active phases of the intervention. The intervention's activities, outputs and outcomes also need to be conceptually clear from the start.

Monitoring is concerned with continual measuring of the attainment of the intervention's stated activities (e.g. identification of relevant "snapshots" or eliciting of the practical knowledge of winemakers through the critical decision interview method) and outputs (e.g. transcripts of winemaking descriptions, a content analytical framework for the descriptions,

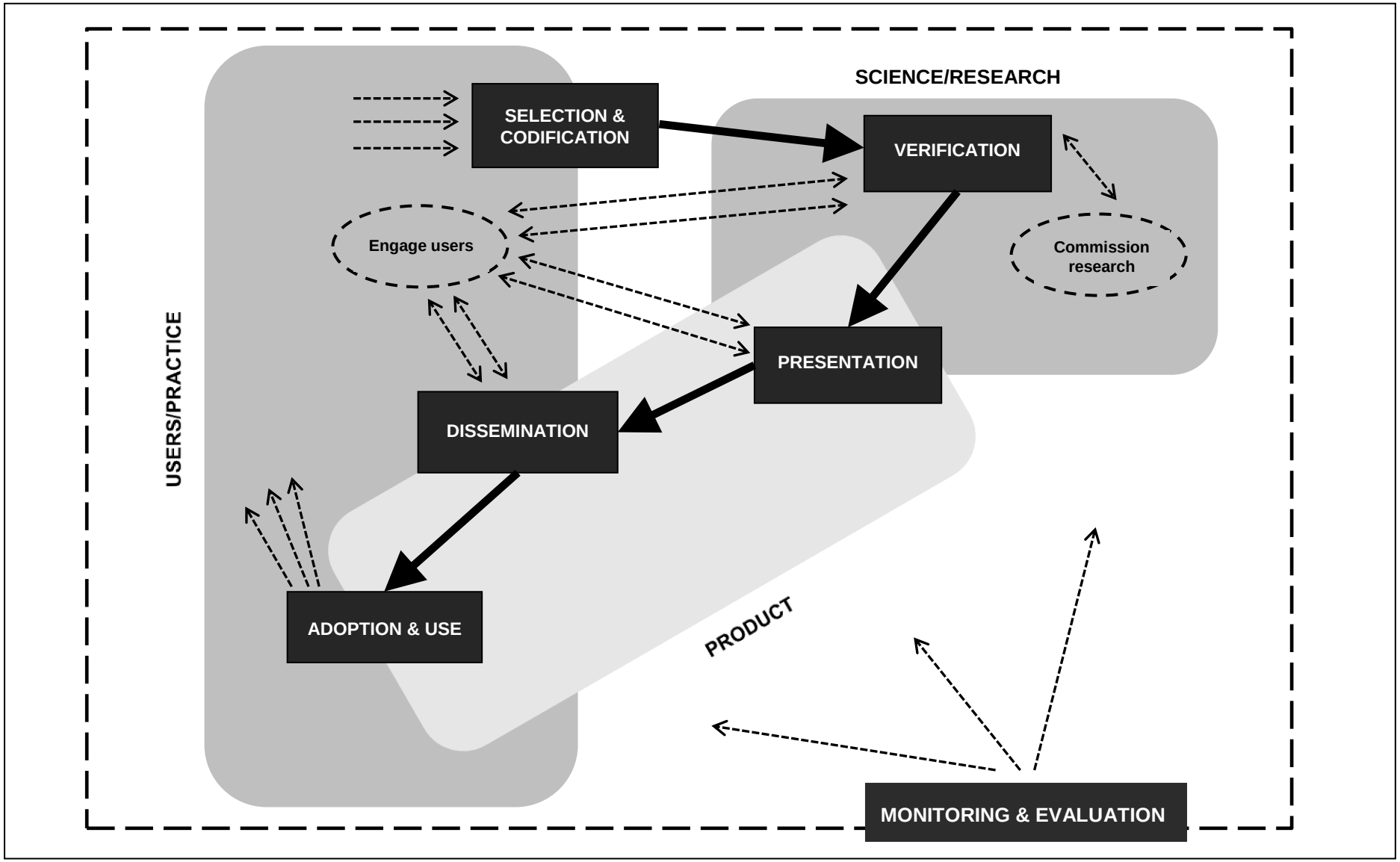
or a booklet consisting of two sections). As part of performance monitoring, the accomplishment of the activities and outputs needs to be examined in relation to set targets and milestones.

Evaluation aims to make an assessment with regard to the value of the intervention. Outcome evaluation tackles the stated outcomes of the intervention (e.g. more winemakers use research-based evidence in practices related to the selected "snapshots"). The evaluator needs to construct reliable and valid measures of these outcomes that demonstrate sensitivity to finer nuances and distinctions (e.g. different considerations of what constitute knowledge utilisation, as the latter can conform to either a typology or stages – Blake & Ottoson, 2009). Impact evaluation, on the other hand, aims to attribute changes, both intended and unintended, to the intervention. It also reflects on the ultimate merit of the intervention by assessing broader and differential effects (e.g. how and under what conditions certain knowledge components are diffused among members of large private cellars, or settings where the intervention appears to be least effective as users employ information based on colloquial rather than scientific evidence). Issues concerning sustainability of use of the knowledge product, and also sustainability of the KT intervention itself, typically forms part of impact evaluation.

Lastly, knowledge of the different disciplinary contributions within various traditions related to knowledge utilisation, which include KT, knowledge transfer and knowledge diffusion (Ashley, 2009; Davison, 2009; Oliver, 2009), can supplement standard evaluation practices. According to Ottoson (2009:7), insights from the different disciplinary traditions "individually and collectively provide multiple lenses on the evaluation of complex interventions". A certain "depth and perspective on the change process" (Ottoson, 2009:17) can be achieved during evaluation by shifting between the multiple lenses.

Figure 7.2 concludes this discussion by presenting a visual representation of the proposed model of KT for winemakers.

**Figure 7.2: Model of knowledge translation for South African winemakers**



## 7.3 CONCLUSION

The objective of this final chapter was to provide a normative model of KT for winemakers, which can be interpreted as both a practical and conceptual output of the study. In the context of the broader study the literature and empirical chapters generated insights that can be interpreted as more theoretical. These particularly pertain to the incorporation of a body of literature that is not typically associated with winemaking (e.g. EBM and KT) into the study of the knowledge sources and knowledge use of winemakers. In addition, the elements of practical knowledge have also been explored within the context of winemaking and additional insights provided with regard to the relationship between practical and factual knowledge as well as the relationship between different conceptions of knowledge use, and how knowledge sources relate to knowledge use. The findings and subsequent insights generated undoubtedly apply beyond studies of the knowledge use of winemakers.

Lastly, stakeholder and user engagement with the model, in all likelihood, will suggest further refinements to the model. It is also envisaged that implementation of the model will reveal finer nuances of knowledge use among winemakers, which should be investigated in future studies and in that way contribute to the emerging field of implementation science.

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# LIST OF REFERENCES


Adams, M.P. 2009. Empirical evidence and the knowledge-that/knowledge-how distinction. *Synthese*, *170*, 97-114.

Agri-Africa 2008. *South African wine industry benchmarking*. Draft report to the Western Cape Department of Economic Development and Tourism, February 29.

André, M., Borgquist, L., Foldevi, M. & Mölstad, S. 2002. Asking for 'rules of thumb': A way to discover tacit knowledge in general practice. *Family Practice*, *19*(6), 617-622.

André, M., Borgquist, L. & Mölstad, S. 2003. Use of rules of thumb in the consultation in general practice - An act of balance between the individual and the general perspective. *Family Practice*, *20*(5), 514-519.

