

**The Sustainability Performance of the  
South African – European Wine Supply Chain:**  
Differences in sustainability from a scientific and actor perspective



**A.G. Abbing**

*Master's Thesis Research  
MSc Sustainable Development EP & M  
Department of Innovation and Environmental Science*



**Utrecht University**

October 2010

*The sustainability performance of the South African – European Wine Supply Chain: differences in sustainability from a scientific and actor perspective*

May 2010

Master's Thesis Research Project, 45ECTS

Submitted in completion of the MSc Sustainable Development: Environmental Policy and Management

Department of Innovation & Environmental Science

Faculty of Geosciences, Utrecht University

Albertus Grietinus Abbing

*Student number:* 3133273  
*Correspondence:* Groenhoven 307  
1103 LH Amsterdam  
The Netherlands  
[bertil.abbing@gmail.com](mailto:bertil.abbing@gmail.com)

*Supervisor:* Dr. Walter J.V. Vermeulen  
Copernicus Institute  
Utrecht University  
The Netherlands  
[w.vermeulen@geo.uu.nl](http://w.vermeulen@geo.uu.nl)

Photograph on front cover by author

## Summary

In this report it is discussed that differences in perception on improving the sustainability performance of the South African – European wine supply chain can be observed. It is expected that these differences exist between different chain actors connected to the supply chain and between those chain actors and objective-empirical concluded results. This research, attempts to conclude if these differences exist and what effect they have on the sustainability performance of the South African – European wine supply chain.

## **Introduction & methodology**

Differences in perception are generally acknowledged for Market actors directly involved in global supply chains. The perception towards Sustainable Development differs between 'North' and 'South' and can lead to 'Eurocentric' solutions (Ras, Vermeulen, & Saalmink, 2007). However, the wine supply chain is not solely the domain of Market actors. Actors from other societal spheres are indirectly involved in the wine supply chain and can significantly influence the approach taken for improving the sustainability performance of the South African – European wine supply chain. State establishes policy and legislation to which actors in the supply chain have to comply with. Both these policies and legislation can therefore affect the sustainability performance of the supply chain. Non Governmental Organisations (NGOs), often recognized as the voice of Civil Society, can influence chain actors to improve the sustainability performance of the supply chain. The consumer, part of Market and being an economic actor, can influence the supply chain, demanding more sustainable products. Finally, the Scientific Community offers new knowledge on a wide array of sustainable development subjects and provides new methods to improve the sustainability performance of the supply chain. Moreover, the Scientific Community is also responsible for conducting objective-empirical research on the sustainability performance.

Hence, the transformation to a more sustainable supply chain does not only affect chain actors from the Market. Furthermore, Market actors are not the only actors deciding how to enhance the sustainability performance of the wine supply chain. This suggests that, besides Market actors, actors from the other societal spheres should be involved in the efforts towards a more sustainable supply chain. However, such a multiplicity of chain actors implies an unequal perception towards improving the sustainability performance of the wine supply chain. Letting us believe that; a) Chain actors connected to the supply chain have unequal perceptions towards achieving a more sustainable supply chain; and b) Perceptions of chain actors towards achieving a more sustainable supply chain do not coincide with objective-empirical concluded results. In order to verify these hypotheses and thus, to determine possible differences in perceptions towards achieving a more sustainable supply chain, the following research question needs to be answered:

*What are the differences in perceptions of actors connected to the supply chain, of the relative importance of various sustainability aspects of the South African – European wine supply chain?*

To answer this main research question two analyses, corresponding with the two aforementioned assumptions, have been conducted. An objective-empirical analysis measuring the actual sustainability performance and an interpretative analysis that determined chain actor perceptions towards the sustainability performance of the wine supply chain. Each analysis answers a sub question. Since Sustainable Development is founded upon three dimensions the sustainability performance is measured on the Environmental, Social and (Socio)-economic dimension (Hutchins, Sutherland 2008; Labuschagne, Brent & van Erck 2005; Kloepffer 2008).

To determine the sustainability performance of the supply chain empirically a secondary LCA analysis has been conducted, answering the following sub question.

- *What are the most severe environmental impacts in the current South African – European wine supply chain from an objective-empirical approach?*

For the secondary LCA analysis several LCA studies on wine supply chains and wine production have been identified. A comparative analysis concluded which environmental aspects were most seriously harmed by sections of the wine supply chain. However, the objective-empirical analysis could only been performed for the environmental dimension as such methodology has not been fully developed for the social and socio-economic dimension.

The second analysis determined the perceptions of chain actor from each societal sphere that are connected to the South African – European wine supply chain. This second analysis answers the following sub question and two additional sub questions considered relevant when improving the sustainability performance of the wine supply chain.

- *Which sustainability aspects do involved chain actors perceive to be most relevant to remove, reduce or improve in order to improve the sustainability performance of the South African – European wine supply chain?*
- *Which sections of the South African – European wine supply chain are perceived relevant for improving relevant sustainability aspects?*
- *Which societal sphere, or combination of societal spheres, is considered to be mostly responsible for improving the sustainability performance of the South African – European wine supply chain?*

Since no methodology for assessing perceptions towards Sustainable Development or sustainability (performance) had been identified in the consulted literature the ‘Sustainability Perceptions Analysis’ (SPA) has been designed to determine perceptions of different societal spheres towards the sustainability performance of the wine supply chain. Chain actor perceptions are measured on the three sustainability dimensions. The three sustainability dimensions are divided in sixteen main environmental aspects (table I) that are each divided in a number of detailed sustainability aspects. Perceptions of chain actors from all societal spheres who are connected to the wine supply chain have been collected through semi open interviews in which, the chain actors were asked to fill out the SPA perceptionnaire<sup>1</sup>. Perceptions of Consumers and European Market actors have been collected through surveys and email based surveys respectively. Subsequently, collected perceptions of chain actors have been aggregated to a perception of the societal sphere they operate in.

<b>Main Sustainability Aspects</b>		
<b>Environmental</b>	<b>Social</b>	<b>Socio-economic</b>
Land Use Atmosphere Water Biodiversity Energy & Resources Nuisances	Employment Health and Safety Training and Education Social Capital: Coherence and Trust Physical Capital Consumer Interest	Wages Social safety net Community prosperity Trade & Finances

Table I: Main sustainability aspects employed in the SPA

The SPA determines the perceptions of chain actors towards improving the sustainability performance of the wine supply chain on three levels (figure I); i) an aggregated level, measuring the perceived relevance of the three sustainability dimensions; ii) a main aspect level determining the perceived relevance of sixteen sustainability aspects covering the sustainability dimensions; iii) a

<sup>1</sup> The perceptionnaire is a type of questionnaire to determine chain actors’ perceptions

detailed sustainability aspect level, to determine which of the detailed sustainability aspects are perceived relevant within each main sustainability aspect but also to determine for which sections in the wine supply chain these detailed sustainability aspects are relevant and who is perceived responsible for improving these relevant detailed sustainability aspects.

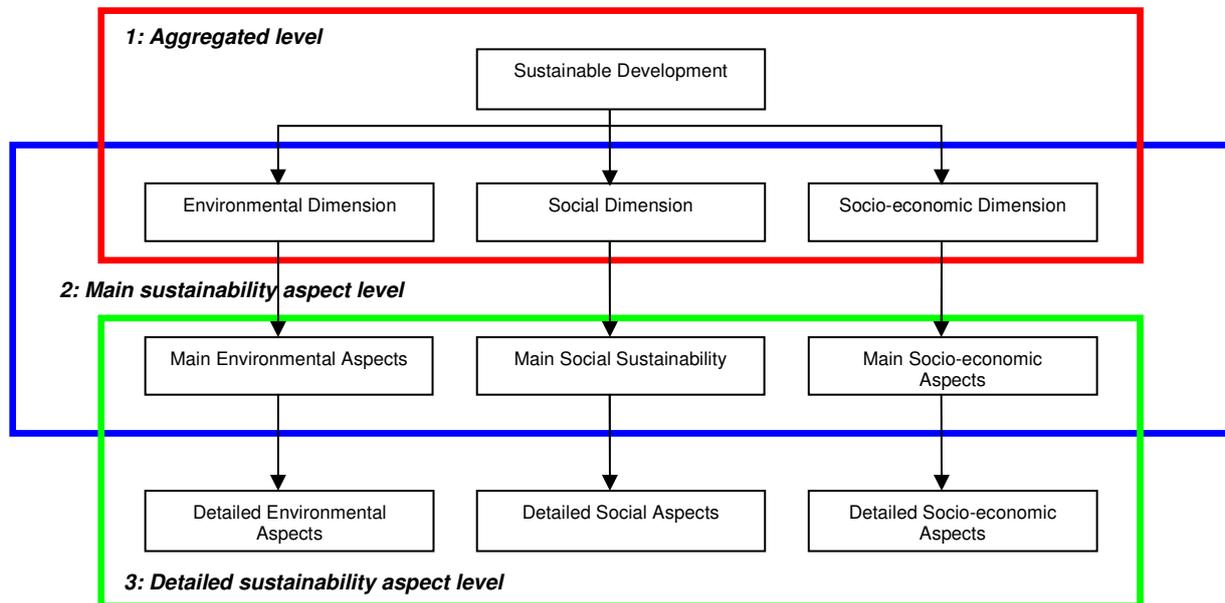


Figure 1: Sustainability Perception Analysis (SPA) levels

## Results

Drawing on results from the secondary LCA analysis, it can be concluded that the supply side sections Vineyard and Winery have the most detrimental effect on the main environmental aspects. However, the supply chain sections Shipping and Consumer have a negative effect on the main environmental aspects Atmosphere and Energy & Resources. The main environmental aspect Nuisances was not mentioned in any of the collected LCAs, therefore considered as irrelevant when improving the sustainability performance of the wine supply chain.

The SPA concludes that differences in perceptions between societal spheres do exist though these are more apparent between societal spheres operating on the same side of the wine supply chain than between societal spheres and their counterparts on the opposite side. Hence, the divide between 'North' and 'South' is smaller than often assumed. Moreover, these differences are more apparent on a main aspect level whereas the three sustainability dimensions are perceived similarly relevant for improving the sustainability performance of the wine supply chain.

For the environmental dimension it can be concluded that Water and Energy & Resources are perceived most relevant on both sides of the supply chain while the demand side additionally considers Land Use a relevant main environmental aspect.

Some differences in perceived relevance can be distinguished for the main social aspects. Both sides perceive Health & Safety as a relevant main social aspect to improve when increasing the sustainability performance of the wine supply chain. However, in addition the supply side perceives Training & Education most relevant while the demand side regards Consumer Interest more relevant. Inequalities in perceived relevance for the main socio-economic aspects are rather small. The main socio-economic aspects are perceived equally relevant compared to each other but also between supply- and demand side.

Though difference between the supply- and the demand side are smaller than expected, a few large differences in perceived relevance can be observed between societal spheres. When large differences appear they often appear between the Scientific Community and/or Civil Society and

their counterparts. State and Market's perceptions are corresponding more with their counterpart's perception.

However, there is no relation between perceived relevance of detailed sustainability aspects and perceived relevance of main sustainability aspects. Detailed sustainability aspects are in general perceived more relevant regardless of societal spheres' perception towards the main sustainability aspects. Hence, if improving the wine supply chain can be done with infinite resources chain actors perceive all sustainability aspects more relevant.

Societal spheres on both sides of the supply chain do regard the sections on the supply side of the supply chain most relevant for improvements. However, it cannot, as often assumed, be confirmed that sections on the supply side are perceived structurally more relevant by societal spheres on the demand side or that sections on the demand side are perceived consistently more relevant by societal spheres on the supply side. However, both sides acknowledge that even if most sustainability gain can be achieved on the supply side of the supply chain, improvements towards the sustainability performance can still be realized on the demand side.

In general societal spheres on both sides of the supply chain assign responsibility to partnerships. However, the supply side is a firm advocate of a governance approach or a State/Market partnership to make improvements toward the sustainability performance. The demand side considers a State/Market partnership often responsible, however, State in particular considers Market often mainly responsible for improving the sustainability performance of the wine supply chain. Though, governance is often perceived as a 'Northern' approach for tackling sustainability issues the SPA demonstrated that governance is more appreciated on the 'Southern' side of the wine supply chain.

A comparison of the objective-empirical results with the SPA results demonstrates that the differences are smaller than expected. Therefore, empirically and interpretatively it can be concluded that sections on the supply side of the supply chain are deemed most detrimental to the environment. Moreover, both approaches conclude that Atmosphere and Energy & Resources are perceived relevant for improving sections besides those on the supply side of the supply chain. Even though the secondary LCA analysis and the SPA arrive at similar results it should be stressed that societal spheres often perceive sections and main environmental aspects relevant to improve that are not detrimental to the environment according to objective-empirical results.

### **Conclusion**

From these results I conclude that the differences in perception towards a more sustainable wine supply chain are in general smaller than expected. Though, they are still evident and can obstruct progress to a more sustainable wine supply chain. As it is, in general, acknowledged that consensus is necessary to attain Sustainable Development differences in perception towards achieving a more sustainable wine supply chain should be reduced. Differences appear in particular between different societal spheres indicating that the supply chain is not sufficiently transparent for indirect chain actors. In order to increase this transparency a better information exchange between direct and indirect chain actors should be established.

The majority of societal spheres on both sides of the supply chain perceive partnerships necessary for improving the sustainability performance of the wine supply chain. These partnerships give an opportunity to increase consensus forming between societal spheres and increase the transparency, hence, increase the effectiveness and efficiency of increasing the sustainability performance of the wine supply chain. Partnerships can take upon two forms; a partnership between different societal spheres operating at the same side of the supply chain, and a partnership between societal spheres and their counterparts on the opposite side of the supply chain.

The first partnership would exchange information and increase communication between societal spheres operating at the same side of the supply chain. This would therefore increase the

transparency of the supply chain. Involvement of the Scientific Community can be desired even if there is no great contrast between the results from the secondary LCA analysis and SPA.

A second partnership would be particularly feasible for the Scientific Community and Civil Society as these tend to differ most in perception. Such a partnership would give societal spheres a better insight in the sustainability situation of the wine supply chain on the opposite side of the supply chain. However, since differences between Market and State and their counterparts are also apparent it would be advisable for these societal spheres to increase communication and information exchange to improve the sustainability performance of the wine supply chain.

Though partnerships increase the success on consensus forming for certain sustainability aspects consensus might not be achieved. Especially when large differences in perception exist it will be more difficult for societal spheres to establish consensus on how to improve the sustainability performance of the wine supply chain. Still, even if consensus is not achieved such a partnerships can contribute to better insights in the different perceptions participating societal spheres have towards a more sustainable supply chain, subsequently, decreasing the risk of implementing solutions often labeled 'Eurocentric'

## Table of Contents

<b>SUMMARY</b>	<b>I</b>
<b>TABLE OF CONTENTS</b>	<b>VI</b>
<b>FIGURES &amp; MAPS</b>	<b>IX</b>
<b>TABLES</b>	<b>IX</b>
<b>ACRONYMS AND ABBREVIATIONS</b>	<b>X</b>
<b>ACKNOWLEDGEMENTS</b>	<b>XI</b>
<b>1 INTRODUCTION</b>	<b>1</b>
1.1 SUPPLY CHAINS IN A GLOBAL ECONOMY	1
1.2 THE SOUTH AFRICAN WINE INDUSTRY PAST AND PRESENT	2
1.3 THE SOUTH AFRICAN - EUROPEAN WINE SUPPLY CHAIN	4
1.4 SUSTAINABLE DEVELOPMENT WITHIN SUPPLY CHAINS	4
1.4.1 RESEARCH QUESTIONS	8
1.5 RESEARCH OUTLINE AND INTRODUCTION TO USED METHODOLOGY	8
<b>2 THEORETICAL FRAMEWORK AND METHODOLOGICAL APPROACH</b>	<b>10</b>
2.1 OBJECTIVELY AND INTERPRETATIVELY SUSTAINABLE	10
2.2 IDENTIFICATION OF LCA STUDIES ON WINE PRODUCTION AND WINE SUPPLY CHAINS	11
2.3 STAKEHOLDER ANALYSIS	12
2.3.1 ANALYSIS METHODOLOGY	12
2.3.2 CHAIN ACTOR CRITERIA AND CATEGORIES	13
2.3.3 CHAIN ACTORS IN THE SUPPLY CHAIN	13
2.3.4 CHAIN ACTOR: THE AFFECTED AND AFFECTING	14
2.4 SUSTAINABILITY ASPECTS	16
2.4.1 SUSTAINABILITY ASPECTS: MAGNIFYING SUSTAINABLE DEVELOPMENT	16
2.4.2 INTERRELATEDNESS OF THE SUSTAINABLE DEVELOPMENT DIMENSIONS	17
2.4.3 SUSTAINABILITY ASPECTS: A THEORETICAL FOUNDATION	18
2.4.4 IMPLICATIONS DETERMINING RELEVANT ASPECTS	18
2.4.5 EXPLORING CURRENT SUSTAINABILITY FRAMEWORKS	19
2.4.6 SELECTED SUSTAINABILITY ASPECTS FOR THE LCA	21
<b>3 METHODOLOGY A: SUSTAINABILITY PERCEPTION ANALYSIS</b>	<b>23</b>
3.1 PERCEPTIONS	23
3.1.1 ANALYSING PERCEPTIONS EMPIRICALLY	23
3.1.2 SOCIAL ACCEPTANCE	24
3.2 THE SUSTAINABLE PERCEPTION ANALYSIS FRAMEWORK	25
3.2.1 PRESENTATION OF SUSTAINABILITY ASPECTS	25
3.2.2 SELECTION OF RESPONSE METHODS	27
3.2.3 SUSTAINABILITY PERCEPTION ANALYSIS METHODOLOGY	28
3.2.3.1 Validity of data resulting from the SPA	30
3.2.4 SELECTION OF CHAIN ACTORS	30
3.2.4.1 Selected chain actors	30