APA Presidential Task Force on Evidence-Based Practice. 2006. Evidence-based practice in psychology. *American Psychologist*, *61*, 271–285.

Armstrong, R., Waters, E., Roberts, H., Olivier, S. & Popay, J. 2006. The role and theoretical evolution of knowledge translation and exchange in public health. *Journal of Public Health*, *28*(4), 384-389.

Ashley, S.R. 2009. Innovation diffusion: Implications for evaluation. *New Directions for Evaluation*, *124*, 35-45.

AWBC 2009. *Global wine support monitor*. Market Insight Report by the Australian Wine and Brandy Corporation, in collaboration with Wine Australia.

Aylward, D.K. 2003. A documentary of innovation support among new world wine industries. *Journal of Wine Research*, *14*(1), 31-43.

Aylward D. K. & Turpin, T. 2003. New wine in old bottles: A case study of innovation territories in 'New World' wine production. *International Journal of Innovation Management*, *7*(4), 501-525.

Backer, T. 1991. Knowledge utilization: The third wave. *Knowledge: Creation, Diffusion, Utilization*, *12*(3), 225-240.

Bandopadhayay, P., Goldschlager, T. & Rosenfeld, J.V. 2008. The role of evidence-based medicine in neurosurgery. *Journal of Clinical Neuroscience*, *15*(4), 373-378.

Bannigan, K. & Bryar, R. 2002. The importance of overcoming barriers to research utilization. *British Journal of Therapy and Rehabilitation*, *9(7*), 270-273.

Benner, P. 1984. *From novice to expert: Excellence and power in clinical nursing practice*. Menlo Park, California: Addison-Wesley Publishing Company.

Blaikie, P., Brown, K., Stocking, M., Tang, L., Dixod, P. & Sillitoe, P. 1997. Knowledge in action: Local knowledge as a development resource and barriers to its incorporation in natural resource research and development. *Agricultural Systems*, *55*(2), 217-237.

Blake, S.C. & Ottoson, J.M. 2009. Knowledge utilization: Implications for evaluation. *New Directions for Evaluation*, *124*, 21-34.

Boerkamp, E.J.C., Haaijer-Ruskamp, F.M., Reuyl, J.C. & Versluis, A. 1996. The use of drug information sources by physicians: Development of a data-generating methodology. *Social Science Medicine*, *42*(3), 379-388.

Boissel, J-P., Amsallem, E., Cucherat, M., Nony, P. & Haugh, M.C. 2004. Bridging the gap between therapeutic results and physician prescribing decisions: Knowledge transfer, a prerequisite to knowledge translation. *European Journal of Clinical Pharmacology*, *60*, 609-616.

Boshoff, N. 2005. *Lactic acid bacteria research: The fermentation of new ideas into winemaking*. In Bailey, T. (ed). The dynamic of knowledge production and utilisation: Fifteen case studies, pp. 15-88. Centre for Research on Science and Technology (CREST), University of Stellenbosch. SUN PRESS: Stellenbosch.

Boström, A.-M., Wallin, L. & Nordström, G. 2006. Research use in the care of older people: a survey among healthcare staff. *International Journal of Older People Nursing*, *1*, 131-140.

Bousquet, J., Bieber, T., Fokkens, W., Humbert, M., Kowalski, M.L., Niggemann, B., Simon, H.U. & Schunemann, H. 2008. Consensus statements, evidence-based medicine and guidelines in allergic diseases. *Allergy*, *63*(1), 1-4.

Bozeman, B. 2000. Technology transfer and public policy: A review of research and theory. *Research Policy*, *29*, 627-655.

Braude, H.D. 2009. Clinical intuition versus statistics: Different modes of tacit knowledge in clinical epidemiology and evidence-based medicine. *Theoretical Medicine and Bioethics*, *30*, 181-198.

Brown-Luthango, M. 2007. *Skills and quality production in the South African wine industry*. Dissertation presented for the Degree of Doctor of Philosophy at the University of Stellenbosch.

Burgers, J.S., Grol, R.P.T.M., Zaat, J.O.M., Spies, T.H., Van der Bij, A.K. & Mokkink, H.G.A. 2003. Characteristics of effective clinical guidelines for general practice. *British Journal of General Practice*, *53*, 15-19.

Cannon, D. 2002. Construing Polanyi's tacit knowing as knowing by acquaintance rather than knowing by representation: Some implications. *Tradition and Discovery*, *29*(2), 26-43.

Caplan, N. 1979. The two-communities theory and knowledge utilization. *American Behavioral Scientist*, *22*(3), 459-470.

Carper, B.A. 1978. Fundamental patterns of knowing in nursing. *Advances in Nursing Science*, *1*, 13-23.

Castaldi, R.M., Silverman, M. & Sengupta, S. 2004. Globalization in the wine industry: Implications for export service providers. *International Journal of Wine Marketing*, *16*(2), 5-23.

Chaffy, L., Unsworth, C. & Fossey, E. 2010. A grounded theory of intuition among occupational therapists in mental health practice. *British Journal of Occupational Therapy*, *73*(7), 300-308.

Champion, V.L. & Leach, A. 1989. Variables related to research utilization in nursing: An empirical investigation. *Journal of Advanced Nursing*, *14*, 705-710.

CHSRF 2005. *Conceptualizing and combining evidence for health system guidance*. Ottawa, Canada: Canadian Health Services Research Foundation.

Chwalisz, K. 2003. Evidence-based practice: A framework for twenty-first-century scientist-practitioner training. *The Counseling Psychologist*, *31*(5), 497-528.

Cialdella, P., Figon, G., Haugh, M.C. & Boissel, J-P. 1991. Prescription intentions in relation to therapeutic information: A study of 117 French general practitioners. *Social Science Medicine*, *33*(11), 1263-1274.

CIAT, 2011a. *Prospectus: B.Agric. Cape Institute for Agricultural Training: Elsenburg*. Department of Agriculture, Western Cape.

CIAT, 2011b. *Prospectus: Higher certificate. Cape Institute for Agricultural Training: Elsenburg*. Department of Agriculture, Western Cape.

Cólon-Emeric, C.S., Lekan, D., Utley-Smith, Q, Ammarell, N., Bailey, D., Corazzini, K., Piven, M.L. & Anderson, R.A. 2007. Barriers to and facilitators of clinical practice guidelines use in nursing homes. *Journal of the American Geriatrics Society*, *55*, 1404-1409.

Conningarth Economists. 2009. *Macro-economic impact of the wine industry on the South African economy (also with reference to the impacts on the Western Cape)*. Pretoria, South Africa: Conningarth Economists.

Cooney, S. & Allen, T.J. 1974. The technological gatekeeper and policies for national and international transfer of information. *R&D Management*, *5*, 29-33.

Costandius, P. 2009. *The winemaking consultant – Guru or geek?* [Online]. Published on 5 November 2009 in WineNews. Available: www.wine.co.za.

Covell, D.G., Uman, G.C. & Manning, P.R. 1985. Information needs in office practice: Are they being met? *Annals of Internal Medicine*, *103*(4), 596-599.

Cusmano, L., Morrison, A. & Rabellotti, R. 2009. *Catching-up trajectories in the wine sector: A comparative study of Chile, Italy and South Africa*. [Online]. American Association of Wine Economists (AAWE) Working Paper No. 34. Available: www.wine-economics.org.

Dahan, R., Borkan, J., Brown, J.-B., Reis, S., Hermoni, D. & Harris, S. 2007. The challenge of using the low back pain guidelines: A qualitative research. *Journal of Evaluation in Clinical Practice*, *13*, 616-620.

Davis, D., Evans, M., Jadad, A., Perrier, L., Rath, D., Ryan, D., Sibbald, G., Straus, S., Rappolt, S., Wowk, M. & Zwarenstein, M. 2003. The case for knowledge translation: Shortening the journey from evidence to effect. *British Medical Journal*, *327*, 33-35.

Davis, D.A. & Tailor-Vaisey, A. 1997. Translating guidelines into practice: A systematic review of theoretic concepts, practical experience and research evidence in the adoption of clinical practice guidelines. *Canadian Medical Association Journal*, *157*(4), 408-416.

Davison, C.M. 2009. Knowledge translation: Implications for evaluation. *New Directions for Evaluation*, *124*, 75-87.

De Vries, R. & Lemmens, T. 2006. The social and cultural shaping of medical evidence: Case studies from pharmaceutical research and obstetric science. *Social Science & Medicine*, *62*, 2694-2706.

Dobbins, M., Rosenbaum, P., Plews, N., Law, M. & Fysh, A. Information transfer: What do decision makers want and need from researchers? *Implementation Science*, *2*(20).

Dreyfus, H.L. & Dreyfus, S.E. 1986. *Mind over machine: The power of human intuition and expertise in the era of the computer*. New York: The Free Press.

Dunn, W.N. 1980. The two communities metaphor and models of knowledge use. *Knowledge: Creation, Diffusion, Utilization*, *1*, 515-536.

Ebitz, D. 1988. Connoisseurship as practice. *Artibus et Historiae*, *9*(18), 207-212.

Eccles, M., Grimshaw, J., Walker, A., Johnston, M. & Pitts, N. 2005. Changing the behavior of healthcare professionals: The use of theory in promoting the uptake of research findings. *Journal of Clinical Epidemiology*, *58*, 107-112.

Ely, J.W., Osheroff, J.A., Ebell, M.H., Bergus, G.R., Levy, B.T., Chambliss, M.L. & Evans, E.R. 1999. Analysis of questions asked by family doctors regarding patient care. *British Medical Journal*, *319*(7206), 358-361.

Ely, J.W., Osheroff, J.A., Ebell, M.H., Chambliss, M.L., Vinson, D.C., Stevermer, J.J. & Pifer, E.A. 2002. Obstacles to answering doctors' questions about patient care with evidence: Qualitative study. *British Medical Journal*, *324*(7339), 710-713.

Estabrooks, C.A. 1999. The conceptual structure of research utilization. *Research in Nursing and Health*, *22*(3), 203-216.

Estabrooks, C.A., Rutakumwa, W., O'Leary, K.A., Profetto-McGrath, J., Milner, M., Levers, M.J. & Scott-Findlay, S. 2005. Sources of practice knowledge among nurses. *Qualitative Health Research*, *15*(4), 460-476.

Estabrooks, C.A., Derksen, L., Winther, C., Lavis, J.N., Scott, S.D., Wallin, L. & Profetto-McGrath, J. 2008. The intellectual structure and substance of the knowledge utilization field: A longitudinal author co-citation analysis, 1945 to 2004. *Implementation Science*. *3*(49).

Esterhuizen, D. & Van Rooyen, C.J. 2006. An inquiry into factors impacting on the competitiveness of the South African wine industry. *Agrekon*, *45*(4), 467-485.

Everitt, S. 2008. Applying evidence-based veterinary medicine. *In Practice*, *30*(9), 526-528.

Ewert, J. 2003. Co-operatives to companies: The South African wine industry in the face of globalization, in R. Almas & G. Lawrence (eds.) *Globalization, localization and sustainable livelihoods*. Aldershot: Ashgate, 153-169.

Eyferth, J. 2010. Craft knowledge at the interface of written and oral cultures. *East Asian Science, Technology and Society: An International Journal*, *4*, 185-205.

Falshaw, M., Carter, Y.H. & Gray, R.W. 2000. Evidence should be accessible as well as relevant. *British Medical Journal*, *321*, 567.

Field, A. 2009. *Discovering statistics using SPSS* (3rd edition). London: Sage.

Foy, R., MacLennan, G., Grimshaw, J., Penney, G., Campbell, M. & Grol, R. 2002. Attributes of clinical recommendations that influence change in practice following audit and feedback. *Journal of Clinical Epidemiology*, *55*(7), 717-722.

Gabbay, J. & Le May, A. 2004. Evidence based guidelines or collectively constructed "mindlines"? Ethnographic study of knowledge management in primary care. *British Medical Journal*, *329*(7473), 1013-1016.

Gagliardi, A.R., Brouwers, M.C., Palda, V.A., Lemieux-Charles, L. & Grimshaw, J.M. 2011. How can we improve guideline use? A conceptual framework of implementability. *Implementation Science*, *6*(26).

Galant, J. 2005. *The role of intermediary organisations in the utilisation of research*. Centre for Research on Science and Technology (CREST), University of Stellenbosch: SUN PRESS.

Garrett, P. 1995. The South African natural wine industry – Recent history with particular reference to the influence of Stellenbosch Farmers' Winery. *International Journal of Wine Marketing*, *7*(2), 46-54.

Garrett, P. 1996. Danie de Wet and his influence on the South African wine industry. *International Journal of Wine Marketing*, *8*(2), 51-56.

Garrett, P. 2002. A background to the South African wine industry 2001. *International Journal of Wine Marketing*, *14*(1), 65-67.

Geertz, C. 1983. *Local knowledge. Further essays in interpretive anthropology*. New York: Basic Books.

Gettier, E.L. 1963. Is Justified True Belief Knowledge? *Analysis*, *23*(6), 121-123.

Giuliani, E. 2007. The wine industry: Persistence of tacit knowledge or increased codification? Some implications for catching-up countries. *International Journal of Technology and Globalisation*, *3*(2/3), 138-154.

Glanzel, W. & Veugelers, R. 2006. Science for wine: A bibliometric assessment of wine and grape research for wine-producing and consuming countries. *American Journal of Enology and Viticulture*, *57*(1), 23-32.

Glasziou, P. & Haynes, B. 2005. The paths from research to improved health outcomes. *ACP Journal Club*, *142*, A8-A10.

Golec, L. 2009. The art of inconsistency: Evidence-based practice my way. *Journal of Perinatology*, *29*, 600-602.

Goode, J. 2005. *Wine science. The application of science in winemaking*. London: Mitchelle Beazly.

Gorman, M.E. 2002. Types of knowledge and their roles in technology transfer. *Journal of Technology Transfer*, *27*(3), 219-231.

Graham, K. & Logan, J. 2004. Using the Ottawa Model of Research Use to implement a skin care program. *Journal of Nursing Care Quality*, *19*(1), 18-26.

Graham, I.D., Logan, J., Harrison, M.B., Straus, S.E., Tetroe, J., Caswell, W. & Robinson, N. 2006. Lost in knowledge translation: Time for a map? *Journal of Continuing Education in the Health Professions*, *26*(1), 13-24.

Graham, I.D., Tetroe, J. & the KT Theories Research Group. 2007. Some theoretical underpinnings of knowledge translation. *Academic Emergency Medicine*, *14*(11), 936-941.

Grainger, K. & Tattersall, H. 2005. *Wine production: Vine to bottle*. Oxford: Blackwell Publishing Ltd.

Greenhalgh, T. 2002. Intuition and evidence – Uneasy bedfellows? *British Journal of General Practice*, *52*, 395-400.