<b>4</b>	<b>METHODOLOGY B: SECONDARY LCA ANALYSIS</b>	<b>35</b>
4.1	AN EMPIRICAL APPROACH TO MEASURE SUSTAINABILITY PERFORMANCE	35
4.2	SOCIAL LIFE CYCLE ASSESSMENT (SLCA) & LIFE CYCLE COSTING (LCC) ANALYSIS: SHORTCOMINGS AND SCIENTIFIC DISAGREEMENT	35
4.3	LIFE CYCLE ASSESSMENT METHODOLOGY	36
4.4	LCA APPLICATIONS	37
4.5	PHASES IN LCA METHODOLOGY	37
4.6	SECONDARY LCA ANALYSIS FRAMEWORK	37
4.6.1	THE EXECUTER'S CHOICE: SIGNIFICANT CHOICES DETERMINING FINAL LCA RESULTS	38
<b>5</b>	<b>RESULTS B: SECONDARY LCA ANALYSIS</b>	<b>42</b>
5.1	CHOICES IN THE COLLECTED LCAs EXPlicated	42
5.1.1	CONCLUSION EXECUTIONERS CHOICES	46
5.2	RESULTS INDIVIDUAL LCAs	46
5.3	CONCLUSIONS LCA COMPARISON	50
<b>6</b>	<b>RESULTS A: SUSTAINABILITY PERCEPTION ANALYSIS</b>	<b>54</b>
6.1	PERCEPTIONS TOWARDS A SUSTAINABLE SUPPLY CHAIN ON AN AGGREGATED LEVEL	54
6.1.1	PERCEIVED RELEVANCE OF THE SUSTAINABILITY DIMENSIONS	54
6.1.2	PERCEIVED RELEVANCE OF SUPPLY CHAIN SECTIONS	57
6.1.3	PERCEIVED RESPONSIBILITY FOR IMPROVING SUSTAINABILITY DIMENSIONS	60
6.2	PERCEPTIONS TOWARDS A SUSTAINABLE SUPPLY CHAIN ON A MAIN ASPECT LEVEL	63
6.2.1	PERCEPTIONS ON A MAIN ENVIRONMENTAL ASPECT LEVEL	64
6.2.1.1	Perceived relevance for main environmental aspects	64
6.2.1.2	Relevant supply chain sections for main environmental aspects	68
6.2.1.3	Responsibility improving environmental aspects	71
6.2.2	PERCEPTIONS ON A MAIN SOCIAL ASPECT LEVEL	73
6.2.2.1	Perceived relevance for main social aspects	73
6.2.2.2	Relevant supply chain sections for improving main social aspects	78
6.2.2.3	Responsibility improving main social aspects	80
6.2.3	PERCEPTIONS ON A MAIN SOCIO-ECONOMIC ASPECT LEVEL	83
6.2.3.1	Perceived relevance for main socio-economic aspects	83
6.2.3.2	Relevant supply chain sections for main socio-economic aspects	87
6.2.3.3	Responsibility improving main socio-economic aspects	89
<b>7</b>	<b>OBJECTIVE-EMPIRICAL RESULTS VERSUS INTERPRETATIVE RESULTS</b>	<b>92</b>
7.1	COMPARISON BETWEEN OBJECTIVE-EMPIRICAL AND INTERPRETATIVE RESULTS	92
7.2	OBJECTIVE-EMPIRICAL VERSUS INTERPRETATIVE RESULTS	93
7.3	DIFFERENCES AND SIMILARITIES BETWEEN OBJECTIVE-EMPIRICAL AND INTERPRETATIVE RESULTS	94
<b>8</b>	<b>TOWARDS A MORE SUSTAINABLE SOUTH AFRICAN – EUROPEAN WINE SUPPLY CHAIN</b>	<b>95</b>
8.1	MEASURING THE SUSTAINABILITY PERFORMANCE OF SUPPLY CHAINS	95
8.2	CONSENSUS OR DISAGREEMENT TOWARDS A MORE SUSTAINABLE WINE SUPPLY CHAIN	96
8.3	GOVERNANCE FOR IMPROVING THE SUSTAINABILITY PERFORMANCE OF THE WINE SUPPLY CHAIN	97
<b>9</b>	<b>REFLECTION: SPA METHODOLOGY</b>	<b>100</b>
	<b>APPENDIX I: CONSULTED LITERATURE FOR SUSTAINABILITY ASPECTS</b>	<b>104</b>
	<b>APPENDIX II: DETAILED SUSTAINABILITY ASPECTS</b>	<b>105</b>

<b>APPENDIX III: PERCEPTIONNAIRE</b>	<b>106</b>
<b>APPENDIX IV: CONSUMER PERCEPTIONNAIRE (IN DUTCH)</b>	<b>116</b>
<b>APPENDIX V: EXCLUDED PERCEPTIONS CONCERNING APPLICABILITY AND RESPONSIBILITY</b>	<b>118</b>
<b>APPENDIX VI: PERCEIVED RELEVANCE DETAILED SUSTAINABILITY ASPECTS</b>	<b>119</b>
<b>APPENDIX VII: SUPPLY CHAIN SECTION RELEVANCE – MAIN ENVIRONMENTAL ASPECTS</b>	<b>122</b>
<b>APPENDIX VIII: SUPPLY CHAIN SECTION RELEVANCE – MAIN SOCIAL ASPECTS</b>	<b>124</b>
<b>APPENDIX IX: SUPPLY CHAIN SECTION RELEVANCE – MAIN SOCIO-ECONOMIC ASPECTS</b>	<b>126</b>
<b>APPENDIX X: PERCEIVED RESPONSIBILITY IMPROVING ENVIRONMENTAL PERFORMANCE</b>	<b>128</b>
<b>APPENDIX XI: PERCEIVED RESPONSIBILITY IMPROVING SOCIAL PERFORMANCE</b>	<b>129</b>
<b>APPENDIX XII: PERCEIVED RESPONSIBILITY IMPROVING SOCIO-ECONOMIC PERFORMANCE</b>	<b>130</b>
<b>APPENDIX XIII: PERCEIVED RESPONSIBILITY IMPROVING SOCIO-ECONOMIC PERFORMANCE</b>	<b>132</b>
<b>REFERENCES</b>	<b>134</b>

## Figures & Maps

Figure 1.1: Simplified representation of the global supply chain	1
Figure 1.2: Sections and processes in the wine supply chain	4
Figure 1.3: Research Framework	9
Figure 2.1: Possible contrasting perspectives	11
Figure 2.2: Stages in Stakeholder Analysis adapted from Grimble (1998)	13
Figure 2.3: Societal spheres affecting and influencing Market	14
Figure 2.4: Conventional sustainability model	18
Figure 2.5: Levett's 'Russian Dolls' sustainability model	18
Figure 3.1: Compared societal spheres	28
Figure 3.2: Sustainability Perception Analysis (SPA) levels	29
Figure 6.1: Initial perceptions on Sustainable Development	55
Figure 6.2: Perceived relevance sustainability dimensions	56
Figure 6.3: Perceived relevance supply chain sections for the environmental dimension	58
Figure 6.4: Perceived relevance supply chain sections for the social dimension	59
Figure 6.5: Perceived relevance supply chain sections for the socio-economic dimension	60
Figure 6.6: Assigned responsibility for the environmental dimension	61
Figure 6.7: Assigned responsibility for the social dimension	62
Figure 6.8: Assigned responsibility for the socio-economic dimension	62
Figure 6.9: Perceptions of societal sphere towards the relevance of main environmental aspects	64
Figure 6.10: Perceptions of societal sphere towards the relevance of main social aspects.	74
Figure 6.11: Perceptions of societal sphere towards the relevance of main socio-economic aspects	84
Map 1.1: Production areas of South Africa	3

## Tables

Table 2.1: Chain actor spheres	14
Table 2.2: Main sustainability aspects involved in SPA	21
Table 3.1: Number of directly selected chain actor participating in SPA	34
Table 3.2: Number of indirectly selected actors participating in SPA	34
Table 4.1: Mandatory and optional LCIA elements	41
Table 5.1: Goal, Scope, Functional Unit, and Boundaries in selected LCA studies	43
Table 5.2: Cut-offs and allocations in selected LCA studies	45
Table 5.3: Employed databases in selected LCAs	45
Table 5.4: Impact Assessment Methods and respective Impact Categories employed in selected LCA studies	46
Table 5.5: Significant range of impacts in the wine supply chain concluded from the LCAs	52
Table 7.1: Differences and similarities between objective-empirical concluded and perceived relevance of main environmental aspects	93

## Acronyms and abbreviations

BWI	Biodiversity and Wine Initiative
CS	Civil Society
CSD	(United Nations) Commission of Sustainable Development
CSO	Civil Society Organisation
CSR	Corporate Social Responsibility
EU	Europe
FTSA	Fair Trade South Africa
GDP	Gross Domestic Product
LCA	Life Cycle Assessment
LCC	Life Cycle Costing Analysis
LCI	Life Cycle Inventory analysis
LCIA	Life Cycle Impact Assessment
LCM	Life Cycle Management
MR	Mean Relevance
IPW	Integrated Production of Wine
ISO	International Organisation for Standardization
KWV	Koöperatieve Wijnbouwers Vereniging
MDGs	Millennium Development Goals
MVO	Maatschappelijk Verantwoord Ondernemen
N/A	Not Applicable
NGO	Non Governmental Organisation
PW	Productschap Wijn
R	Rand
SA	South Africa
SAWIS	South African Wine Industry Information & Systems
SAWIT	South African Wine Industry Trust
SC	Scientific Community
SLA	Sustainable Livelihood Approach
SLCA	Social Life Cycle Analysis
SME	Small and Medium size Enterprise
SPA	Sustainability Perception Analysis
UK	United Kingdom
UNEP	United Nations Development Program
US	United States of America
WIETA	Wine Industry Ethical Trade Organisation
WOSA	Wines Of South Africa
WUR	Wageningen University Research

## **Acknowledgements**

Conducting research is hardly ever a solitary activity. At least this research has not been. It is therefore that I would like to thank the following people and organisations. Without whom this research would not have been possible.

I would first of all like to thank my supervisor Dr. Walter Vermeulen for giving me the opportunity to research sustainable global supply chains, moreover, sharing his knowledge and time and letting me benefit from his contacts in the Netherlands and South Africa. I am also very grateful to the Sustainability Institute in Lynedoch, South Africa and to Jess Schulschenk in particular for arranging my living arrangements, providing me with workspace and sharing her contacts. Furthermore, I would like to thank Peter Ras, Claribel Muller and SANPAD for giving me the opportunity to present the preliminary results of this research on the 'Expert Workshop Sustainable Table Grapes' in Paarl, South Africa. Most certainly I will not forget all the interviewees for participating in sometimes lengthy interviews and the respondents for completing the extensive surveys. Without them this research would not have been possible. Moreover, I would also like thank the organisers of wine taste sessions for allowing me to distribute my survey to the Consumer. My family and friends deserve some gratitude for continuing to ask me if I had finally finished my thesis. Special thanks go out to Jordan Nikoloyuk and Gemma Morrison for reading and rereading parts of this report and giving me useful input. Last but not least a special appreciation for my Epiphone AJ18SCE NA for required distraction, though, to be honest, sometimes providing too much of a distraction.

Sincerely,

Albertus G. Abbing  
October 2010

## 1 Introduction

Since 2004, the Copernicus Institute at Utrecht University, in cooperation with Tshwane University of Technology in South Africa, has been researching how to manage Global Product Chains in a more sustainable fashion<sup>2</sup>. The subject of this research project is the wine and fruit chain between South Africa and the Netherlands. Various studies relating to this supply chain have been conducted, ranging from ‘Environmental self regulation in the South African wine industry’ (Boudreau-Sannier, 2008) to ‘Sustainable production and the performance of South African entrepreneurs in a global supply chain’ (Ras & Vermeulen, 2009).

This forthcoming research report attempts to contribute to this research project. The focus of this research is to determine which sustainability aspects are perceived to be essential to attain a more sustainable supply chain. Sustainability aspects in this context are those aspects being affected by the sustainability performance of the supply chain. Two approaches to determine these essentials have been employed. The objective-empirical approach, often referring to natural science, explicates which processes in the supply chain have an objectively measurable effect on the sustainability performance of the supply chain. The interpretative approach demonstrates which aspects actors connected to the South African – European wine supply chain perceive to be relevant for improving the sustainability performance of the wine supply chain. The conclusions of these two approaches demonstrate whether or not objective priorities are aligned with the perceptions of actors in the supply chain.

### 1.1 Supply chains in a global economy

Currently a wide terminology for supply chains is being employed. Most commonly used terms are product chains, commodity chains, value chains and supply chains. Though slight differences within these terms occur a generalized definition of global supply chains could be drafted as;

*(Global supply chains are) interlinking economic actors that, in various places on the globe, sequentially contribute and add value to the product’s life cycle from raw material extraction to disposal and all activities in between.*

A simplified illustration of the global supply chain is given in figure 1.1. The arrows represent shipping between each product stage.

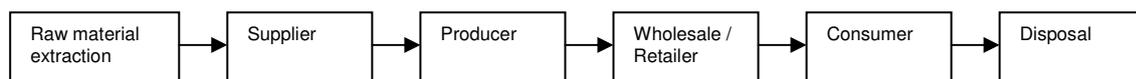


Figure 1.1: Simplified representation of the global supply chain

The increasing demand of cheap and larger quantities of consumer goods and agro-commodities has been the main reason for the emergence of global supply chains. Since the existence of global supply chains in a liberal economy, actors in the supply chain maximize their profits. This means that consumers demand quality products for the lowest price while the producing company strives for the highest profit (Cypher & Dietz, 2009). In order to ensure profits, companies create a competitive advantage by outsourcing production facilities to low income countries. The outsourcing of production results in reduced costs and increased revenues (Ferdows, 1997). Hence, our current global free market system stimulates companies to trade their commodities outside their borders. As global supply chains are emerging the rise of new economies, like China, India, Brazil, South Africa, etc., the so-called transition economies, is evident.

<sup>2</sup> For more detailed information see <http://www.see-project.org.za/>

However, agro-commodities are often acquired abroad already. Exotic products like coffee, tea, cocoa, and bananas grow in the South but are consumed in the North as well. The same theory for maximizing profits however does not result in outsourcing production since production is already abroad. While prices decrease at the demand side of the supply chain, savings have to be made down the supply chain to assure profits. Savings made in the supply chain will therefore most often trickle down until it reaches the bottom of the supply chain. Moreover, the rise of global supply chains increase the distance of transport which has a significant impact on the environment. Global trade itself might have an impact as well. Besides cheaper production, less stringent environmental laws may persuade industries to go abroad, while availability of land can be another reason for the agro-industry to produce for the western market in underdeveloped countries and therefore affecting biodiversity (UNEP, 2007).

## **1.2 The South African wine industry past and present**

South Africa is, besides New Zealand, Australia, Chile and California (US), counted among one of the new wine countries. Although the South African wine industry has existed for approximately 350 years, it only became internationally competitive recently (Davidson et al., 2009). The South African wine industry is mainly situated in the western part of South Africa (map 1.1). Jan van Riebeeck, who had come to the Western Cape to establish a settlement on behalf of the Dutch East Indian Company in 1652, pressed the first South African grapes in 1659. Van Riebeeck encouraged farmers to plant vineyards. Though the quality of the first wines was not too good, things improved when Van Riebeeck was succeeded by Simon van der Stel, who was more knowledgeable about viticulture and winemaking (WOSA, 2009a). With the Dutch having a limited tradition in wine-making the industry stayed rather small. It was not until the French Huguenots arrived when the Western Cape wine industry started to flourish. With the exception of Constantia and some other sweet wines the South African wine quality was poor. The poor wine quality combined with an unstable foreign market resulted in a surplus of wine dumped on the national market. The mediocrity of South African wine as a result of shoddy viticulture and winemaking methods in the 18<sup>th</sup> and 19<sup>th</sup> century ended with the establishment of the Koöperatieve Wijnbouwers Vereniging (KWV) in 1918. The KWV controlled wine production, preventing surplus, and set a fixed price for wine. In addition, the establishment of cooperative cellars offered wine farmers the chance to pool their resources and jointly mobilize more capital, ensuring a lower cost and higher quality of wine. A third factor causing a transformation of the wine industry was advancing scientific and technological expertise. The accumulation of these factors led to a dramatic improvement of South African wine quality in the first half of the 20<sup>th</sup> century (Zyl, 1987). However, South African wine did not receive much attention worldwide. In the period 1973 – 1994, it even was partially cut-off from the global market due to sanctions laid upon as a protest against the Apartheid system that ruled in South Africa from 1948 – 1994. Between 1993 and 1995, when South Africa's system was changing towards democracy and sanctions were about to be lifted the wine industry tripled sales (Demhardt, 2003). When the trade barriers were lifted in 1994, the South African wine industry re-entered the global market. The departure of Apartheid did not only revitalize the wine industry but also had positive effects on the South African tourism Industry (Demhardt, 2003).

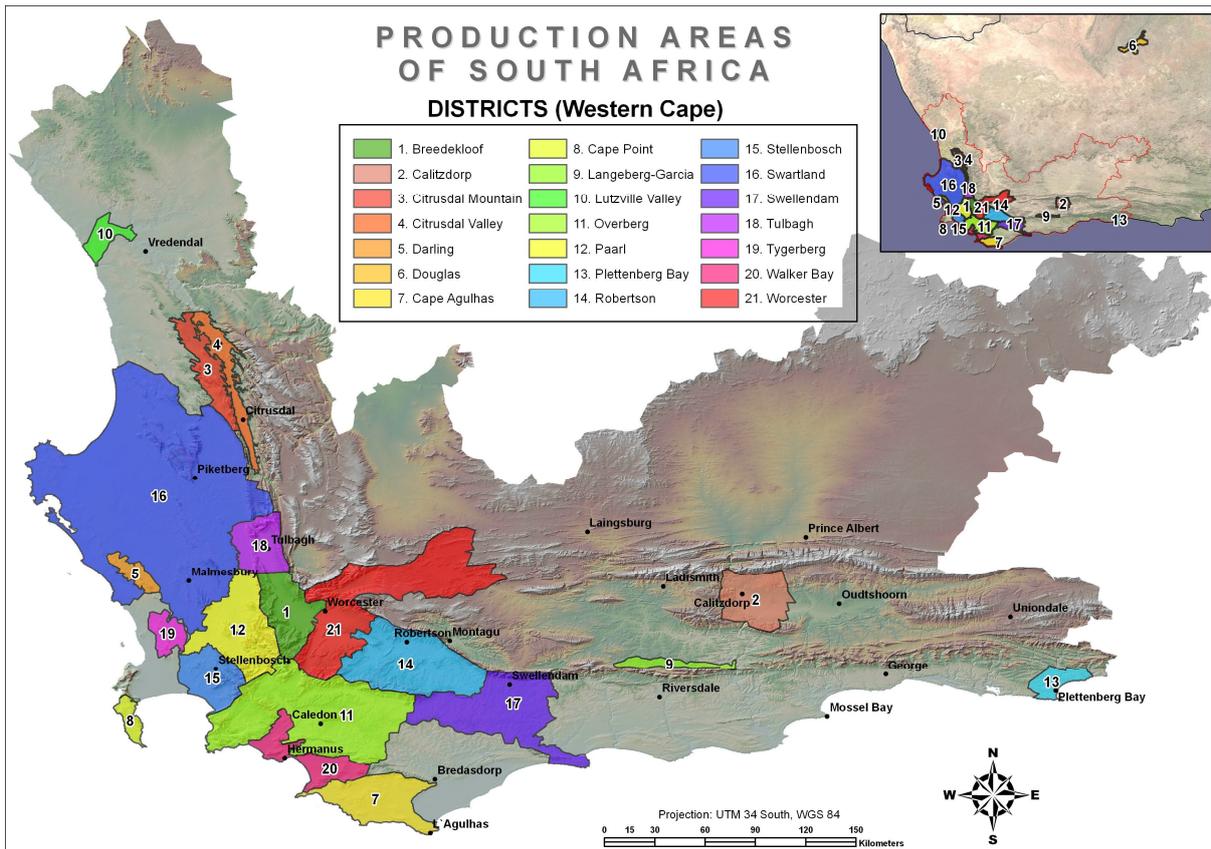
Fifteen years of democracy have boosted the industry through exposure and a new dedication to quality (Davidson et al., 2009). This new dedication has also been noticed outside South Africa. Between 1997<sup>3</sup> and 2008, the export of wine increased annually at an average rate of about 13.5 percent, including a lull in sales in 2006 (SAWIS, 2009b). To stimulate the transformation of the wine industry and promote the export of wine and spirits the South African Wine Industry Trust (SAWIT) has been established in 1999 (SAWIT, 2010; WOSA, 2009a). During this period, a noticeable shift in production towards red wine, from 15.2% to 37.6%, has been made (SAWIS, 2009a). In 2008, the total wine production amounted to 763 million litres. 412 million litres were exported. With an

---

<sup>3</sup> Export figures of SAWIS start in 1997

export of 53.9% of South Africa’s total wine production, export volumes exceeded domestic consumption for the first time (SAWIS, 2009b).

In 2007, approximately 3999 vineyards and 560 cellars were established in South Africa (WOSA, 2009b). In 2008, 101,325 ha of land were used for vineyards, of which 93,000 ha were mature vineyards growing grapes for the production of wine. Most vineyards are situated in the Western Cape (map 1.1). The wine industry contributes R26,223 million to the GDP of South Africa, of which approximately 54% stays within South Africa. Due to the value added in every step of the process, the industry shows the ability to create economic growth. The GDP/capital ratio of 0.53 – compared to the average national ratio of 0.48 – shows that capital invested in the wine industry contributes more to the GDP than an average industry does. The South African wine industry employs about 275,000 people. Of these 275,000 positions, 58% is unskilled labour, 29% is semiskilled labour and 13% is skilled labour. Because of the labour intensity in the wine industry, the wine industry creates more labour than the average industry in South Africa. In the Western Cape, the industry is responsible for 8.8% of labour compared to 2.2% for the rest of the country. A total of R17,124 million household income has been generated by the South African wine industry in 2008. Of that number, R2,908 is destined for low income groups of which a large portion is spent in the Western Cape. 17% of household income is generated by the wine industry, which makes it the backbone of the Western Cape economy. These numbers show that the wine industry has a positive effect on South Africa’s national economy; however, they should be viewed against the background of the world wide financial crises that started during the second half of 2008 (SAWIS, 2009a).



Map 1.1: Production areas of South Africa

Source: (SAWIS, 2010b)

### 1.3 The South African - European wine Supply Chain

In the former section, an introduction to the South African wine industry was outlined. In this section the South African wine industry, the beginning of the chain, will be connected to the European part of the chain. An illustration of the South African - European wine supply chain can be found in figure 1.2. It should be clear that the production of wine within this chain occurs in South Africa. Production entails the growing and harvesting of grapes, processing the grapes into wine and the bottling<sup>4</sup> of wine. Though, it should be mentioned that bottling of wine is only partially done in South Africa. In 2008, 45 percent of the exported wine was shipped in bulk and bottled in the importing country (SAWIS, 2009b). Wine is shipped globally from Cape Town, which is the second biggest port of South Africa after Durban and responsible for handling the largest amount of wine and fresh fruit (Ports & Ships, 2010). The total amount of wine exported to Europe in 2008 was roughly 310 million litres<sup>5</sup>, 66 % of the total export. The three largest consumers of South African wine are the United Kingdom, Germany, and the Netherlands importing 110 million, 67 million, and 29 million litres respectively in 2008. Additionally, within the top 25 of largest importers 14 countries belong to the European continent. From this, it can be concluded that the European market is essential for the South African wine industry.

From Cape Town, wine is shipped to various ports in Europe. Upon arrival, wine is transported to the different wholesalers and wine traders. Within the four largest European importing countries, there are approximately 330 wholesalers and wine traders trading in South African wine<sup>6</sup>, ranging from large corporations to Small and Medium sized Enterprises (SMEs). These wholesalers and wine trader sell directly and indirectly, through liquor stores and Horeca (Hotels, Restaurants, Cafés), to consumers. Consumption relates not only to wine itself but also to packaging. However, it is likely only packaging will enter the final stage of the supply chain. Since most wine is bottled in glass, glass will make up the main product of disposal. Cork, labels, aluminium foil are also among products for disposal, though in much smaller quantities. The three largest importing European countries all have glass-recycling schemes and recycle between 58% and 90%<sup>7</sup> of the total amount of glass used. The remainder is either incinerated or disposed of in landfills.

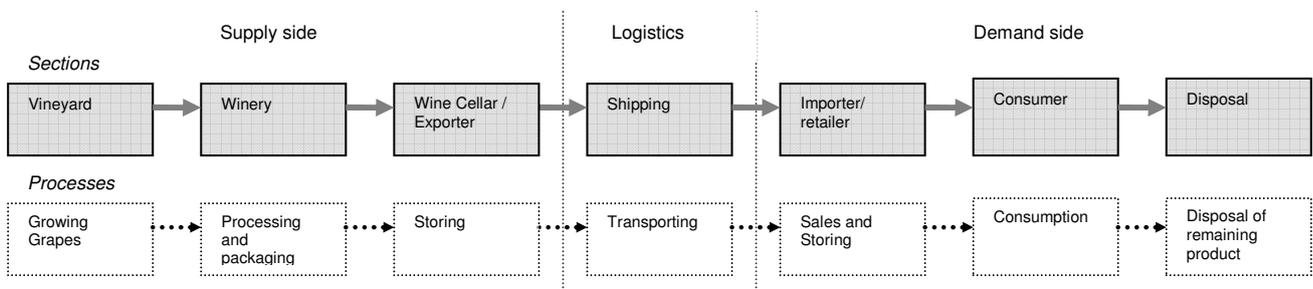


Figure 1.2: Sections and processes in the wine supply chain

### 1.4 Sustainable Development within Supply Chains

In section 1.1, it is explained that the transformation to transnational supply chains has had an effect on the global economy. Involving countries on the periphery in global supply chains has given some of these countries the opportunity to enter the world market and develop into transition economies. This section addresses the roll of sustainable development in (global) supply chains arguing some of

<sup>4</sup> Eventhough most wine for export is bottled (76.91%) wine is also packed and exported in 'bag-in-box' (23.04%) and tetra packs (0.05%) (SAWIS, 2009b). For convenience the term bottling refers also to those types of packaging.

<sup>5</sup> This amount includes exports to Russia as well. Even though Russia is spread out on the European and Asian continent politically it belongs to Europe, moreover, most of Russia's population lives on the European continent.

<sup>6</sup> Based upon data received from WOSA United Kingdom, WOSA Germany, WOSA Netherlands, and the Productschap Wijn

<sup>7</sup> UK recycles 58% (1,336,000 Ton) (British Glass, 2008)

The Netherlands recycles 80% (400,000 Ton) (Glasbak, 2009)

Germany recycles 90% (Deutsche Umwelthilfe, 2009)

the sustainability downfalls of this development. The essence of sustainable development and what this means for global supply chains in general is explicated.

With the rise of global supply chains in the global free economy, the opportunity arose to outsource production to less developed countries and produce or acquire products at lower prices. The lower product prices result from savings made in production cost. Savings are often made through lower wages, the absence of a national or company established social safety nets, less stringent health and safety procedures, or less stringent environmental regulation. Absence of these aspects, usually well established in Western societies, allows companies to produce more cheaply abroad. The outsourcing of production might aid those national economies in developing their economies the absence of these aspects can have a considerable effect on the sustainability performance of the individual companies and therefore the entire supply chain. However, it would be far too simple to state that sustainability problems in the supply chain only appear in underdeveloped countries. Transportation of goods to the consumer is often seen as an impact on the environment. The consumer's demand for non-local products, cheaper products and their desire for a high turnover of product forces companies to import, produce and acquire at lower cost, saving costs down the supply chain and resulting in unsustainable practices at the beginning of the chain. Hence, this demonstrates that global supply chains can have benefits for a countries national economy though it often accompanied with unsustainable practices. Global supply chains managed in a sustainable fashion can contribute to a growing and equal economy that does not jeopardize environmental and social aspect.

However, the concept sustainable development, generously used in the above, is used in a wide context. No consensus on how to achieve sustainable development has been reached and the term is more and more becoming a buzz-word for marketers. Furthermore, a multitude of definitions for sustainable development can be found in literature, demonstrating that sustainable development is still ambiguous, though, the definition most often referred to is the one presented in 'Our Common Future', also known as the 'Brundtland Report'.

*"Development that meets the need of the present without compromising the ability of future generations to meet their own needs."* (WCED, 1987)

Even though the term sustainable development is somewhat ambiguous, it is generally acknowledged that the sustainable development paradigm is divided into three dimensions: Environmental, Social, and Economic (Hutchins & Sutherland, 2008; Labuschagne, Brent & van Erck, 2005; Kloepffer, 2008). In order to achieve sustainable development, each of these three dimensions needs to be developed. The sustainability performance of the supply chain depends therefore on the combined environmental, social and economic performance. Improving the sustainability performance of a supply chain can only be done if trade-offs are balanced and all three dimensions improve (de Leeuw, 2006; Kloepffer, 2008). The economic dimension can be divided between internal economic sustainability and external economic sustainability. Internal economic sustainability addresses the economic performance of the company itself. External economic sustainability addresses the socio-economic performance of the company, benefiting the company only indirectly (Labuschagne et al., 2005; Schaffer & Schmidt, 2006). In this respect the external sustainability, the economic responsibility towards society, is deemed more important for the sustainability performance of the supply chain as this is contrary to the internal sustainability often underexposed (Labuschagne & Brent, 2006).

Though global supply chains are mainly the domain of Market actors the Market is not the only societal sphere affecting the performance of supply chain, and therefore the sustainability performance of the supply chain. Creating a justified sustainable supply chain requires cooperation with other societal spheres. Each of these societal spheres plays their own distinctive roles (Müller,

Vermeulen, & Glasbergen, 2009). Government, responsible for establishing policy and legislation can influence the Market becoming more sustainable in their processes and conduct by establishing legislation that enforces sustainability. Civil Society, to be understood as the public sphere composed of actors outside the State and Market realm (Fung, 2003; Pietrzyk, 2003), has an influence on the Market. As Markets become more transparent, Civil Society is becoming more aware of business conduct. Often the voice of Civil Society is expressed by NGOs demanding a more sustainable business conduct for a more just economy. Finally, the Scientific Community, usually not recognized as an independent societal sphere, does affect the supply chain in a wide array of sustainable development subjects among others. The Scientific Community creates new knowledge and methods for more sustainable production and how to achieve a more sustainable supply chain. Involvement of all these spheres in the supply chain results in many different actors from different societal spheres on the demand as well as the supply side of the supply chain.

Differences between 'North' and 'South' regarding Sustainable Development can be distinguished. Ras et al. (2007) concluded that distinctions in perceptions regarding chain performance and sustainability between South African and the Netherlands are present. Though the sustainability aspects regarding product quality and related issues were perceived relevant at both sides of the chain, the supply side considers issues such as poverty and unemployment relevant as well. While the 'North' assumes sustainability issues related to the social and (socio-)economic dimension mainly taken care of awareness grows that their consumption pattern has a detrimental effect on the environment. Hence, the 'North' associates environmental sustainability mostly with Sustainable Development. Environmental problems are acknowledged in the 'South', however, sustainability issues regarding the social and (socio-)economic dimension are still evident and therefore considered more important to overcome. The development of social and (socio-)economic standards in the 'South' is often achieved by growing industries and depletion of natural resources resulting in environmental degradation. The development of social and (socio-)economic sustainability is given precedence at the cost of environmental sustainability.

Additionally, the involvement of different societal spheres brings different perceptions and dispersed knowledge into the sustainability debate (Lafferty & Meadowcroft, 1996). This would form an even wider perception gap than the already existing North-South gap. Müller et al. (2009) concluded that from a North-South perspective a gap exist between Civil Society's perception and the South African reality. NGOs often perceive the sustainability performance of sections on the supply side worse than it actual is. Communicating such information to potential consumers could discourage them to buy those products because of alleged unsustainable practices. The lack of demand could then lead to loss of job opportunities, hence, a lack of income for the very workers they try to protect (Müller et al., 2009). If Northern NGOs perceive the sustainability performance of the chain unequally to the Southern reality it can be expected that other societal spheres connected to the wine supply chain perceive the sustainability performance unequally as well. Moreover, it can be expected that this inequality in perception also works the other way around. Societal spheres on the supply side have an unequal perception towards the sustainability performance on the demand side opposed to societal spheres on the demand side.

These differences in perception will not only relate to the sustainability aspect to improve in order to enhance the sustainability performance. They will also relate to where the sustainability performance should be improved. Though it is assumed that production processes on the supply side have the most harmful effect on sustainability, it cannot with absolute certainty be stated that all chain actors perceive these sections equally applicable for improvement. As with the relevance of sustainability aspects an unequal perception between 'North' and 'South' as well as between involved societal spheres is to be expected.

Another distinction can be noticed for responsibility assigned, or taken, to improve the sustainability performance of the supply chain. Even though Market actors in the 'North' do take responsibility

towards a more sustainable supply chain as well, in practice various Market actors on the demand side perceive this responsibility differently. While accepting joint responsibility in addressing sustainability challenges in the developing world, chain actors on the demand side often focus on those sustainability aspects they perceive relevant themselves (Ras et al., 2007). Since the South African – European wine supply chain is buyer driven the most powerful Market actors reside at the demand side of the supply chain. Having the economic power does not only result in an unequal allocation of profits and risks, it often results in enforcing Eurocentric solutions to improve the sustainability performance of the supply chain in such a way it not always corresponds with the supply side's vision (Ras et al., 2007). In this respect, Market on the demand side ensures a more sustainable supply chain according their views on sustainability by taking responsibility, or getting responsibility assigned to by other societal spheres on the demand side, from Market on the supply side.

However, Market does not have to be held solely responsible. Governance, a partnership between State, Market and Civil Society, is often perceived an effective approach to involve all societal spheres in the sustainability debate, forming solutions that progress to Sustainable Development. However, governance requires an equally representative State, Market, and Civil Society. While equal representation can be identified for Northern countries, countries in the South often perceive State most important for attaining Sustainable Development, therefore, State has a larger representation in the sustainability debate (Tabbush, 2005). Responsibility for improving the sustainability performance on the supply side is more likely to be assigned to State while responsibility on the demands side is assigned to a State/Market/Civil Society partnership or partnerships involving two of these societal spheres.

Finally, the Scientific Community perceived as a chain actor in this sustainability debate can also express itself in another way. Within science two main approaches can be distinguished; an interpretative approach, determining how chain actors perceive the sustainability performance of the supply chain, and an objective natural scientific approach, measuring the sustainability performance of the supply chain empirically by assessing the actual impact supply chain processes have on the supply chain's sustainability performance. Perceptions, rooted in social science, are socially constructed and therefore depend highly on your surrounding world. Hence, the perceptions of chain actors in societal spheres can be considerably different from the empirically measured sustainability performance of the supply chain.

From the former six hypotheses are drafted:

- h1: Societal spheres on the supply side of the supply chain perceive Social and Socio-economic aspects as most relevant for attaining a more sustainable supply chain while societal spheres on demand side of the supply chain consider the Environmental aspects most relevant to attain a more sustainable supply chain.*
- h2: Societal spheres operating on the same side of the supply chain differ extensively in perception towards relevance of the sustainability aspects for improving the sustainability performance of the supply chain*
- h3: Societal spheres on the demand side differ extensively in perception towards relevance of the sustainability aspects for improving the sustainability performance of the supply chain, as opposed to their counterparts on the supply side.*
- h4: Societal spheres on both side of the supply chain perceive supply side sections most relevant for improvement. However, societal spheres on the supply side perceive sections on the demand side more relevant while societal spheres at the demand side perceive sections on the supply side more relevant.*

*h5: Societal spheres on the supply side assign most responsibility to State while societal spheres on the demand side assign most responsibility to partnerships.*

*h6: Perceptions of societal spheres regarding the sustainability performance of the supply chain will deviate from natural scientific concluded results towards that sustainability performance.*

#### 1.4.1 Research Questions

Based upon the above hypotheses I surmise that different perceptions towards the relevance of sustainability aspects in order to enhance the sustainability performance of the South African – European Supply chain exist. In order to determine *a)* if there are differences in perceptions between various societal spheres on the supply and demand side of the wine supply chain, and *b)* if differences occur between the empirically concluded results and interpretively concluded chain actor perceptions the following research question has been designed.

*What are the differences in perceptions of actors connected to the supply chain, of the relative importance of various sustainability aspects of the South African – European wine supply chain?*

To further detail these research questions additional information is required. In order to obtain this information several sub questions have been formulated. These sub questions correspond with the different sections of the research framework.

*a1: Which of the generally recognized sustainability aspects can be applied to the South African – European wine supply chain?*

*a2: Which actors are identified as being involved in the South African – European wine supply chain?*

*b1: What are the most severe environmental impacts in the current South African – European wine supply chain from an objective-empirical approach?*

*b2: Which sustainability aspects do involved chain actors perceive to be most relevant to remove, reduce or improve in order to improve the sustainability performance of the South African – European wine supply chain?*

*b2a: Which sections of the South African – European wine supply chain are perceived relevant for improving relevant sustainability aspects?*

*b2b: Which societal sphere, or combination of societal spheres, is considered to be mostly responsible for improving the sustainability performance of the South African – European wine supply chain?*

#### 1.5 Research outline and introduction to used methodology

To answer the above research question and its sub questions, the following research framework has been designed. The research framework, depicted in figure 1.3, entails three sections. Section a. involves the preliminary analysis. This section is considered to be the foundation of the research, collecting and determining the information necessary for the main analysis in section b. In section c. results from the main analysis will be used to answer the research questions and explicate what this will involve for the sustainability performance of the South African – European wine supply chain.

##### Section a.: Primary analysis

Section a. involves mainly the collecting of information used for the main analysis, though, some initial analyses have been made based on the collected information. Four analyses that have been executed in random order are distinguished. Initially a clear understanding between the objective-empirical and interpretative approach has been established. Secondly a literature search for LCA studies on wine production and/or wine supply chains was conducted. Thirdly a stakeholder analysis to determine the main stakeholders in the South African – European wine supply chain and which of

them could be approached for concluding the perception towards relevant sustainability aspects. Lastly a content analysis on the available sustainability aspects was conducted. From these identified sustainability aspects a selection of suitable sustainability aspects was made that was thereafter transformed in a perceptionnaire to measure chain actor perception on these sustainability aspects.

**Section b.: Main analysis**

The main analysis in section b. is based on the information derived in section a. Two main analyses were conducted, the Secondary LCA analysis to empirically determine which of the sustainability aspects within the South African - European wine supply chain are most detrimental to the environment, and the Sustainability Perception Analysis (SPA) to determine which of the sustainability aspects are perceived as most relevant to improve the sustainability performance of the supply chain. Moreover, the relevant section of the supply chain and the societal spheres responsible for improving the sustainability performance of the supply chain is concluded.

**Section c.: Conclusion**

In section c., it is concluded which differences can be identified between relevant sustainability aspects from the objective-empirical and interpretative approaches. A conclusion is also made about the different perceptions between supply and demand sides and between societal spheres.