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., Kyriakidou, O. & Peacock, R. 2005. Storylines of research in diffusion of innovation: A meta-narrative approach to systematic review. *Social Science & Medicine*, *61*(2), 417-430.

Grilli, R. & Lomas, J. 1994. Evaluating the message: The relationship between compliance rate and the subject of a practical guideline. *Medical Care*, *32*, 202-213.

Grimshaw, J.M., Eccles, M.P., Lavis, J.N., Hill, S.J. & Squires, J.E. 2012. Knowledge translation of research findings. *Implementation Science*, *7*(50).

Grimshaw, J.M., Shirran, L., Thomas, R., Mowatt, G., Fraser, C., Bero, L., Grilli, R., Harvey, E., Oxman, A. & O'Brien, M.A. 2001. Changing Provider Behavior: An Overview of Systematic Reviews of Interventions. *Medical Care*, *39*(8), Supplement 2, II.2-II.45

Grol, R. 2001. Successes and failures in the implementation of evidence-based guidelines for clinical practice. *Medical Care*, *39*(8), Supplement 2, II-46-II-54.

Grol, R., Dalhuijsen, J., Thomas, S., Veld, C., Rutten, G. & Mokkink, H. 1998. Attributes of clinical guidelines that influence use of guidelines in general practice: Observational study. British Medical Journal, *317*(7162), 858-861.

Guyatt, G.H., Meade, M.O., Jaeschke, R.Z., Cook, D.J. & Haynes, R.B. 2000. Practitioners of evidence based care. *British Medical Journal*, *320*(7240), 954-955.

Haack, S. 1993. *Evidence and inquiry: Towards reconstruction in epistemology*. Malden, Massachusetts: Blackwell Publishers.

Haines, A. & Donald, A. 1998. Getting research findings into practice: Making better use of research findings. *British Medical Journal*, *317*(7150), 72-75.

Hair, J.F., Anderson, R.E., Tatham, R.L., & Black, W.C. (1998). *Multivariate Data Analysis*. New Jersey: Prentice-Hall International.

Harvey, G., Loftus-Hills, A., Rycroft-Malone, J., Titchen, A., Kitson, A., McCormack, B. & Seers, K. 2002. Getting evidence into practice: The role and function of facilitation. *Journal of Advanced Nursing*, *37*(6), 577-588.

Haynes, R.B., Devereaux, P.J. & Guyatt, G.H. 2002. Physicians' and patients' choices in evidence based practice. *British Medical Journal*, *324*(7350), 1350.

Haynes, B. & Haines, A. 1998. Getting research findings into practice: Barriers and bridges to evidence based clinical practice. *British Medical Journal*, *317*(7153), 273-276.

Heiskanen, E. 2006. Encounters between ordinary people and environmental science – A transdisciplinary perspective on environmental literacy. *The Journal of Transdisciplinary Environmental Studies*, *5*(1-2), 1-13.

Hogan, D.L. & Logan, J. 2004. The Ottawa Model of Research Use: A guide to clinical innovation in the NICU. *Clinical Nurse Specialist*, *18*(5), 255-261.

Holmes, M.A. & Ramey, D.W. 2007. An introduction to evidence-based veterinary medicine. *Veterinary Clinics of North America – Equine Practice*, *23*(2), 191.

Howland, R.H. 2008. Limitations of evidence in the practice of evidence-based medicine. *Psychiatric Annals*, *38*(5), 334-336.

Huberman, M. 1990. Linkage between researchers and practitioners: A qualitative study. *American Educational Research Journal*, *27*(2), 363-391.

ICEBeRG (Improved Clinical Effectiveness through Behavioural Research Group). 2006. Designing theoretically-informed implementation interventions. *Implementation Science*, *1*(4).

Jacobson, N. 2007. Social epistemology – Theory for the "Fourth wave" of knowledge transfer and exchange research. *Science Communication*, *29*(1), 116-127.

Jenicek, M. 2006. The hard art of soft science: Evidence-based medicine, reasoned medicine or both? *Journal of Evaluation in Clinical Practice*, *12*(4), 410-419.

Kitson, A., Harvey, G. & McCormack, B. 1998. Enabling the implementation of evidence based practice: A conceptual framework. *Quality in Health Care*, *7*, 149-158

Kitson, A.L., Rycroft-Malone, J., Harvey, G., McCormack, B., Seers, K. & Titchen, A. 2008. Evaluating the successful implementation of evidence into practice using the PARiHS framework: Theoretical and practical challenges. *Implementation Science*, *3*(1).

Kitto, S., Villanueva, E.V., Chesters, J., Petrovic, A., Waxman, B.P. & Smith, J.A. 2007. Surgeons' attitudes towards and usage of evidence-based medicine in surgical practice: A pilot study. *ANZ Journal of Surgery*, *77*(4), 231-236.

Klein, G.A., Calderwood, R. & MacGregor, D. 1989. Critical decision method for eliciting knowledge. *IEEE Transactions on Systems, Man, and Cybernetics*, *19*(3), 462-472.

Knott, J. & Wildavsky, A. 1980. If dissemination is the solution, what is the problem? *Knowledge: Creation, Diffusion, Utilization*, *1*(4), 537-578.

Kontos, P.C. & Poland, B.D. 2009. Mapping new theoretical and methodological terrain for knowledge translation: Contributions from critical realism and the arts. *Implementation Science*, *4*(1).

Kothari, A., Rudman, D., Dobbins, M., Rouse, M., Sibbald, S. & Edwards, N. 2012. The use of tacit and explicit knowledge in public health: A qualitative study. *Implementation Science*, *7*(20).

Kramer, D.M. & Wells, R.P. 2005. Achieving buy-in. Building networks to facilitate knowledge transfer. *Science Communication*, *26*(4), 428-444.

Lagendijk, A. 2004. Global 'lifeworlds' versus local 'systemworlds': How flying winemakers produce global wines in interconnected locales. *Tijdschrift voor Economische en Sociale Geografie*, *95*(5), 511-526.

Lambert, H. 2006. Accounting for EBM: Notions of evidence in medicine. *Social Science & Medicine*, *62*, 2633-2645.

Landry, R., Amara, N. & Lamari, M. 2001a. Climbing the ladder of research utilization. Evidence from social science research. *Science Communication*, *22*(4), 396-422.

Landry, R., Amara, N. & Lamari, M. 2001b. Utilization of social science research knowledge in Canada. *Research Policy*, *30*, 333-349.

Lang, E.S., Wyer, P.C. & Haynes, R.B. 2007. Knowledge translation: Closing the evidence-to-practice gap. *Annals of Emergency Medicine*, *49*(3), 355-363.

Larsen, J.K. 1980. Knowledge utilization. What is it? *Knowledge: Creation, Diffusion, Utilization*, *1*(3), 421-442.

Logan, J. & Graham, I.D. 1998. Toward a comprehensive interdisciplinary model of health care research use. *Science Communication*, *20*(2), 227-246.

Logan, J., Harrison, M.B., Graham, I., Bissonette, J. & Dunn, K. 1999. Evidence-based ulcer practice: The Ottawa model of research use. *Canadian Journal of Nursing Research*, *31*(1), 37-52.

Mansfield, E. 1961. Technical change and the rate of imitation. *Econometrica, 29*, 741-766.

Martin, B.R. 2003. The changing social contract for science and the evolution of the university, in A. Geuna, A. Salter & W.E. Steinmueller (eds.). *Rethinking the rationality for funding and governance*. Cheltenham: Edward Elgar Publishing, 7-29.

May, C. & Finch, T. 2009. Implementing, embedding, and integrating practices: Normalization process theory. *Sociology*, *43*(3), 535-554.