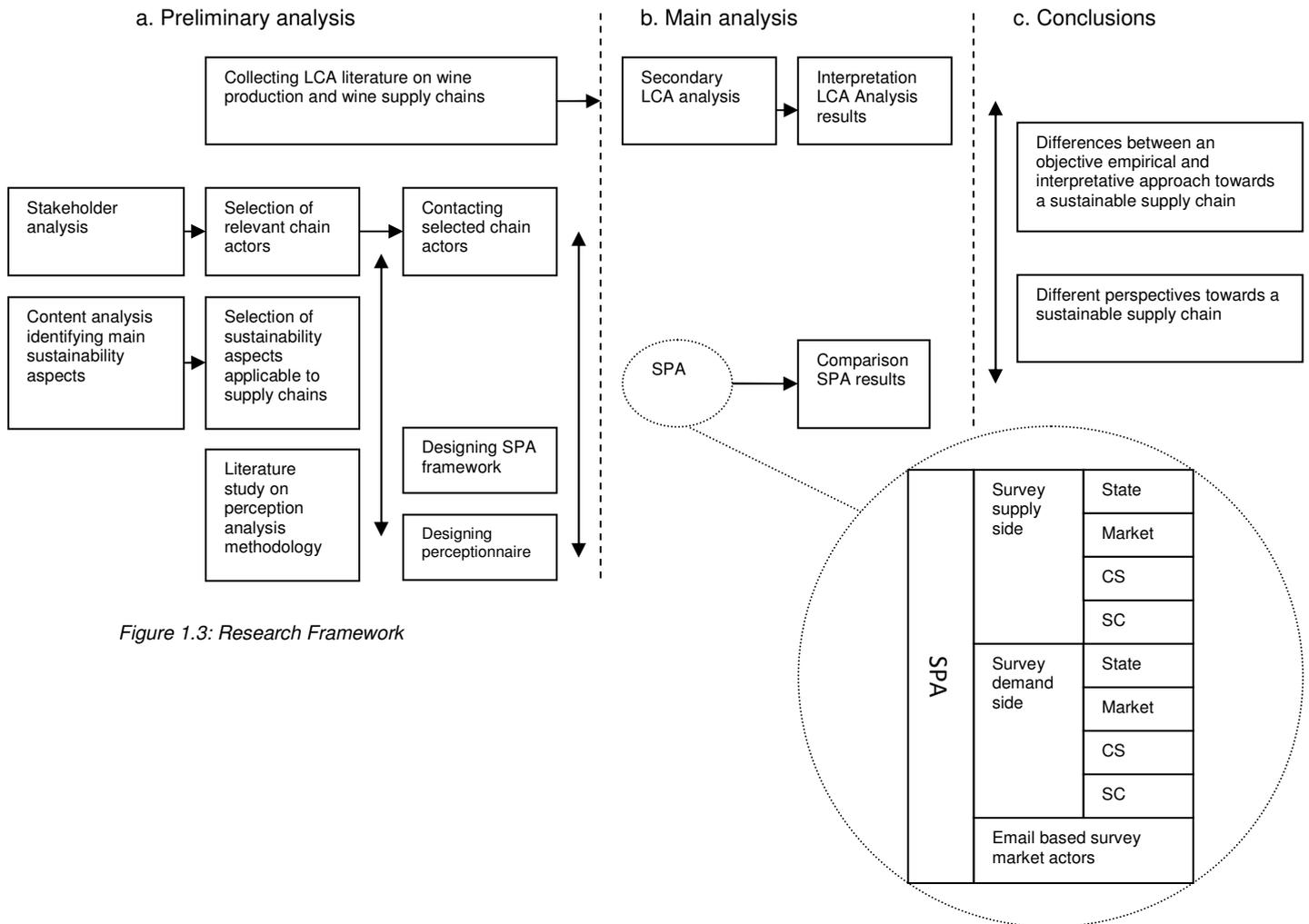


Figure 1.3: Research Framework

## 2 Theoretical Framework and methodological approach

In the forthcoming chapter, the preliminary analyses will be clarified. The preliminary analyses are the foundation for the main research activities in this research and consist of four different analyses. Firstly, a description will be given on the difference between the objective-empirical and interpretative approach considered relevant for this research. Secondly, the method used to identify LCA studies on wine production and wine supply chain is explained. The third analysis focuses on the selection of chain actors to involve in the research. As this research depends greatly on chain actor perceptions, a prudent and justified selection of chain actors from both supply sides and all societal spheres is essential. Conducting a stakeholder analysis prevents recognizing merely those perspectives from more obvious or powerful chain actors. Each chain actor's perspective towards improving the sustainability performance must be considered equally important to justify differences towards relevant aspects to improve and possible improvements. Finally, literature describes a large set of sustainability aspects. However, not all of these aspects might be relevant for the South African – European wine supply chain. In order to condense the numerous available sustainability aspects to a set that is relevant to address for effectively improving the sustainability performance of the South African – European wine supply chain a selection has to be made.

### 2.1 Objectively and interpretatively sustainable

As the main objective of this research is to determine which of the sustainability aspects are most relevant in order to enhance the sustainability performance of the South African wine supply chain a method for distinguishing this relevance needs to be chosen. Two approaches are distinguished; an objective-empirical and an interpretative approach. The objective-empirical approach is looking for facts in a real world scenario that explain the problem to be solved. Hence, conducting objective-empirical analysis to determine what the actual sustainability performance of the wine supply chain is. The interpretative approaches that problem from the individual's perception. There is no absolute truth only an interpretation of that truth, a perception towards a problem is socially constructed and can be perceived differently by each individual. Therefore the sustainability performance of the supply chain is determined by chain actor's perceptions.

Several methodologies demonstrating the environmental performance objectively are available in scientific literature. Especially methods measuring environmental impact can be identified<sup>8</sup>. However, the life cycle (production-, use-, and waste-phase) of a product in the wine supply chain is located at different places, environmental impacts are globally spread. This necessitates a method that tracks the products environmental performance throughout the entire supply chain. LCA would be the most effective method to analyse the various environmental impacts as this method is not site specific but studies the environmental impact of a product throughout the whole life cycle (Bauman, and Tillman, 2004). Assessing the Social and Socio-economic aspects in the supply chain tends to be a bit more difficult since no standardized methodology has been developed yet. Though several scholars are working on such methodology, it has not been applied to the wine supply chain yet. Chapter 4 will elaborate on methodology for social and economic assessment closely related to LCA. In section 1.3 has been described that the South African wine industry exports more than half of its wine and about two third of that amount is exported to Europe. This demonstrates that Europe is an important market for the South African wine Industry and since wine is no scarce commodity this supply chain is demand driven. The economic power in the supply chain therefore lies at the demand side<sup>9</sup> (Ras et al., 2007). Besides having economic power the demand side often implements sustainability neglecting issues perceived important by the supply side (Ras & Vermeulen, 2009). This demonstrates a difference in what is perceived as a sustainable supply chain. Different sustainability aspects can be perceived unequally important to improve the sustainability performance of the wine

<sup>8</sup> Methods such as Environmental Risk Assessment (ERA), Material Flow Accounting (MFA), and Environmental Input-Output Analysis (IOA) are a few to name. For further information see (Wrisberg et al., 2002)

<sup>9</sup> This has been mentioned during several interviews with market actors at the supply side.

supply chain. Moreover, Market actors are not the only actors involved in the supply chain. Government issues legislation and policies to be abided by the Market. Civil Society can demand more sustainable products and processes. This demand is often expressed through Non Governmental Organisations (NGOs) (Müller et al., 2009). NGOs can in this respect be understood as the voice of society. Besides these three societal spheres the Scientific Community contributes knowledge on improving the sustainability performance of supply chain. While the latter three are perceived as indirect chain actors is Market perceived as direct chain actor (Vermeulen & Ras, 2006). The transformation to a more sustainable supply chain does affect many directly and indirectly involved actors. These involved actors can have different perceptions towards the relevance of the sustainability aspects needed to be improved in order to enhance the sustainability performance of the supply chain. In sum, four potentially different contrasting perspectives depending on the actor's position in the supply chain can be recognized (figure 2.1):

- Supplier side versus Demand side
- Direct involvement versus indirect involvement
- Indirect involvement versus indirect involvement
- Objective-empirical versus interpretative

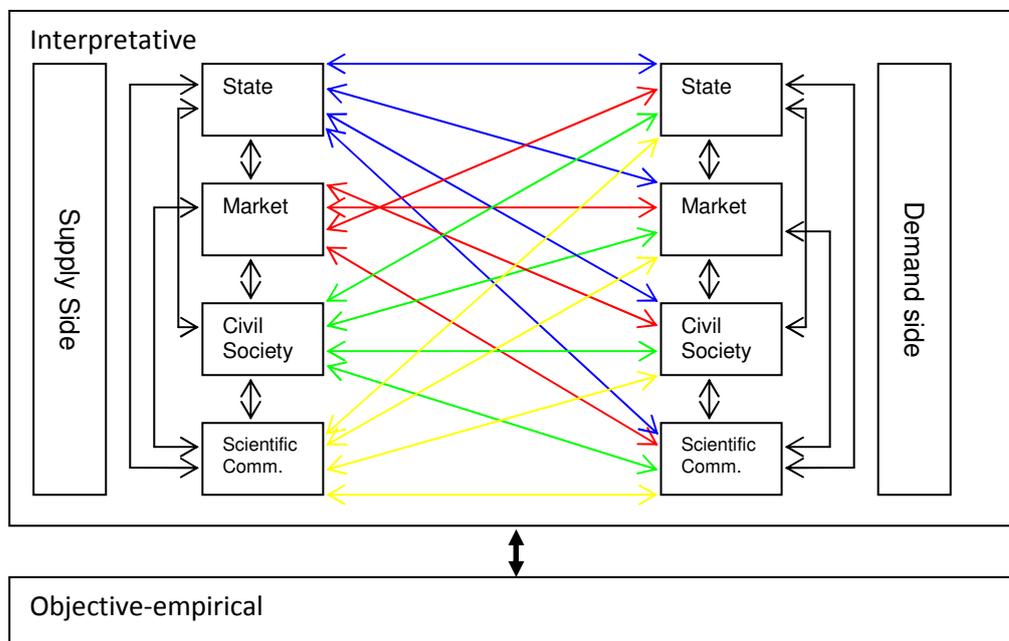


Figure 2.1: Possible contrasting perspectives

## 2.2 Identification of LCA studies on wine production and wine supply chains

Objectively determining the effect of supply chain processes on the environment will be done issuing a secondary LCA analysis. This secondary analysis entails a comparison of LCA case studies on results and choices made during the LCA studies. In order to employ such an analysis different LCA studies need to be identified. Identification of these LCA studies has been done according a general literature search. The main criteria for this literature search entails LCA studies on wine production or wine supply chains. Databases that were used during this search are Omega, Scopus, ISI, Google Scholar, and Web of Science; however, other non scientific internet sources have been used as well. The literature search to provide the required LCA case studies has been done in the period between 01-04-2009 and 01-06-2009 and employed the following key words or a combination of these words; LCA, wine, wine supply chain, wine value chain, wine production, viticulture, viniculture, agriculture. These same combinations have also been made with 'Life Cycle Analysis' and 'Life Cycle Assessment' instead of the abbreviation LCA. LCA studies identified but not accessible through the Utrecht University library have been kindly made available by peers at other Universities. Besides this

literature search, authors of identified studies were approached by email and asked if they knew of any LCA studies on wine production or wine supply chains not already identified.

The following list contains the identified LCAs on wine production and wine supply chains used for the secondary LCA analysis. All of these were identified through literature research with the exception of the study conducted by Clavijo Izquierdo et al. which was made available by the author.

- Economic and Environmental Analysis of the Wine Bottle Production in Spain by means of LCA (Aranda, I. Zabalza, & S. Scarpellini, 2005)
- POEMS: A Case Study of an Italian Wine-Producing Firm (Ardente et al., 2006)
- Análisis del Ciclo de Vida del vino de crianza D.O.C. Rioja<sup>10</sup> (Clavijo Izquierdo et al., 2005)
- Life Cycle Analysis of Wine Production Process: Finding Relevant Process Efficiency and Comparison to Eco-Wine Production (Gonzales, A. Klimchuck, & M. Martin, 2006)
- Life cycle assessment (LCA) of wine production (Notarnicola, Tassielli, & Nicoletti, 2003)
- The joint use of LCA and emergy evaluation for the analysis of two Italian wine farms (Pizzigallo, Granai, & Borsa, 2008)
- Life Cycle Environmental Impact of Wine production in Nova Scotia, Canada (Point, 2008)

The collection of LCA studies consists of reports, articles and book chapters. The reports in general give more detailed information on choices made in the study. Articles and book chapters provide less detailed data since these texts are limited to a specific amount of words for publishing.

### **2.3 Stakeholder Analysis**

Stakeholder analysis is a methodology for understanding a network and changes in it by systematically identifying individuals and/or groups in the same network and assessing their respective interests in that network (Grimble & Wellard, 1997). During this research, stakeholders are addressed as chain actors. Classifying these chain actors into categories provides an understanding of the chain actor relationship (Rowley, 1997). Moreover, stakeholder analysis also distinguishes between conflicts and trade-offs (Grimble, 1998) that could mitigate improvements towards a more sustainable wine supply chain. Two significant terms can be distinguished in the previous and therefore need to be elucidated before a stakeholder analysis can be conducted.

*Stakeholders; “actors who are both affected by and affecting the problem and are, at the same time, participating in the process of formulating and solving it” (Banville et al., 1998)*

*Networks; a network of relationships between multiple actors from different spheres who simultaneously operate in the same system (Kickert, Klein, & Koppenjan, 1997; Rowley, 1997)*

If the South African - European wine supply chain is explicated along these definitions it means the system in this research is the South African - European wine supply chain. This system involves several chain actors.

#### **2.3.1 Analysis methodology**

Stakeholder analysis is not a straight-forward methodology. Every analysis has its own objective and no blueprint is available for conducting a stakeholder analysis (Grimble, 1998). Nevertheless, Grimble recognizes five essential stages to be completed in order to conduct a comprehensive stakeholder analysis (figure 2.2). However, to achieve the objective of this stakeholder analysis only the first three stages are essential, since there is no attempt to establish any action plans for change at this

<sup>10</sup> The LCA report by Clavijo Izquierdo et al. has been written in Spanish. Since the author's Spanish language skills are almost non existing, parts have been translated using an online translator (<http://translate.reference.com/>). Using an online translator hardly ever results in an exact translation, though it is believed that the data extracted from this report is adequate however mistakes in interpretation could have occurred due to mistranslations.

point. This research will merely establish the prerequisites for possible improvements towards the sustainability performance of the supply chain by identifying the different chain actor perceptions on how to attain sustainability. Subsequently, this should reveal chain actors' interests and diminish patterns of inter-action and dependence.

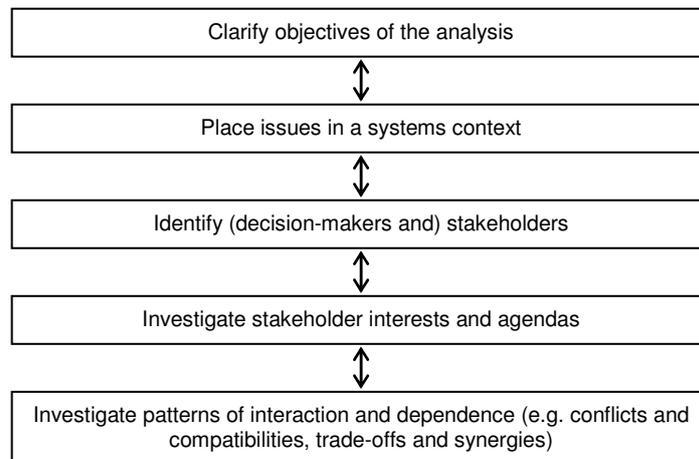


Figure 2.2: Stages in Stakeholder Analysis adapted from Grimble (1998)

### 2.3.2 Chain actor criteria and categories

The objective of this stakeholder analysis is to identify chain actors who affect or are affected by improvements towards a more sustainable performance of the supply chain. Consequently, these chain actors have a certain perspective on how to improve the supply chain according to their position and interest in the supply chain. Moreover, experts from the Scientific Community need to be identified. These scholars can address the sustainability performance from an external perspective. In order to identify relevant chain actors it is necessary to determine some criteria. Any actor who does not comply with the established criteria is not considered to be relevant and will not be selected for the stakeholder analysis. A relevant chain actor is therefore perceived as a chain actor:

- Who will be positively or negatively affected when the sustainability performance of the supply chain will improve on at least one sustainability aspect;
- Affect possible solutions towards improving the sustainable performance of the supply chain; or,
- has the potential to contribute scientific knowledge on improving the sustainability performance of the supply chain.

### 2.3.3 Chain actors in the supply chain

Identified actors can be categorized according to their position in the supply chain and societal sphere (table 2.1). The Scientific Community in this respect is seen as a separate sphere, contrary to scholars as Glasbergen who often include the Scientific Community into one of the three generally acknowledged spheres, but in accordance with the Governing for Sustainable Development diamond (Vermeulen, 2007). The categorization can be extended by distinguishing between supply-, shipping- and demand side. Furthermore, a distinction can be made between indirect and direct actors. However, only chain actors from the Market sphere are considered to be directly involved in the supply chain. Chain actors from the other three spheres are therefore perceived as indirect chain actors. Actors shipping wine from South Africa to Europe are assumed to have a marginal interest in and impact on all aspects of the supply chain's sustainability performance since wine is not their core business but a product amongst many others. Therefore, these chain actors will fall outside the scope of the Sustainability Perception Analysis (SPA). Subsequently, there is no need to identify these actors, but this does not imply that sustainability aspects concerning this section of the supply chain are not to be considered.

Societal Sphere	Supply side		Demand Side	
	Direct	Indirect	Direct	Indirect
State		✓		✓
Market	✓		✓	
Civil Society		✓		✓
Scientific Community		✓		✓

Table 2.1: Chain actor spheres

### 2.3.4 Chain actor: the affected and affecting

A more thorough description of the chain actor network can be found in the following section, describing the affected and affecting chain actors within the different societal spheres. The relation between the different spheres as well as the relation between the supply- and demand-side is depicted in figure 2.3.

*Market* actors are those actors commercially involved in the supply chain. Chain actors with such a financial incentive are directly involved in the chain processes. Chain actors at the supply side are directly affected if the sustainability performance of the supply chain is improved. Improving the sustainability performance will most likely result in shifting currently used processes to more sustainable alternatives. Not only does this entail (technical) processes to improve environmental performance, but also the social and socio-economic output of these processes. South African actors are mainly interested in the sustainable development of the supply side, bringing about direct benefits (Vermeulen & Ras, 2006). However, Market actors at the supply side are affected by all chain actors in the supply chain.

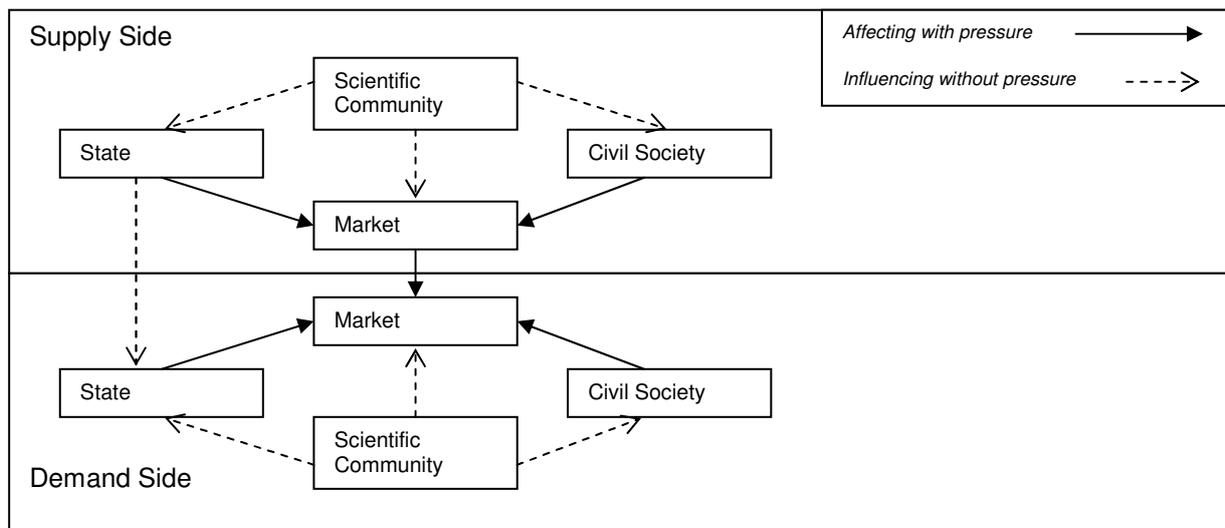


Figure 2.3: Societal spheres affecting and influencing Market

Actors residing in other societal spheres do affect the market. However, a distinction between affecting with and influencing without pressure can be made, though, this distinction is not always that straightforward.

Government on both sides of the supply chain establish policies and laws, affecting the Market on their respective side of the chain to adjust their business conduct in order to abide law. Market actors have to comply with these policies and laws while operating in the supply chain and also have to consider them when improving the supply chain's sustainability performance (Vermeulen & Ras, 2006). At the European level, the EU established the Integrated Product Policy to stimulate each Market actor to improve their environmental performance (EU, 2008). Policies like these do put extra pressure on the demand side, who in turn pressure distribution and suppliers to become more sustainable (Hall, 2001). Hence, even if business is performed according law on the supply side,

demand side can pressure markets on the supply side into improving business performance according to the European standards. This pressure implies a 'Eurocentric' development towards a sustainable supply chain which does not allow for much consideration regarding South Africa's national situation (Ras et al., 2007). Hence, Market at the supply side is directly pressured by Market on the demand side and the government they abide. Moreover, they are indirectly pressured by government at the demand side due to government's pressure on Market at the demand side. Though government establishes laws and policies, it also establishes institutes supporting the Market to adjust their practices to abide law. These government-affiliated institutes are therefore influencing the Market in the right direction. Furthermore, Dutch government has foreign departments<sup>11</sup> addressing national agriculture policy (Landbouwrapaad) and develop and execute coherent effective policies in relation to the region and countries they operate in. This interference does influence the government of the countries these departments are established in. Consumers are also perceived as commercially involved actors and therefore belong within the Market. Consumers have the ability to pressure Market by demanding more socially and environmentally aware products. This pressure for a sustainable product is affecting the company's conduct in the supply chain.

On the demand side as well as on the supply side, pressure from Civil Society can initiate the implementation of more sustainable processes. Civil society can be defined as that part of the societal sphere composed of organisations articulating and representing the interests of the public at large. Additionally, distilling and transmitting societal problems to the public and enhancing problem-solving discourses on questions of general interest<sup>12</sup> (Kohler-Koch & Quittkat, 2009). Civil Society Organisations (CSOs) in this respect are non-political and non-market institutes. Organisations belonging to Civil Society are Non Governmental Organisations (NGOs), Labour Unions, Employer's Organisations, Churches etc. Especially NGOs represent a wide variety of interests: environment, human rights, social welfare, health, and culture. Civil Society's voice is often expressed through NGOs. Often these NGOs try to convince Market actors to convert to sustainable business practices and create more awareness among customers. In doing so, CSOs also affect the Market. However, besides direct pressure on Market, Civil Society can pressure the Market indirectly. NGOs can pressure government, who in turn, as mentioned above, do pressure Market.

The Scientific Community includes scientists at universities, research institutes affiliated with universities, and independent research institutes. These scientists can provide an external perception towards a more sustainable supply chain. Moreover, scholars enquiring these topics at different sides of the supply chain could have different perceptions towards sustainability in relation to supply chains. In general, the Scientific Community does not directly affect nor is it affected by any of the chain actors but influences the perception of all three societal spheres by providing new knowledge. The Scientific Community is mainly perceived as an influence on the three societal spheres at their respective supply chain side. However, scholars operating in that community do influence and are influenced by other scholars in the same community, consulting each others studies for further research and peer reviewing articles in scientific journals.

Such a diverse group of chain actors with different interests in the supply chain consequently has a different perspective on how to improve the supply chain's sustainability performance. These perspectives define which sustainability aspects they perceive relevant to address for improving the supply chain's sustainability performance. Chain actors will therefore not always agree on the relevance of sustainability aspects. In order to improve the sustainability performance and preventing Life Cycle Management (LCM) being practised purely on western standards, it is crucial to

---

<sup>11</sup> LNV – Landbouwrapaad <http://www.dutchembassy.co.za/landbouw>  
BuZa – Regiodirectie <http://www.minbuza.nl/nl/Organisatie/Organisatiestructuur/Regiodirecties>

<sup>12</sup> Compiled out of definition 1 and 2 in (Kohler-Koch & Quittkat, 2009)

establish an understanding of all chain actors' perception towards achieving a more sustainable wine supply chain.

## 2.4 Sustainability aspects

Numerous aspects relating to the sustainable development paradigm can be considered relevant to enhance the sustainability performance of the supply chain. In order to understand which aspects to consider it is crucial to identify which of these aspects could be perceived relevant for improving the supply chain's sustainability performance. Revealing those aspects is a necessity to effectively develop the supply chain's sustainability performance. In the following sections is explicated which sustainability aspects are selected and where this selection is based on. Once relevant sustainability aspects for the South African - European wine supply chain are determined, differences in chain actor perception on the relevance of these aspects can be analysed.

### 2.4.1 Sustainability Aspects: magnifying sustainable development

Several institutions and scholars attempted to establish a common set of sustainability indicators. However, Parris and Kates (2003) concluded that no universally accepted sets of sustainability indicators have been established. Established sustainability criteria and indicators operate on different levels with different foci. Moreover, sustainability aspects used in these frameworks are often extracted from existing frameworks. In almost all cases, the reason for choosing these sustainability aspects remains ambiguous.

In order to conclude which of the many sustainable aspects to address it is necessary to determine which are most significant for a sustainable supply chain. However, it is generally acknowledged that Sustainable Development, in spite of its many definitions, is founded upon the Environmental, Social and Economic dimension<sup>13</sup>. Improving the sustainability performance of any supply chain depends on the improvement of these individual dimensions without trade-offs between dimensions (de Leeuw, 2006; Kloepffer, 2008). Improving the sustainability dimensions necessitates these dimensions to be measurable<sup>14</sup>, allowing us to demonstrate if the sustainability performance has been improved. However, each of the sustainability dimensions covers a wide array of sustainability issues. Consequently, each dimension needs to be subdivided in sustainability aspects considered relevant for the South African - European wine supply chain in order to demonstrate what to improve.

The environmental and social performance of the supply chain is rather clear as these performances have a positive or negative sustainability impact on society. However, the impact of the economic performance can be perceived in twofold. A distinction can be made between internal and external economic sustainability. Internal economic sustainability addresses the economic performance of the company itself. External economic sustainability addresses the socio-economic performance of the company, benefiting the company only indirectly (Labuschagne et al., 2005; Schaffer & Schmidt, 2006). The external economic sustainability, the economic responsibility towards society, is considered more important when the sustainability performance of the supply chain is to be improved since this research intends to make a contribution regarding all chain actors. Moreover, the external economic sustainability is opposed to the internal economic sustainability often underexposed (Labuschagne & Brent, 2006) and could offer new insights.

Therefore, a sustainability aspect framework for the South-African European supply chain needs to be designed encompassing environmental, social and socio-economic aspects. However, before any

<sup>13</sup> Institutional aspects are considered important for achieving sustainability as well (Labuschagne, Brent, & van Erck, 2005; Parris & Kates, 2003) however it is concluded that these are mainly relevant for issues regarding transfer of information and collaboration. These issues can be perceived as a social characteristic of the supply chain as well and are therefore included in the social aspects.

<sup>14</sup> Measurable in this respect does not per definition mean quantified as aspects can be measured along chain actor perspective. Qualitative sustainability aspects as well as quantitative aspects are identified

initiative can be taken towards the design and selection a clear definition of these dimensions is necessary in order to prevent certain aspects to overlap.

**Environmental aspects** have a direct impact on the environment caused by activities and processes in the supply chain.

**Social aspects** have a direct impact on quality of life for actors and communities involved in the supply chain caused by activities and processes in the supply chain.

**Socio-economic aspects** have a direct impact on economic means to increase the community's or society's quality of life.

Indirect sustainability impacts will not be included as they will appear as a direct sustainability aspect in one of the other dimensions. For instance, deforestation is a direct impact on the environment and an indirect impact on community, however, the indirect impact will appear as a direct impact under the social aspect in the form of loss of livelihood.

#### 2.4.2 *Interrelatedness of the sustainable development dimensions*

Despite all the discussion concerning the definition of sustainable development consensus has been found on the importance of the preceding sustainability dimensions not as separate but as interwoven. In the conventional 'three ring circus model' this interrelatedness is displayed (figure 2.4). Nonetheless according to Levett (1998) this model is not completely accurate. The conventional model fails to depict the environment as a prerequisite for economic and social life. Furthermore, Economy is considered to be a social construct. The Economy functions because humans have created the assumptions, behaviours and institutions which make it work. In that respect economy exists and functions because we believe it assists us in achieving our needs (Levett, 1998). However, this is a very neo-liberal perspective and debatable if this approach is correct for underdeveloped countries to achieve sustainability. Nevertheless, global South-North supply chains do partly operate in a neo-liberal economy. Adapting this neo-liberal model might therefore be unavoidable for developing countries involved in global supply chains.

Levett (1998) introduces a "Russian Dolls" model for sustainability which would be more applicable if we perceive environment as a prerequisite for the social and economic dimension (figure 2.5). Without the environment there will be no society, without society there is no need for an economic model to meet human needs whatsoever. Based on this model, the most important questions to answer is, if we are living within environmental limits and if we are achieving a good quality of life (Levett, 1998). Social and Socio-economic sustainability in this respect should be achieved by improving those aspects perceived important to increase the quality of life, and therefore can differ between supply chain sides. However, environmental limits should be globally equal and achieved at the same level, therefore rationally determined. Though these limits are currently hard to define perceptions on relevance should be similar.

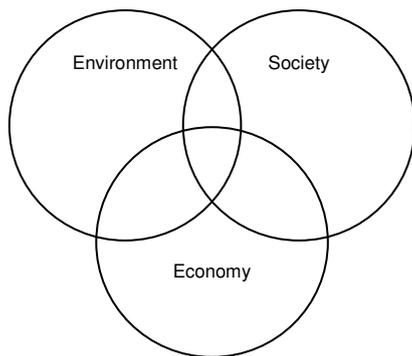


Figure 2.4: Conventional sustainability model

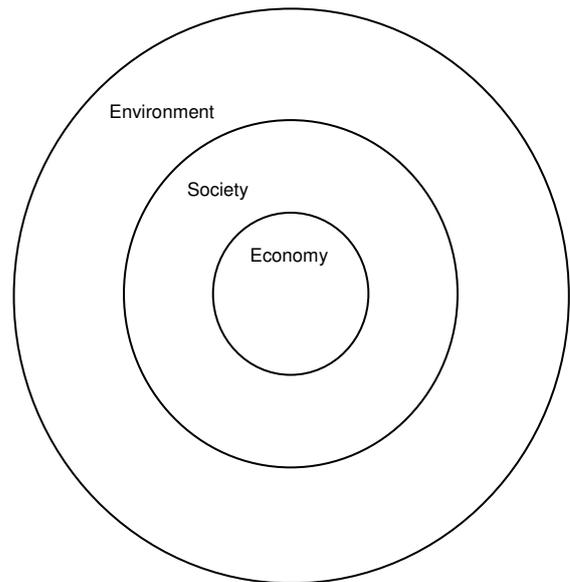


Figure 2.5: Levett's 'Russian Dolls' sustainability model

### 2.4.3 Sustainability aspects: a theoretical foundation

In the following sections an attempt is made to design a sustainability aspects framework for the South African – European supply chain which should also be applicable for South – North supply chains in general. The choice for sustainability aspects is not solely based on aspects adapted from other frameworks. A theoretical foundation is used to elucidate the relevance of chosen sustainability aspects. This theoretical foundation is not only grounded in sustainable development theory but also incorporates development theory. Development theory needs to be integrated since the sustainability aspects framework addresses a supply chain with its supply side located in an underdeveloped country therefore it needs to function in a developing context. This entails a different approach and understanding of sustainable development than the general western approach offers. Making use of development theory can provide more insight into achieving the sustainable development objective according a development context. Finally, sustainable development and developing theory have become largely intertwined since the 1980s as becomes clear through the definition of a sustainable livelihood as defined by Carney (1998): A livelihood comprises

*“...the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is considered to be sustainable when it is resilient. It should be able to cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base.”*

### 2.4.4 Implications determining relevant aspects

Proceeding on Levett's model of sustainability, selected sustainability aspects have to demonstrate that supply chain processes do not exceed environmental limits and contribute to a respectable quality of living. In order to select these sustainability aspects, an analysis of the generally acknowledged sustainability aspects is required. Within the realm of sustainable development and development theory, a distinction can be made between theoretical and more practical approaches. The theoretical approaches attempt to elucidate what is necessary for a sound environment and a

good quality of life as the practical approaches tend to achieve that goal by managing development. This could be perceived as the difference between a top down and a bottom up approach.

However, there are some implications when aspects need to be selected that have to demonstrate not exceeding environmental limits. Demonstrating that environmental limits are not exceeded does imply that these limits are known. However, no consensus on what these environmental limits are has been formed (WCED, 1987). Moreover, environmental limits are also relative in both time and space (Dahl, 1999) therefore constantly changing and, different worldviews do exist on the earth's resiliency to cope with our impacts on the environment (Elizabeth, 2009). The worldview adhered by an individual defines that individual's discernment towards environmental limits.

Processes in the supply chain do affect the quality of life in a society positively or negatively. Analysing Social and Socio-economic performances of the supply chain could determine if the supply chain contributes towards an increased quality of life. Therefore a selection of sustainability aspects should be focused on displaying whether we are attaining a good quality of life. However, yet another implication surfaces; determining if a decent quality of living is achieved implies it is generally known what a decent quality of living is. Quality of life is debatable, what one can understand as a decent quality of life could be unacceptable for others. Simply assuming that a good quality of life can be globally defined might be too straightforward. Western society has different standards of a good quality of life compared to underdeveloped countries. However, the different UN and WHO interpretations will delineate several general aspects minimally required for a good quality of life. Aspects like, good health, freedom, security, education, choices and opportunities, dignity and respect are only a few to be recognized as essential for a good quality of life.

Although it is important that the supply chain's impact on the environment stays within the (yet to be established) limits, establishing these limits is far beyond the scope of this study. The same goes for determining quality of life. Since people differ from nation to nation and even within nations, it is almost impossible to establish precisely what quality of life is. Therefore, identifying which sustainability aspects, when improved, contribute to the enhancement of the sustainability performance of the supply chain, deserves our attention.

Escaping from before mentioned implications can be done by initially considering a wide array of sustainability aspects relevant for the SPA framework. Having said that, it can be concluded that improving supply chain's conduct on the three sustainability dimensions; environment, social and socio-economic, should result in a sound environment, and good quality of life respectively. However, what is perceived sound environment and good quality of life will not be defined.

#### *2.4.5 Exploring current sustainability frameworks*

If recent development and sustainability frameworks are analysed a multitude of aspects can be distinguished. Some of these aspects focus on the entire array of sustainable development while others focus on certain aspects perceived essential for achieving sustainability in a specific area. Since it is concluded that the selected aspects also have to function in a development context, aspects will be retrieved from both disciplines. An attempt is made to organize the multitude of sustainability aspects and translate to main sustainability aspects relevant for improving the sustainability performance of the South African wine supply chain.

##### *Development frameworks*

Maslow's hierarchy of needs, probably the most well known framework to distinguish human needs, offers a general framework showing which needs need to be achieved in order to maintain a good quality of life. Both Daly (in Hilderink, 2004) and Bossel (1999) sophisticated Maslow's hierarchy of needs to be more applicable in a (sustainable) development context. Bossel identifies for his framework three subsystems that incorporate six systems necessary for development:

- Human system; the social system, individual development, and government
- Support system; infrastructure and economic system
- Natural system; resources & environment

The Daly triangle progresses in four steps from ultimate means to ultimate ends incorporating the World Bank's capital approach (Hilderink, 2004). These capital approaches show similarity to the capitals used in the Sustainable Livelihood Approach (SLA). The SLA acknowledges five capitals essential for development (DFID, 1999) described in the order applied in the Daly triangle:

- Natural capital; the natural stock of resources to be used to develop a decent quality of life.
- Physical capital; the infrastructure and tools to aid in their basic needs and become more effective in achieving quality of life.
- Human capital; represents the skills, knowledge ability to labour and good health to ensure they can pursue a good quality of life.
- Social capital; is understood as the means to pursue a decent quality of life. These means entail social networks and connectedness, relationships of trust and reciprocity and cooperation.
- Financial capital; the financial resources people require to develop to a decent quality of life.

#### *Global development frameworks*

The most renowned attempt to achieve an equal and good quality of life on a global scale is the United Nation's (UN) Millennium Development Goals (MDGs). The MDGs, to be achieved in 2015, encapsulate development aspirations of the world as a whole. The MDGs encompass universally accepted human values and rights such as health, education, eradication of poverty and a sustainable environment (UN, 2008). The UN Commission of Sustainable Development (CSD) indicators incorporate a wider array of sustainability aspects on an international and national level and in line with agenda 21 and the Johannesburg declaration (UNSD, 2007). These indicators embrace besides five environmental aspects also economic development, global economic partnerships and governance as relevant aspects for sustainable development. The five environmental aspects recognised by UNSD are Atmosphere, Land, Oceans, Sea and Coast, Fresh Water, and Biodiversity (UNSD, 2007). In preparation of The Johannesburg World Summit WEHAB<sup>15</sup> contributed five frameworks promoting sustainable practices. The frameworks cover the following priority areas for sustainable development; Agriculture, Energy, Health and Environment, Water & Sanitation, and Biodiversity & Ecosystem management (WEHAB, 2002). Each of these frameworks describes how the critical role of that priority area is interrelating with the priority areas of the other frameworks to increase sustainable development. The UN Environment Programme (UNEP) Drive Pressure State Impact Response (DPSIR) framework offers a representation of the links between the environment and development, human well being and vulnerability to environmental change. Human intervention on the environment is perceived having an impact on Atmosphere, Biodiversity, Land and Water resulting in environmental impacts and change (UNEP, 2007). Moreover UNEP identified three important environmental issues in South Africa, Water Availability and Quality, Land Degradation, and Threats to Biodiversity (UNEP, 2008). Nuisances are however hardly ever considered a relevant aspect for achieving sustainable development, however Guinée et al. (2002) does recognise it as an impact on the environment and will therefore be included as a main aspect.

From the former, sixteen main aspects have been identified as possible relevant for improving the sustainability performance of the supply chain. From these sixteen main aspects, six correspond with the environmental dimension, six with the social dimension, and four with the socio-economic dimension (table 2.2). A more detailed description of the main aspects can be found in box 1 at the end of chapter.

<sup>15</sup> WEHAB is an acronym for Water, Energy, Health, Agriculture, and Biodiversity which are the framework topics

<b>Main Sustainability Aspects</b>		
<b>Environmental</b>	<b>Social</b>	<b>Socio-economic</b>
<i>Land Use</i> <i>Atmosphere</i> <i>Water</i> <i>Biodiversity</i> <i>Energy &amp; Resources</i> <i>Nuisances</i>	<i>Employment</i> <i>Health and Safety</i> <i>Training and Education</i> <i>Social Capital: Coherence and Trust</i> <i>Physical Capital</i> <i>Consumer Interest</i>	<i>Wages</i> <i>Social safety net</i> <i>Community prosperity</i> <i>Trade &amp; Finances</i>

Table 2.2: Main sustainability aspects involved in SPA

#### 2.4.6 Selected sustainability aspects for the LCA

Each of the main sustainability aspects contains several sustainability aspects. To identify these sustainability aspects a number of certification schemes, scientific sustainability frameworks and assessment methodologies have been analysed. A complete list of consulted literature can be found in appendix I.