May, C.R., Mair, F., Finch, T., MacFarlane, A., Dowrick, C., Treweek, S., Rapley, T., Ballini, L., Ong, B.N., Rogers, A., Murray, E., Elwyn, G., Légaré, F., Gunn, J. & Montori, V.M. 2009. Development of a theory of implementation and integration: Normalization process theory. *Implementation Science*, *4*(29).

McColl, A., Smith, H., White, P. & Field, J. 1998. General practitioners' perceptions of the route to evidence based medicine: A questionnaire survey. *British Medical Journal*, *316*(7128), 361-365.

McCormack, B. 1992. Intuition: Concept analysis and application to curriculum development. I. Concept analysis. *Journal of Clinical Nursing*, *1*, 339-344.

McCormack, B., Kitson, A., Harvey, G., Rycroft-Malone, J., Titchen, A. & Seers, K. 2002. Getting evidence into practice: The meaning of 'context'. *Journal of Advanced Nursing*, *38*(1), 94-104.

McLean, R.K.D., Graham, I.D., Bosompra, K., Choudhry, Y., Coen, S.E., MacLeod, M., Manuel, C., McCarthy, R., Mota, A., Peckham, D., Tetroe, J.M. & Tucker, J. 2012. Understanding the performance and impact of public knowledge translation funding interventions: Protocol for an evaluation of Canadian institutes of health research knowledge translation funding programs. *Implementation Science*, *7*(57).

Moussa, I.D. 2008. The practice of interventional cardiovascular medicine: "Evidence-based" or "Judgment-based"? *Catheterization and Cardiovascular Interventions*, *72*(1), 134-136.

Murphy, K.R. & Davidshofer, C.O. 1994. *Psychological testing: Principles and applications* (3rd edition). Englewood Cliffs, New Jersey: Prentice Hall.

Nagel, U.J. 1997. Alternative approaches to organizing extension, in: B.E. Swanson, R.P. Bentz & A.J. Sofranko (eds.). *Improving agricultural extension: A reference manual*. Rome: Food and Agriculture Organization of the United States.

NCDDR 2005. *What is knowledge translation*? Technical brief number 10. National Center for the Dissemination of Disability Research.

NCDDR 2006. *Overview of international literature on knowledge translation*. Technical brief number 14. National Center for the Dissemination of Disability Research.

NCDDR 2007. *Knowledge translation at the Canadian Institutes of Health Research: A primer*. Technical brief number 18. National Center for the Dissemination of Disability Research.

Nilsen, P., Roback, K., Broström, A. & Ellström, P-E. 2012. Creatures of habit: Accounting for the role of habit in implementation research on clinical behaviour change. *Implementation Science*, *7*(53).

Nonaka, I. 1994. A dynamic theory of organizational knowledge creation. *Organization Science*, *5*(1), 14-37.

Norman, G., Young, M. & Brooks, L. 2007. Non-analytical models of clinical reasoning: The role of experience. *Medical Education, 41*(12), 1140-1145.

O'Brien, D. 2006. *An introduction to the theory of knowledge*. Cambridge: Polity Press.

Oliver, M.L. 2009. The transfer process: Implications for evaluation. *New Directions for Evaluation*, *124*, 61-73.

Ottoson, J.M. 2009. Knowledge-for-action theories in evaluation: Knowledge utilization, diffusion, implementation, transfer, and translation. *New Directions for Evaluation*, *124*, 7-20.

Pears, D. 1971. *What is knowledge?* London: George Allen & Unwin Ltd.

Polanyi, M. 1958. *Personal knowledge: Towards a post-critical philosophy*. Chicago, Illinois: University of Chicago Press.

Polanyi, M. 1966. *The tacit dimension*. Garden City, New York: Doubleday.

Ponte, S. 2007. *Governance in the value chain for South African wine*. [Online]. Tralac Working Paper No. 9. Available: www.tralac.org.

Ponte, S. & Ewert, J. 2007. *South African wine - An industry in ferment*. [Online]. Tralac Working Paper No. 8. Available: www.tralac.org.

Pretorius, I.S. 2000. Tailoring wine yeast for the new millennium: Novel approaches to the ancient art of winemaking. *Yeast*, *16*, 675-729.

Pronovost, P., Berenholtz, S. & Needham, D. 2008. Translating evidence into practice: A model for large scale knowledge translation. *British Medical Journal*, *337*, 963-965.

Ramey, H.L. & Grubb, S. 2009. Modernism, postmodernism and (evidence-based) practice. *Contemporary Family Therapy*, *31*, 75-86.

Rankine, B. 1989. *Making good wine: A manual of winemaking practice for Australia and New Zealand*. Melbourne: Sun books.

Ratcliffe, M. 2011. *Where are the wine industry's leaders*? [Online]. An edited extract from a speech given by Michael Ratcliffe at the Stellenbosch launch of the book 'Grape - from Slavery to BEE' by Jeanne Viall, Wilmot James and Jakes Gerwel. Submitted by Open Space on 30 October 2011.
Available: www.grape.co.za/users/open_space/blog/2011-10-30-where_are_wine_industrys_leaders.html.

Rew, L. 1986. Intuition: Concept analysis of a group phenomenon. *Advances in Nursing Science*, *8*(2), 21-28.

Rew, L. 1988. Intuition in decision-making. *Image - The Journal of Nursing Scholarship*, *20(*3), 150-154.

Rich, R.F. 1979. The pursuit of knowledge. *Knowledge: Creation, Diffusion, Utilization*, *1*, 6-30.

Rich, R.F. 1997. Measuring knowledge utilization: Processes and outcomes. *Knowledge and Policy: The International Journal of Knowledge Transfer and Utilization*, *10*(3), 11-24.

Rogers, E.M. 1988. The intellectual foundation and history of the agricultural extension model. *Knowledge: Creation, Diffusion, Utilization*, *9*(4), 492-510.

Rogers, E.M. 2003. *Diffusion of innovations* (5th ed). New York: Free Press.

Rotter, B. 2009. *Art and science in winemaking*. [Online]. Available: www.brsquared.org/wine. [2010, May 11].

Rutledge, D.N. & Bookbinder, M. 2002. Processes and outcomes of evidence-based practice. *Seminars in Oncology Nursing*, *18*(1), 3-10.

Ryan, B. & Gross, N. 1943. The diffusion of hybrid seed corn in two Iowa communities. *Rural Sociology*, *8*(1), 15-24.

Rycroft-Malone J., Harvey, G., Seers, K., Kitson, A., McCormack, B. & Titchen, A. 2004a. An exploration of the factors that influence the implementation of evidence into practice. *Journal of Clinical Nursing*, *13*, 913-924.

Rycroft-Malone J., Seers, K., Titchen, A., Harvey, G., Kitson, A. & McCormack, B. 2004b. What counts as evidence in evidence-based practice? *Journal of Advanced Nursing*, *47*(1), 81-90.

Ryle, G. 1949. *The concept of mind*. London: Hutchinson.

Ryle, G. 1971. *Knowing how and knowing that*. Chapter 15 (pp. 212-215) in: Collected Papers. Volume II of Collected Essays, 1929-1968. London: Hutchinson & Co.

Sackett, D.L., Rosenberg, W.M.C., Gray, J.A.M., Haynes, R.B. & Richardson, W.S. 1996. Evidence based medicine: What it is and what it isn't. It's about integrating individual clinical expertise and the best external evidence. *British Medical Journal*, *312*(7023), 71-72.