Environmental and social certification schemes are established to ensure companies comply with the sustainability standards outlined in the scheme to increase their sustainability performance. Assessment methodologies do assess impacts caused by company processes in order to measure the sustainability performance. The impact categories included in the assessment methodology can provide relevant sustainability aspects to consider. Furthermore, several scholars have been working on sustainable production and supply chains establishing frameworks entailing possibly relevant sustainability aspects. Finally, the Development Frameworks used to form the main aspects were subject to a more detailed analysis. These four sources will be employed to generate a generic framework for supply chains.

Each of the sustainability aspects identified in the certification schemes, sustainability frameworks, assessment methods and development frameworks, belonging in one of the main sustainability aspects were selected and categorised. All selected aspects and indicators have been compared on similarities before combined into a single aspect. Aspects and indicators that addressed more than one issue have been taken apart when necessary and joint with the appropriate sustainability aspect. This analysis resulted in a list of ninety-six sustainability aspects, thirty-six environmental aspects, thirty-nine social aspects, and twenty-one socio-economic aspects. A complete list of the sustainability aspects can be found in appendix II.

### *Box 1: Main Sustainability Aspects*

#### *Main Environmental sustainability aspects*

1. **Land Use**; covers the effect processes in the wine supply chain have on the quality and quantity of land.
2. **Atmosphere**; covers the effect processes in the wine supply chain have on the quality of the atmosphere.
3. **Water**; covers the effect wine supply chain processes have on the quality and quantity of water.
4. **Biodiversity**; covers the effect wine supply chain processes have on nature and wildlife.
5. **Energy & Resources**; covers the consumption of energy and resources in the wine supply chain and the wine supply chain's conduct to reduce the consumption of energy and resources.
6. **Nuisances**; covers the annoyance and irritation caused by processes and facilities necessary for processes in the wine supply chain.

#### *Main Social sustainability aspects*

1. **Employment**; covers the wine supply chain's conduct towards employment related issues.
2. **Health & Safety**; covers the wine supply chain's conduct towards health and safety on the workplace and the community in which the wine supply chain is active.
3. **Training & Education**; covers the wine supply chain's conduct towards training and education for employees and the community the supply chain is active in.
4. **Social Capital: Coherence and Trust**; covers the wine supply chain's conduct towards interaction between chain actors and the flow of information with direct and indirect chain actors.
5. **Physical Capital**; covers, tools, equipment, buildings, and infrastructure required for wine supply chain processes to increase efficiency and sustainability.
6. **Consumer Interest**; covers the conduct of the wine supply chain towards the consumer of the end product.

#### *Main Social-economic sustainability aspects*

1. **Wages**; covers the conduct of the wine supply chain towards wages and related aspects.
2. **Social Safety Net**; covers a broad array of aspects ensuring social security for employers and families in the wine supply chain.
3. **Community Prosperity**; covers the conduct of the wine supply chain to improve the community financially.
4. **Trade & Finances**; covers the conduct of the wine supply chain towards ensuring honest and sustainable trade practices.

### 3 Methodology A: Sustainability Perception Analysis

In the previous chapters, the chain actors have been identified and the relevant sustainability aspects were determined. In order to reveal those aspects that chain actors perceive as most important for improving the sustainability performance of the South African – European wine supply chain a methodology has to be designed. This methodology will be addressed in the Sustainability Perception Analysis (SPA). The SPA has several building blocks on which the analysis is conducted. The main analysis should result in the different perspectives between South African and European chain actors. However, time does not allow for an in-depth analysis on European chain actors in all societal spheres. Hence, the demand side perceptions will be analysed mainly focusing on Dutch chain actors. Nevertheless, to attain some results on the European-level, Market actors from the three largest importing countries will be approached, though, in a different manner. Moreover, consumers will be perceived as a somewhat odd group of chain actors and also be approached differently. However, this chapter will begin explicating the scientific background of perceptions and the justification of analysing perceptions empirically.

#### 3.1 Perceptions

Perception can refer to how one physically perceives the world through vision, sound, smell, taste or touch. Those perceptions are mostly agreed upon by people surrounding us since they are actually there and not constructed in our head (Mather, 2006). Perceptions on sustainability can rely on the above mentioned senses; a river can look dirty and smell bad because of polluted water and a city can smell bad because SMOG caused by industrial and vehicular emissions. Such aspects of sustainability can be easily determined by everyone. However, a polluted river can also be perceived a burden for farmers, for example, who rely on that water for irrigation. Improving the water quality of the river can then be perceived as very relevant for that farmer, but less relevant for an industry dumping their waste in the river. Additionally, a polluted river might not affect someone not using the river. This individual rather sees the resources used to improve the water quality of the river allocated to a sustainability issue affecting him/her. The perception towards improving water quality will in these cases not be unanimously shared and the relevance of a clean river will therefore differ between individuals. When determining the sustainability performance of the wine supply chain, similar perceptions can occur since not every chain actor in the supply chain is directly affected by the un-sustainability aspects, or particular sustainability aspects are not directly visible for each chain actor. Moreover, sustainability and sustainable development are both difficult concepts that lack a universally accepted definition (Lélé, 1991; Meadowcroft, 2000). Different perceptions towards achieving sustainability can be distinguished, even if it is agreed upon that sustainable development is built upon the environmental, social and economic dimensions<sup>16</sup>. While perceptions between experts differ, a larger ‘perception gap’ is evident between experts, the public and other groups like NGOs and Government (Brown, 1989).

##### 3.1.1 Analysing perceptions empirically

Since perceptions differ between individuals and no ‘absolute’ or ‘objective’ truth can be identified, perceptions are considered to be socially constructed (Downing, 2005). Interpretivism and Social Constructivism both recognize that actor perception is socially constructed, and both methodologies do search for patterns of meaning in the obtained perceptions (Gephart, 1999). Embracing an objective-empirical approach to determine actor perception seems therefore not to result in a sound analysis. However, this would only be if the main purpose of the analysis is to elucidate ‘how’ and ‘why’ these different perceptions came to existence. Since the main purpose of the analysis is to identify the different actor perceptions existing in the different societal spheres an objective-empirical approach can be employed. Additionally, if that data is obtained sufficiently during data

<sup>16</sup> Some scientists add the institutional dimension as a fourth dimension (i.e. Labuschagne, 2007). This will be discussed in a later footnote.

collection, the analysis can attempt to find reasoning in these assumed different perceptions. The additional analysis would be considered a most welcome elaboration on the primary goal, identifying the difference in existing perceptions. In order to conduct an analysis on the actor's perception a method needs to be employed that is able to collect perceptions in such a way they can be compared between actors from the different societal spheres and between supply chain sides. This entails that the subject for which the perception is measured need to be identical, or at least similar.

To achieve such an analysis, employing a perceptionnaire seems to be the most effective method. A perceptionnaire can be understood as a questionnaire but instead is used to determine the perceptions of chain actors. A perceptionnaire, other than a questionnaire, does not attempt to obtain fact. Therefore, respondents are, before filling out the perceptionnaire, informed that it is not designed to determine the absolute truth but merely their perception towards the stated sustainability aspect.

Employing a perceptionnaire ensures that all aspects are examined. Using perceptionnaires to obtain data is regarded as an empirical approach. Results from the survey can be statistically determined and generalised according to societal sphere and supply side. Remember, the goal is not to identify the individual perception but to identify the dominant perceptions of the different societal spheres. Generalization is, contrary to the Interpretivist view, something common in empirical research (Williams, 2000) and generalisation of perceptions is allowed. If the reasoning behind these perceptions is to be determined, an Interpretivist approach should be taken. Each actor perception would be a conclusion on its own without being able to determine the reasoning of the societal sphere as an entity; since the Interpretivists opinion is that perceptions are personal and therefore cannot be generalised (Williams, 2000). However, perceptions are constructed by society, or said differently; your perception is constructed by those operating in your societal sphere. Subsequently, a resembling perception should subsist when actors operate in the same societal sphere. Hence, generalisation should be possible. The Interpretivist opinion towards generalisation is also contradicted by Williams (2000), proving that Interpretivists do make conclusions on society based on data from specific individuals. In order to make any conclusions at all it is inevitable to generalise (Williams, 2000).

### *3.1.2 Social Acceptance*

The sustainability aspects considered important for improving the sustainability performance of the South African – European wine supply chain are taken from a wide array of global development initiatives, sustainability frameworks, assessment methods, and certification schemes. Especially the latter two are often employed to determine the sustainable performance of a business. Since the supply chain is a chain of interlinking business, these aspects should be applicable to the individual businesses in the supply chain as well. However, aspects extracted from sustainability schemes are often intended for audit purposes; to determine if companies comply with these sustainability aspects. As this research does not intend to conduct an audit, caution should be taken how these aspects are addressed. Moreover, one should consider if some of the aspects should be addressed at all, as these will obviously answered positively with socially correct answers even if the company would not comply with or perceive the aspect irrelevant purely out of self-interest. It is important that the perceptionnaire avoids a Western bias. An approach from a more South African perspective is therefore required.

It is acknowledged that different perspectives might occur between the supply side and demand side of the chain. These different perceptions, if present, can partly result from a difference in social acceptance towards aspects. However, possible relevant aspects included in the perceptionnaire might address issues that are not socially acceptable to discuss. These subjects need to be approached with caution or excluded altogether when necessary. If aspects are excluded perceptions can not be measured; however, the subject addressed by these excluded aspects can have a value

most important to measure the sustainability performance. The ideal approach would be to design the South African perceptionnaire in line with South African accepted subjects and the European version in line with European accepted subjects. However, South African and European perceptions need to be compared in order to discover similarities and differences. Consequently, the perceptionnaire needs to be identical, making it impossible to decouple the perceptionnaires from each other.

### **3.2 The Sustainable Perception Analysis framework**

Within environmental science, actor perceptions are mostly employed in risk management. Risk management is often used to determine the risks certain activities have for the environment and livelihood of the public. However, the public often experiences this risk differently than objectively determined. Many methods and indicators to represent the public's behaviour towards risk can be identified (Brown, 1989). Surveys, discourse, polls, interviews are methods that can be used to identify the public's perception towards risk. However, risk is much more stringent as it affects the individual directly. Therefore can it also be determined through behaviour of the public. For instance, if a factory is perceived to be a risk factor, houses will drop in price and protests against the factory can be arranged. Since risk directly affects the public, or at least the community at large, it can not be compared with the sustainability performance of the wine supply chain that affects certain actors in this chain. Although certain methodologies employed in risk management can be used for the SPA the indicators used in risk management differ from the sustainability aspects relevant for the supply chain. More applicable for measuring the relevance of sustainability aspects is a method designed by Nasar (2008). With this method, perceptions on 'Environments for Active Living' were assessed. Nasar's method recognizes four aspects to be addressed before perceptions can be measured. This method is not readily adaptable for the SPA, though the four aspects used in the methodology offers a theoretical foundation on which the SPA can be constructed. However, an additional methodological aspect has been incorporated for practicality. The following five aspects have been addressed in the SPA framework.

- 1) Selection of sustainability aspects
- 2) Presentation of sustainability aspects
- 3) Selection of response measures
- 4) Sustainability perception analysis methodology
- 5) Selection of chain actors

Since the first aspect has been addressed in the preliminary analysis the main focus will be on the presentation of sustainability aspects the selection of response measure and method of response analysis.

#### *3.2.1 Presentation of sustainability aspects*

Presenting the subject to be perceived can be done in several ways. If the subject allows it one can use visual methods like photos, video or even invite the selected respondents to visit the sites (Nasar, 2008). In case of the latter the participation rate would probably be very high though the necessary funding would also be astronomical since selected actors had to be flown from SA to Europe and back and vice versa. A more practical approach would be employing a survey since obtained perceptions need to be comparable and measurable. Surveys offer the opportunity to address the subject in a fixed format from which it is hard to deviate assuring that each subject is considered. Compared to open interviews a survey is more efficient when a large amount of subjects are to be considered. However, aspects should be described in such a context they have the same meaning for everyone, though it is acknowledged that this is difficult and respondents can comprehend aspects differently. Because of the large amount of aspects it is not possible to explain every aspect in detail due to time constraints nor is it desired to do so. Explaining each subject in detail would influence the

actor's perception, something that should be prevented at all times. The broad selection of aspects undoubtedly includes aspects never considered by the respondent, even more, a respondent might have no perception towards that aspect. Since perception is measured there is no point in getting random answers as these will contaminate results. It should be stressed that having no perception towards an aspect is different than perceiving the aspect irrelevant. In the latter case the respondent has an opinion in the first one the aspect could be either relevant or irrelevant. However, with a survey these aspects will be identified, as opposed to an open interview where such aspects might not be considered and therefore would not know if the respondent perceives the aspect relevant or irrelevant.

Three different perceptionnaires have been employed; a semi-open perceptionnaire used during the interviews, an email based perceptionnaire, and a perceptionnaire specifically designed for the consumer. These perceptionnaires differ in extensiveness and detail, though all include the same sustainability aspects. All three perceptionnaires are designed with a similar format and are divided in five sections. However, the consumer perceptionnaire differs from this format for practical and comprehensibility reasons which will be explained below. The semi-open perceptionnaire has been employed during interviews with selected actors from all three societal spheres and the Scientific Community in South Africa and the Netherlands.

Additionally, Market actors in the UK and Germany have been approached by an email based perceptionnaire. Including European Market actors other than Dutch was required since the objective of this research is to conclude the difference in perception between chain actors from Europe and South Africa. However, the same survey was also sent to Dutch and South African Market actors previously not involved. A larger group of respondents allows for more significant results for the Market sphere. This seemed desirable since Market actors are directly affecting the sustainability performance and are directly affected by improving the sustainability performance. The email based perceptionnaire is, however, less extensive than the one used during the interviews. Two reasons can be given for reducing the survey; reducing the time to complete the perceptionnaire and simplification of the perceptionnaire since the interviewer cannot clarify possible ambiguities. Both reasons have been considered necessary to increase the response rate as it is assumed that surveys that require too much time or are too difficult to complete will create little response or are returned unfinished.

The consumer perceptionnaire differs from the other perceptionnaires. After several discussions with retailers and wine tasting organizers it was concluded that the general survey is too detailed and hypothesised that consumers would not comprehend the sustainability aspects addressed in the survey. Moreover, it is assumed that consumers lack a profound view on the South African – European wine supply chain therefore have no perception towards the improvement of the sustainability performance. However, consumer perception towards the sustainability performance is desired, hence, the perceptionnaire was simplified, adjusted and restructured. Moreover, to prevent respondents from randomly filling out the perceptionnaire just to get to the end a 'bail out' option was added. Respondents were allowed to discontinue if they thought aspects became too detailed. However, an additional question has been added, measuring the consumers view on the sustainability performance of the South African - European wine chain. These answers conclude if the initial hypothesis can be falsified.

The sections in the general format are:

*Personal information* obtained to determine if differences in perception do appear because of age, education, function, and sex. For the wine farmers an additional question was added to determine if wine farmers are IPW certified or if other certification schemes are applied which could show a higher affection towards sustainability in all or one of the three dimensions. Personal information is

excluded from the consumer survey as it is assumed that respondents are selected more randomly and possible differences because of personal features can not significantly be concluded.

*The sustainable development* section determines what respondents perceive as sustainable development and which of the three dimensions is most relevant to improve the sustainability performance of the wine supply chain.

Both *environmental and social sustainability* have been divided in six main aspects covering the environmental and social dimension respectively. Each of these main aspects contains several sustainability aspects possibly relevant for improving the sustainability performance of the wine chain. The consumer perceptionnaire entails the same six main aspects. However, sustainability aspects have been included as examples in the main aspect for comprehensibility.

The section on *socio-economic sustainability* has been divided in four main aspects covering the socio-economic dimension. Equally to the environmental and social dimension each of these main aspects contains several sustainability aspects possibly relevant for improving the sustainability performance of the wine chain. The consumer survey entails the same four main aspects. However, similar to the environmental and social dimension, sustainability aspects have been included as examples in the main aspect for comprehensibility.

### 3.2.2 Selection of response methods

Personal information depends on the respondent and can vary widely, therefore, will be collected through open question. The Sustainable Development section consists of two parts, but cannot be presented sequentially. The first part determines the initial perception on sustainable development and the second part the relative relevance of the three sustainability dimensions after the survey has been completed. The first part was added to the survey to assess possible different perceptions towards sustainable development as this is still an abstract concept. A different perception on the sustainable development concept could therefore result in a different perception towards improving the sustainability performance.

The initial perception will be determined having the respondent describe what they perceive as sustainable development. This description was quantified, determining which of the sustainability dimensions is mentioned most often.

The second part weighs the relative relevance of the sustainability dimensions dividing a total of 100 points giving the dimension most relevant the most points. The first part of sustainable development has been excluded from the consumer survey but has been replaced with a question to determine the consumer's view on the current sustainability performance of the South African – European wine supply chain. The consumer's view will be measured on a 5-point Likert scale with a neutral middle. The second part determining the relative relevance of the sustainability dimensions will be following the consumer's view on the sustainability performance of the chain.

The perception on the *environmental, social and socio-economic sustainability* will be measured for each sustainability aspect on an adjusted four point Likert scale without a neutral middle but with additional answer options. Only one option will be offered when an aspect is perceived as not relevant. If an aspect is perceived relevant one of three options can be checked; slightly relevant, relevant, and very relevant. One of the additional options can be chosen if the respondent perceives the aspect not applicable (N/A) for the South African - European wine supply chain or if an aspect has, according to the respondent, already been instated (I) due to law, covenant, or other regulation and no necessary improvements need to be made. If the respondent had no opinion on an aspect, none of the options was checked. Additionally, the respondent is asked to specify which section of the supply chain is considered relevant to improve the relevant sustainability aspect and who is

considered responsible for improving that aspects. If a sustainability aspect is perceived not relevant, I, or N/A, chain section relevance and responsibility do not have to be answered. Choices for relevant supply chain section are; three sections on the supply side (vineyard, winery, cellar/exporter), logistics (transport from exporter to harbour, from SA harbour to EU harbours, from EU harbour to importer/retailer), and three sections on the demand side (importer/retailer, consumer, waste disposal). The respondent is allowed to check multiple sections if more then one section is perceived as relevant for that specific sustainability aspect. These results show where chain actors think the sustainability can be improved the most or which section is currently most unsustainable. The three generally acknowledged societal spheres, State, Market and Civil Society, can be checked for the responsibility. Similar to the supply chain sections, the respondent can check more then one of the options if improving the aspect is perceived as a shared responsibility.

In addition, the relative relevance will be measured for each sustainability dimension to identify which of the main aspects is perceived most important. Instead of simply determining how relevant the respondent perceives single sustainability aspects respondents have to weigh between main aspects and make a deliberate choice which is perceived more relevant. The relative relevance is measure by means of percentage. Respondents are dividing 100% across the main aspects in each sustainability dimension, giving the lowest percentage to the main aspect perceived least important and vice versa.

The email based perceptionnaire is similar to the semi-open perceptionnaire. However, the Market's perceptions on 'relevant supply chain section' and 'responsibility' will not be measured. The consumer survey is even more simplified and only requires the respondent to fill out the relative relevance of the main sustainability aspects for each dimension. The perceptionnaires can be found in appendix III and appendix IV.