Sahdra, B. & Thagard, P. 2003. Procedural knowledge in molecular biology. *Philosophical Psychology*, *16*(4), 477-498.

SAWB 2003a. *A strategic plan for a vibrant, united, non-racial and prosperous South African wine industry* (version 1, October 2003). South African Wine and Brandy Company.

SAWB 2003b. *Cape winelands quality commitment. Setting the strategic course for excellence*. *South African wine, brandy, grape juice concentrate*. South African Wine and Brandy Company.

SAWIS 2011. *South African wine industry statistics*. [Online]. Annual statistics (for 2010) by the SA Wine Industry Information and Systems. Available: www.sawis.co.za. (2011, August 4].

Schmidt, P.L. 2007. Evidence-based veterinary medicine: Evolution, revolution, or repackaging of veterinary practice? *Veterinary Clinics of North America – Small Animal Practice*, *37*(3), 409.

Shekelle, P., Eccles, M.P., Grimshaw, J.M. & Woolf, S.H. 2001. When should clinical guidelines be updated? *British Medical Journal*, *323*(7305), 155-157.

Silagy, C.A., Stead, L.F. & Lancaster, T. 2001. Use of systematic reviews in clinical practice guidelines: Case study of smoking cessation. *British Medical Journal*, *323*(7317), 833-836.

Simunovic, M. & Baxter, N.N. 2009. Knowledge translation research: A review and new concepts from a surgical case study. *Surgery*, *145*(6), 639-644.

Smith, R. 1996. What clinical information do doctors need? *British Medical Journal*, *313*(7064), 1062-1068.

Snowdon, P. 2003. Knowing how and knowing that: A distinction reconsidered. *Proceedings of the Aristotelian Society*, *104*(1), 1-29.

Stacey, D., Pomey, M.-P., O'Connor, A.M. & Graham, I.D. 2006. Adoption and sustainability of decision support for patients facing health decisions: An implementation case study in nursing. *Implementation Science*, *1*(177).

Stanley, J. & Williamson, T. 2001. Knowing how. *The Journal of Philosophy*, *98*(8), 411-444.

Stetler, C.B. 1985. Research utilization: Defining the concept. *Image: The Journal of Nursing Scholarship*, *17*(2), 40-44.

Stetler, C.B. 1994. Refinement of the Stetler/Marram model for application of research findings to practice. *Nursing Outlook*, *42*(1), 15-25.

Stetler, C.B. 2001. Updating the Stetler model of research utilization to facilitate evidence-based practice. *Nursing Outlook*, *49*(6), 272-279.

Stetler, C.B. & Marram, G. 1976. Evaluating research findings for applicability in practice. *Nursing Outlook*, *24*, 559-563.

Stetler, C.B., Morsi, D., Rucki, S., Broughton, S., Corrigan, B., Fitzgerald, J., Giuliano, K., Havener, P. & Sheridan, E.A. 1998. Utilization-focused integrative reviews in a nursing service. *Applied Nursing Research*, *11*(4), 195-206.

Stolper, E., Van Bokhoven, M., Houben, P., Van Royen, P., Van de Wiel, M., Van der Weijden, T. & Dinant, G.J. 2009a. The diagnostic role of gut feelings in general practice: A focus group study of the concept and its determinants. *BMC Family Practice*, *10*(17).

Stolper, E., Van Royen, P., Van de Wiel, M., Van Bokhoven, M., Houben, P., Van der Weijden, T. & Dinant, G.J. 2009b. Consensus on gut feelings in general practice. *BMC Family Practice*, *10*(66).

Stolper, E., Van de Wiel, M., Van Royen, P., Van Bokhoven, M., Van der Weijden, T. & Dinant, G.J. 2010. Gut feelings as a third track in general practitioners' diagnostic reasoning. *Journal of General Internal Medicine*, *96*(2), 197-203.

Straus, S.E. & Sackett, D.L. 1998. Getting research findings into practice: Using research findings in clinical practice. *British Medical Journal*, *317*(7154), 339-342.

Straus, S.E., Tetroe, J. & Graham, I. 2009. Defining knowledge translation. *Canadian Medical Association Journal*, *181*(3-4), 165-168.

Stricker, G. 2003. Evidence-based practice: The wave of the past. *The Counseling Psychologist*, *31*(5), 546-554.

Sudsawad, P. 2007. *Knowledge translation: Introduction to models, strategies, and measures*. Austin, TX: Southwest Educational Development Laboratory, National Center for the Dissemination of Disability Research.

Swart, E. & Smit, I. 2009. *The essential guide to South African wines* (2nd edition). Cape Town: Cheviot Publishing.

Taylor, H. 2005. A critical decision interview approach to capturing tacit knowledge: Principles and application. *International Journal of Knowledge Management*, *1*(3), 25-39.

Thagard, P. 2006. How to collaborate: Procedural knowledge in the cooperative development of science. *The Southern Journal of Philosophy*, *XLN*, 177-196.

Theron, C. 2008. *Wynkundige tegnologie oordrag in die Suid-Afrikaanse wynbedryf* (Enological technology transfer in the South African wine industry). Report produced for Winetech.

Timmermans, S. & Kolker, E.S. 2004. Evidence-based medicine and the reconfiguration of medical knowledge. *Journal of Health and Social Behavior*, *45*, 177-193.

Tonelli, M.R. 2010. The challenge of evidence in clinical medicine. *Journal of Evaluation in Clinical Practice*, *16*, 384-389.

Townsend, R. & Van Zyl, J. 1998. Estimation of the rate of return to wine grape research and technology development expenditures in South Africa. *Agrekon*, *37*(2), 189-210.

Turnbull, D. 1997. Reframing science and other local knowledge traditions. *Futures*, *29*(6), 551-562.

Valente, T.W. 1996. Social network thresholds in the diffusion of innovations. *Social Networks*, *18*(1), 69-89.

Van de Luitgaarden, G.M.J. 2009. Evidence-based practice in social work: Lessons from judgment and decision-making theory. *British Journal of Social Work*, *39*, 243–260.

Viljoen, F. 2000. VINPRO(SA): Consultation Service – Past and future. *WineLand*, February 2000. [Online].

Vink, N., Williams, G. & Kirsten, J. 2004. South Africa, in K. Anderson (ed.). *The world's wine markets: Globalization at work*. Cheltenham: Edward Elgar.

Wallin, L. 2009. Knowledge translation and implementation research in nursing. *International Journal of Nursing Studies*, *46*, 576-587.

Weiss, C.H. 1978. Broadening the concept of research utilization. *Sociological Symposium*, *21*, 20-33.

Weiss, C.H. 1979. The many meanings of research utilization. *Public Administration Review*, *39*, 426-431.

Weiss, C.H. 1980. Knowledge creep and decision accretion. *Knowledge: Creation, Diffusion, Utilization*, *1*(3), 381-404.

Welsh, I. & Lyons, C.M. 2001. Evidence-based care and the case for intuition and tacit knowledge in clinical assessment and decision making in mental health nursing practice: An empirical contribution to the debate. *Journal of Psychiatric and Mental Health Nursing*, *8*, 299-305.

Williamson, T. 2000. *Knowledge and its limits*. Oxford: Oxford University Press.

WineLand 2006. *South African wine industry directory 2006/7*. WineLand Publications, Paarl, South Africa.

WineLand 2009. *South African wine industry directory 2009/10*. WineLand Publications, Paarl, South Africa.

WineLand 2010. *South African wine industry directory 2010/11*. WineLand Publications, Paarl, South Africa.

Winetech. 2003. *Winetech annual report 2003*. Produced by the Wine Industry Network of Expertise and Technology, South Africa.