### 3.2.3 Sustainability Perception Analysis methodology

Results from the perceptionnaires are entered in the statistical program SPSS 16 to analyse obtained perceptions. Since perceptions of both supply sides and different societal spheres are determined, opposed to individual perceptions of chain actors, all data from perceptionnaires are aggregated to a mean score for supply sides and societal spheres at each supply side. Accordingly, differences in perceptions are compared between supply side and demand side in order to have a general overview how both sides of the wine supply chain perceive the relevance of sustainability and specific sustainability aspects. Additionally a more detailed analysis presents the perceptions of each societal sphere. On a societal sphere level, perceptions are compared between different societal spheres within the supply side as well as the demand side. Moreover, perceptions of societal spheres are compared with their counterparts on the opposite side of the supply chain (figure 3.1).

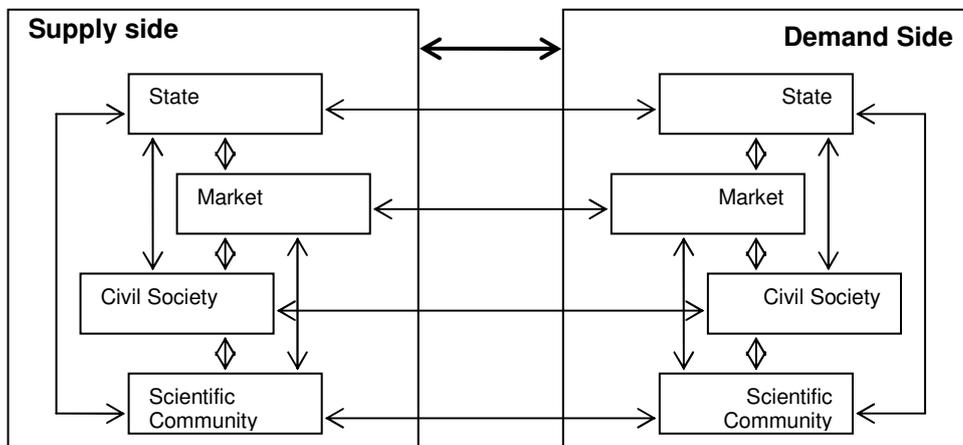


Figure 3.1: Compared societal spheres

The chain actor perceptions are measured on three sustainability levels, which allows for an analysis on three levels (figure 3.2). First level entails the perceived relevance of the three sustainability dimensions to enhance the sustainability performance of the South African – European wine supply chain. A comparison is made on what initially is perceived as sustainable development and what in the end is concluded to be the most relevant dimension for enhancing the supply chain's sustainability performance. Since the initial perception is a qualitative description of sustainable development, the description will be quantified by identifying the dimension most often mentioned to be most relevant and subsequently aggregated to create a single mean score.

In the level 2 analysis different perceptions on the relevance of main sustainability aspects are identified for each sustainability dimension. This analysis concludes which of the main aspects is perceived to be most relevant to enhance the specific sustainability dimension.

The level 3 analysis concludes the perceived relevance of individual sustainability aspects categorised under each of the main sustainability aspects. Results of the level 3 analysis are employed to determine the perceived applicability of the supply chain section and the responsibility for improving the sustainability performance of the wine supply chain.

Additionally, perceptions on the applicability of the various supply chain sections are concluded on main aspect level. Relevant supply chain sections are defined as those for which relevant sustainability aspects are applicable in order to improve the sustainability performance of the wine supply chain. Perceived responsibility for realizing these enhancements is concluded thereafter. Responsibility is appointed to one of the three generally acknowledged societal spheres or combinations of these societal spheres and also will be presented on a main aspect level. Since applicability and responsibility is only addressed when a sustainability aspect is perceived relevant, presented results are therefore not determined on all ninety-six sustainability aspects. Perceptions excluded from this analysis are shown for each main sustainability aspect in appendix V.

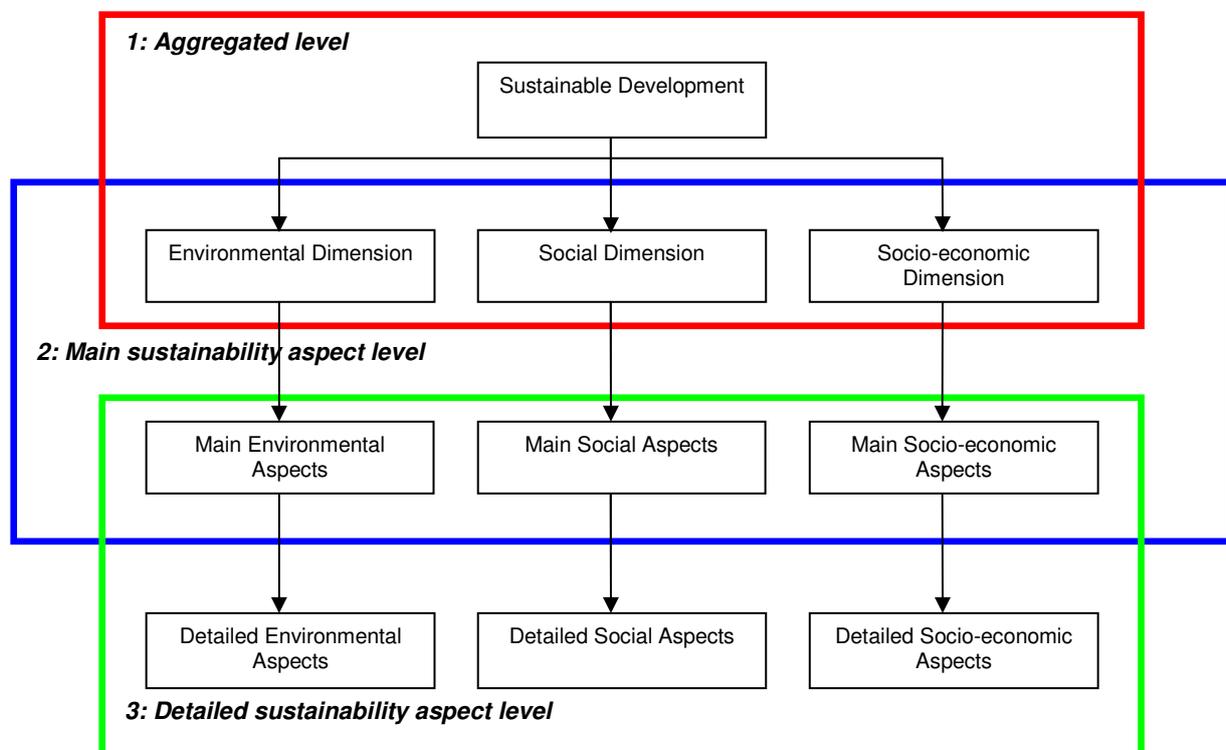


Figure 3.2: Sustainability Perception Analysis (SPA) levels

### 3.2.3.1 *Validity of data resulting from the SPA*

Chain actors involved in the SPA have been defined as individuals connected to the South African – European wine supply chain seated in one of the three societal spheres. Since it is not possible to talk to the societal sphere as an entity, individuals from these societal spheres have been interviewed. Perceptions of these individuals might not represent the perception of all actors in that sphere because actors, even though employed in a certain sphere, do have personal preferences and knowledge on the subject. Even if during any interview it is mentioned that the interviewee has to fill out the perceptionnaire from the perspective of the societal sphere, personal bias is hard to ignore and will most likely affect their answers and therefore their perception. It is impossible to divide the personal side from the employed side. However, knowledge and perceptions usually are closely linked (Cassam, 2008). In that respect, the individual's work and work environment will give him or her certain knowledge about sustainability and therefore the perception is related to that knowledge in such a way it differs from the perception actors from other spheres have. Moreover, a Dutch expression states 'waar men mee omgaat wordt men mee besmet' meaning as much as 'those with whom you are involved affect your perception.' It is therefore true that even if there is some personal bias in filling out the questionnaire this bias is created through, or at least influenced by, others in the same societal sphere. The results will therefore still apply as the perception of that social sphere.

It has also been attempted, in most spheres successfully, to interview more than one actor. These perceptions are aggregated to determine the perception of the specific societal sphere. The more interviews in a specific societal sphere the better the chance that the general perception of that sphere is determined. The SPA does not compare difference in perceptions between actors in the same sphere. Nor is it believed useful to determine the individual perception for the reason that the individual perception will not have any validity in changing the sustainability performance of the supply chain. Individual perception can be biased in only changing that what is important to the individual him/herself. Aggregating perceptions of more actors from a societal sphere will result in a more general perception without any bias to personal gains. However, when no more than one chain actor from a particular societal sphere can be involved the perception is still presented as the perception of the societal sphere to present a more consistent analysis.

### 3.2.4 *Selection of chain actors*

There are several approaches to obtain the necessary information to identify chain actor involvement. The most commonly recognized sources for identification are documents, interviews interpretation/deduction, and observation (Runhaar, 2008). An extensive analysis is not considered essential since the aim is merely to identify chain actors to involve in the Sustainability Perception Analysis (SPA). Chain actors have in first instance been identified using the established Sustainability Institute and Copernicus Institute network. Essential chain actors that did not appear in these networks are identified using information retrieved from associations and institutes connected to the South African –European wine supply chain such as Wines of South Africa (WOSA) and Productschap Wijn (PW). Remaining actors have been identified more pragmatically using the internet and by recommendations made by interviewees.

#### 3.2.4.1 *Selected chain actors*

Chain actor identification is solely done for the selection of chain actors to involve in the SPA. However, SPA outcomes are a result from three approaches<sup>17</sup>. Therefore a select group of chain actors from all societal spheres on both the supply as well as the demand side of the wine supply chain need to be identified for involvement in semi-open structured interviews. A second group of chain actors from the Market sphere at both sides of the supply chain need to be identified for

<sup>17</sup> The SPA methodology will be described more profoundly in the following chapter.

involvement in an email based perceptionnaire. This second group will also involve supply chain actors from Germany and the UK in order to attain results on European level. The third group that has been identified involves the consumer of South African wine.

A following selection of chain actors involved in the supply chain has been made. Selected actors from all societal spheres do comply with the established criteria mentioned above. A description of the involved actors will be given according societal sphere.

#### *Market*

Selected Market actors on the supply side are mainly wine farmers and employees at wine farms and wine cellars. Employees range from viticulturists and winemakers to CEOs. Involving actors who occupy different positions offers a broader perception as it is assumed that CEOs have a better general overview and viticulturists and winemakers have a more specific knowledge on grape growing and winemaking processes respectively. Included vineyards vary from small to large and are mainly conventional wine farms, though one Fair Trade-certified farm has been selected. Besides actors directly involved in wine production, the Integrated Production of Wine (IPW) has been selected. The IPW is a voluntary environmental certification scheme established by the South African wine industry to accomplish more environmentally sound wine production. Although the focus of the IPW is on environment, social and socio-economic aspects are also taken in consideration.

Identified Market actors on the demand side are principally wine importers and wine retailers. Selected wine importers range from smallholders to large wine traders trading in conventional wine from medium quality to premium wines. The exception is Fair Trade Original that only trades fair trade wine. Fair Trade Original is a wholesaler for fair trade wine and for a range of other fair trade products. In cooperation with producing countries, Fair Trade Original supports producers and farmers to produce goods according European consumer standards. Producers and farmers receive information and training on market trends and products and food safety. Moreover, producers and farmers receive support for product development, production methods, logistics and marketing. Products are produced in accordance with the FLO certification scheme and bought according the fair trade philosophy. Fair Trade Original, founder of development trade, embraces the fair trade philosophy while conducting business (Fair Trade Original, 2010). None of the involved actors import or sell exclusively South African wine, though part of their selection contains South African wine. Besides importers and retailers, the Product Board wine has been involved. Het Productschap Wijn (the Product Board Wine), established at the request of the Dutch wine sector, has the statutory task to represent the common interest of the Dutch wine sector and Dutch society. Het Productschap Wijn operates as a platform for companies in the sector and encourages a collective approach to issue. Moreover, the Product Board Wine is the contact on behalf of the wine sector for national and international government (Productschap Wijn, 2008).

Besides Dutch Market actors, two other European countries have been selected for involvement in this research. Selection has been made based on import of South African wine. The United Kingdom and Germany are within Europe the first and second largest importing countries respectively. The Netherlands is the third largest importing European country (Demhardt, 2003; WOSA, 2009b). Actors that have been selected within these European countries are trading and importing South African wine.

Consumers are directly involved when they consume South African wine, though it cannot be expected that consumers solely consume South African wine. Dutch consumers participating in wine tasting sessions have been regarded the best option for obtaining consumer perceptions. This selects a random, though stratified, group of consumers with affection for wine. Wine retailers organising wine tasting session were approached with the request to assist in this research.

### *State*

Since most of the SA wine is produced in the Western Cape (SAWIS, 2010a) state officials on the supply side have been selected on regional level. These state officials are more closely connected to the wine supply chain and therefore have better insight in the wine supply chain. Since sustainability involves environmental social and socio-economic dimensions, state departments were selected on their relation with these dimensions. The department of Social Affairs and the department of Agriculture have been involved.

On the demand side, MVO Nederland (CSR Netherlands) has been involved. MVO Nederland was initiated by Economic Affairs to promote sustainable business practices in line with the three sustainability dimensions. MVO Nederland focuses mainly on Small and Medium size Enterprises (SMEs) willing to increase their sustainability performance but currently lacking the knowledge to do so. MVO Nederland supports these SMEs to embrace the 'People Planet Profit' approach, finding opportunities that are profitable for the company and also profitable for society and environment (MVO Nederland, 2010). Other government departments have been approached to be involved in the SPA. However, these departments assumed they did not have the required knowledge or perception on sustainability issues in the South African European wine supply chain to constructively contribute to this research.

### *Civil Society*

Since this study considers all three sustainability dimension relevant, NGOs concerned with environmental, social and socio-economic sustainability need to be involved. NGOs addressing themes like sustainable viniculture and viticulture or sustainable international supply chains and North-South trade are considered to be the most relevant to represent society's perspective on the current supply chain's sustainability performance and opportunities for improvement.

On the supply side, Fair Trade South Africa (FTSA) has been involved in this research. FTSA is the national umbrella organisation promoting the fair trade concept in South Africa. By using the fair trade concept the fair trade movement attempts to enhance trading conditions, labour conditions and empowerment through ethical and sustainable trading practices (BWI, 2009; FTSA, 2010; WIETA, 2006).

WIETA, a not for profit voluntary association committed to promoting ethical trade in the wine sector but presently promoting ethical trade in agriculture as a whole (WIETA, 2006), and BWI, a partnership between the SA wine industry and the conservation sector seeking to limit the further loss of threatened natural habitat and promoting sustainable wine production through the adoption of biodiversity guidelines (BWI, 2009), have both been approached to be involved in the SPA. However, due to busy and not aligning time schedules both organisations had to be excused from participation.

In order to represent society's perspective on the sustainability performance of the South African – European wine supply chain, (international) NGOs involved in sustainable North-South trading have been perceived most relevant to involve. At the demand side, the following NGOs involved in sustainable and North-South trade have been selected. Solidaridad is an NGO that is in different ways involved in supply chain development. Their core tasks are stimulating chain development at every stage of the chain and supporting chain actors to attain that change. Moreover, Solidaridad increases knowledge and skills of farmer and labourers and stimulates improvements in product quality, certification processing, trade, financing etc. (Solidaridad, 2008). FairFood International is a non-profit campaign and lobby organisation which encourages the food and beverages industry to increase the sustainability performance of their practices and products. In order to aid the food and beverage industry, FairFood offers a range of solutions to improve their sustainability performance, such as linking them to labels or successful sustainability initiatives. Moreover, FairFood includes the

general public in its efforts to increase the sustainability level of products in the food and beverage industry. In addition, it raises awareness among consumers and offers them practical tools to put the awareness in practice (FairFood, 2010). Oxfam Novib, the Dutch division of Oxfam International, is an NGO that fights for a just world without poverty. Oxfam Novib's philosophy is that people in developing countries can build a better life for themselves. To improve the livelihood of the developing countries Oxfam Novib cooperates with communities, organisations and governments and supports projects and organisations locally. Furthermore, Oxfam Novib campaigns and lobbies on an international level to ensure a just world without poverty (Oxfam Novib, 2010). In 2004 Oxfam Novib has been involved in a project to improve working conditions for farm labourers in the South African wine supply chain (Bosker, 2006).

The selected Dutch NGOs all pursue a similar goal by focusing on aspects that can be recognized in the sustainability aspects possibly relevant to enhance the sustainability performance of the wine supply chain.

#### *Scientific Community*

Actors from within the Scientific Community, to be selected for this study, are scientists with a background in vini-/viti-culture and or (sustainable) agricultural/food chains, providing new knowledge on improving the sustainability performance which can be useful to all chain actors.

On the supply side, two scientists directly involved with wine have been selected. The first scientist is conducting research on the environmental impact of viticulture at the department of viticulture at Stellenbosch University. A second scientist has been found at the Sustainability Institute, an affiliation of the Stellenbosch University, who is involved with agriculture in general and has done sustainability assessments on wineries.

On the demand side, two scientists researching agro-commodity chains at Wageningen University Research (WUR) have been involved. Though other universities or research groups are present in the Netherlands, the WUR has an established reputation in agricultural science and scientists researching agro commodity chains have not been identified outside the WUR. Even though both researchers are employed at the 'Fresh Food and Chains' department, their research topics and scientific backgrounds differ from each other, resulting in a more empirical and interpretative approach to sustainability. Besides increasing quality of processes and products in the food supply chain the 'Fresh Food and Chains' department contributes to achieving more sustainable processes in the food supply chains (WUR, 2010).

Though, Utrecht University holds scholars with an expertise in sustainable global supply chains and related topics these scholars have been excluded from this research to prevent a bias as this research has been done at Utrecht University.

As expected, it has been easier, apart from the Market, to identify actors directly involved in the wine supply chain in South Africa than in the Netherlands. The sole reason for this is that wine is not as an important economic commodity as for instance coffee, bananas, palm oil, or soy. It is these commodities that often receive more attention. Still, wine might not be the primary focus for all the involved actors, all have been involved in improving the sustainability performance of agro-commodity chains or supply chains in general. Therefore, each of the selected actors has a certain perception on the relevance of sustainability aspects to improve the sustainability performance of the South African - European wine supply chain; hence, their perception is valuable for the analysis. In table 3.1 and table 3.2 is depicted how many directly and indirectly involved chain actors are selected for each societal sphere.

<b>Interviews</b>	<b>Supply Side</b>	<b>Demand Side</b>
<b>Market</b>	5 Wine farms 1 Wine Cellar 1 Wine association	6 Importers/retailers in the Netherlands 1 Wine association
<b>State</b>	2 Government officials	1 Government official
<b>Civil Society</b>	1 NGO	3 NGOs
<b>Scientific Community</b>	2 (sustainable) agri- / vini-culture experts	2 Supply chain scholars
<b>Total</b>	12	13

Table 3.1: Number of directly selected chain actor participating in SPA

<b>Survey</b>	<b>Supply Side</b>	<b>Demand Side</b>
<b>Consumers</b>		4 consumers from wine tasting groups
<b>Market</b> - wine farmers/retailers	8 Wine farms in South Africa	4 Importers/retailers in the Netherlands 2 Importers/retailers in the United Kingdom 2 Importers/retailers in Germany
<b>Total</b>	8	12

Table 3.2: Number of indirectly selected actors participating in SPA

## 4 Methodology B: Secondary LCA Analysis

Contrary to the SPA this chapter of the research approaches the wine supply chain from a natural scientific viewpoint. The interpretative approach taken in the former chapter will be abandoned and we will continue with an objective-empirical approach to determine the sustainability performance of the wine supply chain. In the next section the objective-empirical approach on the environmental aspects is explicated. Moreover, it is discussed why the social and socio-economic aspects are not included in the objective-empirical analysis. Finally a framework to analyse the selected LCA studies on the wine supply chain is designed.