Winetech. 2006. *Winetech annual report 2006*. Produced by the Wine Industry Network of Expertise and Technology, South Africa.

Winetech. 2008a. *Winetech annual report 2008*. Produced by the Wine Industry Network of Expertise and Technology, South Africa.

Winetech. 2008b. *Winetech strategy: Research and technology innovation and transfer*. [Online]. Wine Industry Network of Expertise and Technology. Available: www.winetech.co.za.

Winetech. 2009. *Constitution of Winetech*. [Online]. Wine Industry Network of Expertise and Technology. Available: www.winetech.co.za.

Winetech. 2010. *Winetech annual report 2010*. Paarl, South Africa: Wine Industry Network of Expertise and Technology.

Wingens, M. 1990. Toward a general utilization theory: A systems theory reformulation of the two-communities metaphor. *Knowledge: Creation, Diffusion, Utilization*, *12*(1), 27-42.

Wissing, G.J. 1969. Certain facts regarding the wine industry in South Africa. *Agrekon*, *8*(4), 18-20.

Yin, R.K. & Moore, G.B. 1988. Lessons on the utilization of research from nine case experiences in the Natural Hazards field. *Knowledge in Society: The International Journal of Knowledge Transfer*, *1*(3), 25-44.

Young, J.O. 2008. The coherence theory of truth. [Online]. *Stanford Encyclopedia of Philosophy*. Available: http://plato.stanford.edu/entries/truth-coherence/.

Yousefi-Nooraie, R., Shakiba B., Mortaz-Hedjri, S. & Soroush, A.R. 2007. Sources of knowledge in clinical practice in postgraduate medical students and faculty members: A conceptual map. *Journal of Evaluation in Clinical Practice*, *13*, 564-568.

# Annexure 1

# QUESTIONNAIRE: SOURCES AND UTILISATION OF KNOWLEDGE AMONG SOUTH AFRICAN WINEMAKERS

## A. Sources of knowledge

1. How closely do you read the following South African publications?

| | Read everything in each edition | Read parts of each edition | Read only some editions | Do not read |
|---|---|---|---|---|
| South African Journal of Enology and Viticulture (SAJEV) | 1 | 2 | 3 | 4 |
| *Wynboer* in the WineLand magazine | 1 | 2 | 3 | 4 |
| Outlook Gazette by Anchor Yeast | 1 | 2 | 3 | 4 |

2. How often do you read/consult the following sources?

| | Once a month | Once in 3 months | Once in 6 months | Never / almost never |
|---|---|---|---|---|
| Winetech Scan | 1 | 2 | 3 | 4 |
| Findings of Winetech-funded research in the Winetech database (available online at the SAWIS information centre) | 1 | 2 | 3 | 4 |
| Trade journals by the wine industries of other countries (e.g. Australian and New Zealand Grapegrower and Winemaker) | 1 | 2 | 3 | 4 |
| International science journals (e.g. Australian *Journal* of Grape and Wine Research, *American Journal of Enology* and Viticulture, International Journal of Wine Research) | 1 | 2 | 3 | 4 |
| Reports by international research organisations (e.g. Australian Wine Research Institute, Marlborough Wine Research Centre) | 1 | 2 | 3 | 4 |
| Contributions in New World Winemaker (www.newworldwinemaker.com) | 1 | 2 | 3 | 4 |
| Textbooks and manuals of winemaking practice (e.g. "Making good wine" by Bryce Rankine) | 1 | 2 | 3 | 4 |

3. How often do you seek expert advice from the following people?

| | At least once a month | At least once in 3 months | At least once in 6 months | Never / almost never |
|---|---|---|---|---|
| Staff from Elsenburg College of Agriculture | 1 | 2 | 3 | 4 |
| Staff from the Department of Viticulture and Oenology and/or the Institute for Wine Biotechnology (IWBT) at Stellenbosch University | 1 | 2 | 3 | 4 |
| Staff from ARC Infruitec-Nietvoorbij | 1 | 2 | 3 | 4 |
| Technical consultants from Anchor Yeast | 1 | 2 | 3 | 4 |
| Technical consultants from other yeast manufacturing companies | 1 | 2 | 3 | 4 |
| Technical consultants from Brenn-O-Kem | 1 | 2 | 3 | 4 |
| VinPro consultants | 1 | 2 | 3 | 4 |
| Staff from wine laboratories responsible for wine analyses | 1 | 2 | 3 | 4 |
| Other winemakers in South Africa | 1 | 2 | 3 | 4 |
| Winemakers in other countries | 1 | 2 | 3 | 4 |

4. How often do you do the following?

| | At least once a month | At least once in 3 months | At least once in 6 months | Never / almost never |
|---|---|---|---|---|
| Obtain feedback on the quality of wine products from wine consumers (e.g. at wine tastings) | 1 | 2 | 3 | 4 |
| Search the Internet for information on issues related to winemaking | 1 | 2 | 3 | 4 |
| Participate in winemaker forums on the Internet | 1 | 2 | 3 | 4 |

5. How often have you in the past attended the following events?

| | 3 or more times | Twice | Once | Never attended |
|---|---|---|---|---|
| Information sessions/seminars/workshops by Winetech/VinPro | 1 | 2 | 3 | 4 |
| Information sessions/seminars/workshops by Anchor Yeast | 1 | 2 | 3 | 4 |
| Workshops and short courses by the South African Society for Enology and Viticulture (SASEV) | 1 | 2 | 3 | 4 |
| The annual conference of the South African Society for Enology and Viticulture (SASEV) | 1 | 2 | 3 | 4 |
| Relevant conferences in other countries | 1 | 2 | 3 | 4 |
| Seminars at Stellenbosch University where postgraduate students present their theses and dissertations | 1 | 2 | 3 | 4 |

6. Rate the importance of each of the following for your OWN winemaking.

| | Of extreme importance | Of some importance | Of little importance | Of no importance |
|---|---|---|---|---|
| South African Journal of Enology and Viticulture (SAJEV) | 1 | 2 | 3 | 4 |
| *Wynboer* in the WineLand magazine | 1 | 2 | 3 | 4 |
| Outlook Gazette by Anchor Yeast | 1 | 2 | 3 | 4 |
| Textbooks and manuals of winemaking | 1 | 2 | 3 | 4 |
| Trade journals by the wine industries of other countries | 1 | 2 | 3 | 4 |
| International scientific publications and reports | 1 | 2 | 3 | 4 |
| Conferences in South Africa | 1 | 2 | 3 | 4 |
| Conferences in other countries | 1 | 2 | 3 | 4 |
| The Internet | 1 | 2 | 3 | 4 |
| Staff from Elsenburg College of Agriculture | 1 | 2 | 3 | 4 |
| Staff from the Department of Viticulture and Oenology and/or the Institute for Wine Biotechnology (IWBT) at Stellenbosch University | 1 | 2 | 3 | 4 |
| Staff from other South African universities | 1 | 2 | 3 | 4 |
| Staff from ARC Infruitec-Nietvoorbij | 1 | 2 | 3 | 4 |
| Technical consultants from Anchor Yeast | 1 | 2 | 3 | 4 |
| Technical consultants from other yeast manufacturing companies | 1 | 2 | 3 | 4 |
| Technical consultants from Brenn-O-Kem | 1 | 2 | 3 | 4 |
| VinPro consultants | 1 | 2 | 3 | 4 |
| Information sessions/seminars/workshops for the South African wine industry | 1 | 2 | 3 | 4 |
| Information in leaflets that accompany commercial yeast products | 1 | 2 | 3 | 4 |
| Information in leaflets that accompany commercial products (starter cultures) for malolactic fermentation | 1 | 2 | 3 | 4 |
| Results of wine analyses from wine laboratories | 1 | 2 | 3 | 4 |
| Staff or colleagues at your cellar/winery/estate | 1 | 2 | 3 | 4 |
| South African winemakers in other cellars/wineries/estates | 1 | 2 | 3 | 4 |
| Winemakers in other countries | 1 | 2 | 3 | 4 |
| Family members who know about winemaking | 1 | 2 | 3 | 4 |
| Own experience (what has worked/ not worked before) | 1 | 2 | 3 | 4 |
| Intuition / common sense / personal knowledge | 1 | 2 | 3 | 4 |
| Formal training received at college/university | 1 | 2 | 3 | 4 |
| Winemaking tradition (of farm, estate, cellar, family etc.) | 1 | 2 | 3 | 4 |
| Opinions of wine consumers | 1 | 2 | 3 | 4 |
| Other (Specify: …….. …….. | | | | |

7. Which ONE of the above is the single most important source of knowledge for you in your winemaking?

……..……..……..……

8. How often do fellow-winemakers come to you for information or advice?

| | |
|---|---|
| At least once a month | 1 |
| At least once in 3 months | 2 |
| At least once in 6 months | 3 |
| Never / almost never | 4 |

## B. Research utilisation

9. Rate the extent to which you agree with the following statements.

| | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|---|---|---|---|---|
| **Scientific research findings on winemaking …** | | | | | |
| Have led me to do things differently in my winemaking | 1 | 2 | 3 | 4 | 5 |
| Have led me to develop a better understanding of some aspect(s) of my winemaking | 1 | 2 | 3 | 4 | 5 |
| Have strengthened my personal belief(s) concerning winemaking | 1 | 2 | 3 | 4 | 5 |
| Have caused me to change some aspect of my winemaking | 1 | 2 | 3 | 4 | 5 |
| Have led me to become more preventive in my winemaking | 1 | 2 | 3 | 4 | 5 |
| Have led me to become more experimental in my winemaking | 1 | 2 | 3 | 4 | 5 |
| Have led me to advise other winemakers to do things differently in their winemaking | 1 | 2 | 3 | 4 | 5 |
| Have not added any value to my winemaking | 1 | 2 | 3 | 4 | 5 |
| Are too complex to be of use in my winemaking | 1 | 2 | 3 | 4 | 5 |
| Are too fragmented to be of use in my winemaking | 1 | 2 | 3 | 4 | 5 |
| Only serve the interests of academics | 1 | 2 | 3 | 4 | 5 |

## C. Demographics

10. What is your highest relevant qualification completed? ("Relevant" means a qualification that is related to winemaking.)

……..……..……..……

11. At what institution did you complete your highest relevant qualification?

……..……..……..……

12. In what year did you obtain your highest relevant qualification? .....…….. (year)

13. Which of the following best describes the winery/cellar(s) where you currently work? (Select all that apply.)

| | |
|---|---|
| Estate winery/cellar | 1 |
| Independent (non-estate) winery/cellar | 2 |
| Co-operative cellar | 3 |
| Producing wholesaler | 4 |
| Garagiste producer (home winemaker) | 5 |
| Other (Specify: ……..) | 6 |

14. What is your position at the winery/cellar where you currently work?

| | |
|---|---|
| Winemaker | 1 |
| Assistant winemaker | 2 |
| Other (Specify: ……..) | 3 |

15. In what wine region is the winery/cellar located?

| | | | | | |
|---|---|---|---|---|---|
| Agulhas | 1 | Olifants River | 8 | Swellendam | 15 |
| Breedekloof | 2 | Orange River | 9 | Tulbagh | 16 |
| Cape Point | 3 | Overberg | 10 | Wellington | 17 |
| Constantia | 4 | Paarl | 11 | Worcester | 18 |
| Darling | 5 | Robertson | 12 | Walker Bay | 19 |
| Durbanville | 6 | Stellenbosch | 13 | Other (Specify:……) | 20 |
| Klein Karoo | 7 | Swartland | 14 | | |

16. On average, what percentage of the total volume of wine production (natural, fortified and sparkling) at the winery/cellar is exported to other countries?

…… % of total volume

17. What is/are your area(s) of specialisation in winemaking? (Select all that apply.)

| | | | | | |
|---|---|---|---|---|---|
| Blanc de Noir | 1 | Cinsaut | 11 | Ruby Cabernet | 21 |
| Bordeaux | 2 | Colombar | 12 | Sauvignon Blanc | 22 |
| Cabernet Franc | 3 | Grenache | 13 | Sémillon | 23 |
| Cabernet Sauvignon | 4 | Jerepigo | 14 | Sherry | 24 |
| Cape Blend | 5 | Merlot | 15 | Shiraz | 25 |
| Cape Riesling | 6 | Muscadel/Hanepoot | 16 | Viognier | 26 |
| Chardonnay | 7 | Pinot Noir | 17 | Other (Specify:…… …… ……..……) | 27 |
| Chenin Blanc | 8 | Pinotage | 18 | | |
| Cap Classique | 9 | Port | 19 | | |
| Other sparkling | 10 | Rosé | 20 | | |

18. What is the flagship wine of the farm/estate/cellar where you work?

……..……..……..……

19. At how many wineries/cellars did you previously work, either as winemaker or assistant winemaker, prior to your current winemaking position? (Do not count the winery/cellar where you currently work.)

    …….. (number)

20. How many of these other wineries/cellars (where you previously worked) are not located in South Africa?

    …….. (number)

21. For how long have you been making wine or assisting in the making of wine?

    …….. (total number of years)

22. Are there any other winemakers in your family?

| | |
|---|---|
| Yes | 1 |
| No | 2 |

23. In the past three years, how many awards (trophies, medals etc.) did the wines that you were involved in receive at national wine competitions, challenges and professional tastings?

    …….. (number of awards)

24. In the past three years, how many awards (trophies, medals etc.) did the wines that you were involved in receive at international wine competitions, challenges and professional tastings?

    …….. (number of awards)

25. Which of the following South African wine-related associations/societies/forums are you a member of? (Select all that apply.)

| | |
|---|---|
| Cape Estate Wine Producers' Association | 1 |
| Cape Winemakers Guild | 2 |
| Chardonnay Forum | 3 |
| Chenin Blanc Association | 4 |
| Garagiste Movement | 5 |
| Institute of Cape Wine Masters | 6 |
| Méthode Cap Classique Producers' Association | 7 |
| Muscadel South Africa | 8 |
| Pinot Noir Interest Group | 9 |
| Pinotage Association | 10 |
| Sauvignon Blanc Interest Group | 11 |
| Shiraz Forum | 12 |
| South African Port Producers' Association | 13 |
| South African Society for Enology and Viticulture (SASEV) | 14 |
| Other (Specify: ……...) | 15 |

26. What is your gender?

| | |
|---|---|
| Female | 1 |
| Male | 2 |

27. In what year were you born? ……...…….

28. Completion of the questionnaire is anonymous. However, I would like to follow up on some of the interesting responses to include as case studies in my research. If you would be willing to talk in more depth about your winemaking, please provide your contact details in the spaces below. (*NB: Provision of these details is voluntary and not compulsory. If you prefer not to provide any details, please leave the spaces blank.*)

Name: ……..……...…..……

Email: ……..……..……..……..

Telephone number: ……..……..……..

**END OF QUESTIONNAIRE**
**THANK YOU FOR YOUR TIME AND CO-OPERATION.**