### 4.1 *An empirical approach to measure sustainability performance*

As explained before, sustainable development covers all three dimensions of sustainability. This dictates that from an LCM perspective, the sustainability performance of the wine supply chain needs to be measured along these three dimensions. Several methods analysing the environmental impact of a process are available such as Material Flow Accounting, Environmental Input-Output Analysis, and Environmental Risk Assessment. Since the supply chain can be seen as a string of sequential processes, any of these methods could be applied. However, more supply chain characteristics have to be taken in account. The South African – European wine supply chain, discussed in this research, is a global supply chain. Accordingly, the life cycle (production-, use-, and waste-phase) of a product in this supply chain is located at different places and environmental impacts are globally spread, necessitating a method that tracks the products environmental performance throughout the entire supply chain. A Life-Cycle Analysis (LCA) would be the most effective method to study the various environmental impacts as this method is not site specific but studies the environmental impact of a product throughout the whole life cycle (Bauman and Tillman, 2004). Moreover, LCA is the most widely acknowledged methodology to measure the environmental impact of a process (Guinée et al., 2002). Furthermore, the standardization of LCA methodology offers the opportunity to compare data available from several studies on processes in the wine supply chain.

If LCA is the most suitable method for analysing environmental impacts of the supply chain, one would expect methods closely related to or with the possibility of being integrated within LCA also to be most suitable to analyse the social and socio-economic impacts of the wine supply chain. Social Life Cycle Assessment (SLCA) which focuses on those activities in the supply chain which affect people (Dreyer, Hauschild, & Schierbeck, 2006) and Life Cycle Costing Analysis (LCC) which addresses the economic effect of a process in the supply chain can be seen as such methods. For both methods attempts have been made to integrate them in LCA. Although progress is made to mature these methods they are still in an infant stage.

### 4.2 *Social Life Cycle Assessment (SLCA) & Life Cycle Costing (LCC) Analysis: shortcomings and scientific disagreement*

Both SLCA and LCC can be very effective when integrated in LCA, analysing the impacts of a process on all three sustainability dimension simultaneously. However, both SLCA and LCC methodology are not as far developed as LCA. This means that there is yet no straightforward methodology for both assessments and no consensus has been formed on the details of the assessment methodology. Not all aspects regarded important for the secondary analysis are currently included in the ambiguous SLCA and LCC methodologies.

As mentioned above, integrating SLCA in LCA would be effective to assess the social impacts of a system. However, current efforts tend to focus only on social impacts closely linked to environmental impacts (Hutchins & Sutherland, 2008) ignoring wider social aspects considered important for the sustainability performance of the supply chain. Equally important, SLCA is still in its infancy. Although

several scholars (Dreyer et al., 2006; Gauthier, 2005; Hunkeler, 2006; Jørgensen et al., 2008; Kloepffer, 2008; Norris, 2006) are involved in maturing this method, yet no consensus has been reached how to operationalise SLCA.

Evidently, SLCA needs to be developed further before it can be rightfully used. Consensus should be reached on how to operationalise SLCA to prevent measuring with different yardsticks. Moreover, the wider social aspects which are addressed in this research should also be included in SLCA if a good comparison is to be made between chain actors' perception and scientific results.

Even though SLCA cannot justifiably be used, an interesting debate on social impacts and how they relate to the supply chain has been established. Where some scholars in the SLCA field do relate social impacts, as with environmental impacts, to the product's life cycle (Norris, 2006) scholars like Dryer et al. (2006) relate the social impact of the supply chain to the conduct of companies engaged in the supply chain. The company, rather than the product, is the fundamental unit. The focus should therefore be on the company's conduct towards involved supply chain actors (Hauschild, Dreyer, & Jørgensen, 2008). This seems to be a logical reasoning as social issues like Occupational Health & Safety, Education and Freedom of Association are not product-related but are decided upon by the company and the national laws of the country the company resides in. Improving the supply chain's social sustainability performance does then also mean that negative impacts on social standards are reduced if involved supply chain actors perceive social standards as being improved.

Similar to SLCA, integrating LCC into LCA would be the most effective. Since LCC addresses the economic effect across the product life cycle it would be possible to integrate LCC within LCA (Hutchins & Sutherland, 2008; Norris, 2001). However, LCC addresses the economic performance of the supply chain or the company in the supply chain and not specifically the socio-economic performance, which is considered important for this study. Socio-economic aspects have been incorporated into LCA by Kruse et al. (2009) but they concluded that involving socio-economic aspects in LCA is still in its nascent stage.

It can therefore be concluded that, except for environmental impacts, no universally-agreeable scientific approach is available to measure the social and socio-economic impact of the wine supply chain. Although for both social and (socio-)economic impacts methods closely related to LCA are available, none of them are that extensively developed they can be used for this secondary analysis. Moreover, no studies have been identified using these LCA related methods to analyse the social and (socio-)economic impacts of wine production or the wine supply chain. Therefore, no secondary analysis can be made to determine these impacts.

#### **4.3 Life Cycle Assessment Methodology**

LCA is a methodology to objectively track the environmental impact of a product and its production process. In general an LCA tracks the product from 'cradle to grave', meaning it includes all processes from raw material extraction up till the disposal of the product (Bauman and Tillman, 2004). Environmental impacts in this respect are not only impacts related to the material in- and outflow of the product but also the in- and outflow for the processes necessary to produce the product. The term 'product' should be understood in the broadest sense of the word. Services are, besides physical goods, also seen as products within LCA. Though LCA is quantitative in character, including qualitative aspects/data might be necessary to create a complete picture of the environmental impacts (Guinée et al., 2002).

#### 4.4 LCA Applications

Depending on the consulted literature, different applications of LCAs can be distinguished. Jönson (1996) distinguishes between LCA as a concept and LCA as a tool for evaluating products, materials and service from an environmental perspective.

LCA as a concept is a way of thinking about and looking at products and materials considering the environmental impact of the product from the beginning till the end of the lifecycle. The LCA concept has generated more awareness of the impact a product or its processes can have on the environment and can therefore be important to 'green' the supply chain; it is an application for designing new products that will be mainly used in the designer phase of the product (Guinée et al., 2002).

LCA as a tool is used to measure the environmental impact of a product and its processes. Three applications for LCA as a tool can be distinguished (Bauman and Tillman, 2004; Guinée et al., 2002). Baumann and Tillman describe these different applications as the following:

- Standalone LCA: in which a single product or service is analysed to identify the origins of environmental problems related to a particular product
- Accounting LCA: where the environmental impact of a product or service is described with the option to compare and choose between different products with a similar function.
- Change-oriented LCA: where environmental consequences of a product or service are compared to alternative processes.

#### 4.5 Phases in LCA methodology

LCA involves a standardized four step procedure, which is extensively documented in ISO 14040-44.

- The *goal & scope definition* where the goal of the analysis is determined and the scope defined to ensure breadth, depth and detail of the study are compatible and sufficient to address the stated goal.
- The *Life Cycle Inventory analysis (LCI)*, involves the collection of data and calculations to quantify relevant in- and out-puts of the supply chain process.
- The *Life Cycle Impact Assessment (LCIA)* phase evaluates the significance of the potential environmental impacts using the LCI results.
- The final phase involves *Interpretation* of the results and reaching a conclusion in line with the stated goal (ISO, 2006).

#### 4.6 Secondary LCA Analysis Framework

Two types of comparative LCAs are identified in scientific literature. The most applied is the LCA comparing the environmental impact of two products with a similar function. The second type of comparative LCA, used for this study, gathers LCA studies on similar product to identify the most severe environmental impacts. In order to conclude the most detrimental environmental impacts for the South African – European wine supply chain using secondary data, studies from the second type are, next to common LCA methodology, consulted to comprehend a common foundation for analysis.

Most comparative LCA analyses examined to design this secondary LCA analysis framework do recognize the ISO 14040 standard as the foundation for their comparative framework. However, consulted studies did not include comparative LCAs on agri-food chains. Since LCA has its roots in the industrial sector (Mourad et al., 2007) all comparative studies identified have been conducted in that sector.

To determine the environmental impact of the South African -European wine supply chain from a scientific perspective several LCA studies will be analysed on their results. By comparing results, those most applicable for the South African – European wine supply chain can be extracted. However, final results of selected LCAs do depend on the execution of the LCA. Some studies focused only on a specific impact as others included the whole scale of impacts. Other studies did only focus

on specific sections or a section of the supply chain when others include the supply chain as a whole. Therefore, end results are influenced by the choices made during the execution of the LCA. These choices have to be considered carefully when comparing the studies on their environmental impacts. It is for that reason that a secondary LCA analysis framework needs to be designed. This framework should illustrate the choices made in the LCA studies and subsequently which results can be included in the secondary LCA. However, since LCA is a standardized methodology the four above mentioned procedures should be included in every study. Therefore, these four procedures will be considered the benchmark for comparison to ensure data can be legitimately used. Moreover, the consulted literature comparing different LCA studies also recognize the ISO 14040 standard as the foundation for their comparative framework (Cleary, 2009; Werner & Richter, 2007). According to the common LCA methodology and consulted literature the most significant choices determining the outcome of the analysis are, (1) *Goal of the study*, (2) *the functional unit, system boundaries and allocation procedure*, (3) *type of data used in the analysis*, (4) *the impact assessment* (Bauman and Tillman, 2004; Cleary, 2009; Werner & Richter, 2007). A description of these choices is given in the next section.

#### 4.6.1 *The executer's choice: significant choices determining final LCA results*

The following section describes the choices LCA executers can make that determine the final LCA results. These choices need to be carefully considered when establishing the secondary LCA. Blindly copying LCA results from other studies into the secondary LCA most likely leads to skewed and non reliable results.

##### *Goal of the study*

Though all collected studies do cover the wine supply chain or parts of that chain the objective for conducting an assessment can differ from each other. Scenarios for conducting an LCA can vary between a general LCA, identifying environmental hotspots, to a comparative LCA, intending to compare the environmental impacts of two similar products with alternative production methods (i.e. conventional vs. organic). Results therefore depend very much on the LCA application used in the assessment.

##### *Functional Unit*

The functional unit is a description of the primary functions of the product in quantitative terms, providing a reference to which the inputs and outputs of the product and its processes can be related (ISO, 2006). Differences in functional unit will bring about differences in end results. Functional units are usually determined as a specific amount of product used over a specific time. However, other aspects of the product can also be proven relevant. In this case the thickness of the bottle can make a difference. More expensive wines usually have thicker bottles while litre bottles use relatively less glass (Notarnicola et al., 2003), moreover, wine is sometimes not bottled before it arrives in the consuming country. Such variations in functional unit contribute to differences in LCA results. If we take in consideration that SLCA is still being developed and hopefully soon to be incorporated in LCA the functional unit can get even more complex to define. Considering alcoholism can be a significant social problem the amount of alcohol per litre of wine or the price per litre of wine can affect the social impact. The cheaper the wine the more the consumer buys with the same amount of money. The higher the alcohol percentage the less wine needs to be consumed to reach the desired state, drunk. The choice of functional unit does affect the outcome of the LCA even if future implementation of SLCA is not considered. Similar functional units would be most ideal for a secondary LCA however differences can be expected. These differences need to be accounted for.

### *System boundaries*

Whenever a system is studied, system boundaries need to be defined to separate the system from the rest of the world (Guinée et al., 2002). Within LCA four boundary dimensions can be recognized (Bauman and Tillman, 2004).

- Boundaries in relation to the natural system
- Boundaries within the technical system
- Geographical boundaries
- Temporal boundaries

*Boundaries in relation to the natural system* refer to the beginning and the end of the product's life cycle. Where is the product's Cradle and where is its Grave? In general, all processes in the system that are controlled by humans do belong to the technical system. Whatever is not under human control is seen as part of the natural system (Bauman and Tillman, 2004).

*Technical boundaries* relate to the technical system. The technical system is that part of the system controlled by humans and the objective of the assessment. In general, an assessment to identify the environmental impacts of a product focuses on the entire life cycle of the product. This would mean that the entire technical system from 'Cradle to Grave' needs to be assessed, considering all stages of the product's life cycle.

The *geographical boundaries* need to be defined to determine in what part of the world the different phases of the life cycle are employed. In- and out flows can have a different severity of impact in different parts of the world.

Two *temporal boundaries* can be distinguished. When looking for alternative processes in the system a prospective approach is considered. Determining which processes in the future can be used to produce the product with less environmental impact. If one studies the system to identify current environmental impacts a retrospective approach is taken, looking back on the system to determine the impacts already caused by the system.

### *Cut-offs and allocation*

If an LCA is conducted only to identify the environmental impacts of the production phase a 'Cradle to Gate' approach, excluding all life cycle phases after the product leaves the factory premises, is more effective. However, one can establish cut-off criteria and choose to focus only on specific parts of the life cycle excluding certain processes. Excluding some flows from the system is allowed when the conclusion will not be significantly different, or if a process is wholly allocated to another system. For example, consider a comparative LCA study on organic and conventional tomatoes grown on neighbouring farms, both transported by truck to Berlin. The transportation phase can be excluded; the environmental impacts caused by transport are equal, and therefore make no difference for the conclusion. Cut-offs can also appear when there is a lack of readily accessible data. Retrieving that data would imply disproportional expenses and efforts have to be made. If those expenses exceed the LCA budget the environmental interventions associated with the flows of the process need to be quantitatively estimated or simply ignored (Guinée et al., 2002). These estimations could lead to less accurate end results. It is therefore a necessity that 'cut-off criteria' are clearly understood and described.

Moreover, one should take in account that certain processes are not solely used for the studied product but shared with other products. In that case an allocation procedure must be established to ensure that only those in- and outflows used for the assessed product are considered. If we return to the previous example we can imagine that tomatoes are grown in a greenhouse. If only one third of that greenhouse is used for growing tomatoes the energy used to heat the greenhouse should only be allocated for one third to the tomatoes life cycle. Allocation therefore should be considered

carefully to avoid skewed results where a product ends up having more or less impact on paper than it in reality has.

#### *Data collection & accounting*

Within the LCA methodology two types of data can be recognized for the LCI procedure. Site specific data, measuring the actual in- and outflow of the studied process, and data retrieved from LCI databases (Bauman and Tillman, 2004; Jönson, 1996). Nevertheless, Point (2008) speaks of secondary data, which she defines as non-site specific data which is not retrieved from databases but from industry, agriculture and scientific publications. Other LCAs have used such secondary data as well. For that reason, the comparative framework will look at those three different types of data.

- site specific data
- secondary data
- databases

The most reliable data to be used for an LCI is site specific data. Site specific data offers factual data on the in- and outflows of the studied process. However, collecting site specific data is usually a very time consuming process, if site specific data is at all available (Bauman and Tillman, 2004). It is therefore that many independent LCA executors use databases. Unfortunately, data obtained from databases may differ greatly from site specific data (Jönson, 1996). These databases contain data representing an average of a population of processes (Bauman, and Tillman, 2004). Several different databases are available representing different areas and industries. Examples of databases used in the analysed studies are EcoInvent v2.1, BUWAL 250 and Franklin. LCI databases are provided by industry branches and other organisations as part of their LCA software packages. Industry provided database often contain Cradle to Gate average data instead of Cradle to Grave data (Bauman and Tillman, 2004). More reliable data can be obtained from secondary sources. The consulted LCA literature, however, does not describe nor define the reliability of secondary data. It is, however, assumed that secondary data are originally retrieved as site specific data and not from a database, since there is no reason to collect secondary data that can be found in databases depriving any means of collecting more rigorous data.

Difference in results can occur if studies make use of global data for the entire supply chain or use the appropriate local databases for the different sections in the supply chain. One could say that a study is less credible if it uses a database intended for a different area. Moreover, the version of the database could make a difference. Older studies could have used outdated databases compared to more recent studies using the same but updated version of that database (Jönson, 1996).

In the previous described LCA procedure, the established allocation and cut-off procedures are regarded as important when establishing the system boundaries. However, only to consider the presence of allocation and cut-off procedures does not fully explain possible differences in LCA results. For both procedures are different accounting methods available that change the outcome of the LCA. These different accounting methods should, when mentioned in the study, be considered. Even if these accounting methods are not described in the selected LCA studies, notice should be taken of the possible effect on the LCA results.

#### *The LC Impact Assessment (LCIA): Classification, Characterisation, and Weighing of impacts*

Within the LCIA procedure the environmental interventions identified in the LCI procedure are translated to environmental impacts. The LCIA procedure has the following discussed mandatory elements and also optional elements not considered for this secondary analysis (Bauman and Tillman, 2004) (table 4.1).

LCIA elements	
Mandatory	Optional
<ul style="list-style-type: none"> <li>- Classification of environmental impacts in categories</li> <li>- Characterization of impact categories</li> </ul>	<ul style="list-style-type: none"> <li>- Normalisation</li> <li>- Grouping</li> <li>- Weighting</li> <li>- Data quality analysis</li> </ul>

Table 4.1: Mandatory and optional LCIA elements

Source: (Bauman, H. and A. Tillman, 2004; DFID, 1999; ISO, 2000)

#### *Classification and Characterisation of impact categories*

The LCI results provide a list of potential environmental impacts. This list of potential impacts can be quite extensive. To generate a good overview these potential impacts have to be classified in various impact categories. When classifying the potential impacts, several things should be considered when deciding on which impact categories to include. Completeness of categories, practicality, and environmental relevance, etc., are a few to name. However, the Impact Categories to be chosen need to be in line with the goal and scope of the LCA. This makes the choice of classification an arbitrary activity (Bauman and Tillman, 2004). Several Impact Category lists have been drawn up. Baumann and Tillman (2004) mention the Nordic Guidelines, SETAC, the EPS system, and the CML guide to ISO standards. The latter one has been designed with the SETAC list as starting point (Guinée et al., 2002). Classification of potential impacts will be done by means of characterisation. In the characterisation phase, environmental interventions are assigned to one particular encompassing category by expressing them in a common unit. This allows the executor to aggregate all environmental interventions in that category into a single score (Bauman and Tillman, 2004; Guinée et al., 2002).

## 5 Results B: Secondary LCA Analysis

Explained in the previous chapter, choices made by the executer influence the end results of the LCA. Therefore, a qualitative description of these choices will be given in order to see how much the selected studies differ from each other, and if end results can be directly compared. A conclusion following the description of the identified LCA choices will determine how to proceed with the comparison of the different LCA studies. Hence, the actual comparison of LCA results will be done later. From these results, it is attempted to determine the environmental impacts for the South African - European wine supply chain.

### 5.1 Choices in the collected LCAs explicated

#### *Goal and Scope definition*

The goals of selected studies are not always explicitly stated, which is a problem recognized in other secondary LCA analysis (Werner & Richter, 2007). Though, the general goal of the studies is to assess the system on their environmental impacts and to find the environmental 'hot spots' (Ardente et al., 2006). Some of the studies do additionally attempt to compare the conventional system to alternative systems in order to conclude the difference in environmental impact (Aranda et al., 2005; Gonzales et al., 2006; Point, 2008) (table 5.1).

#### *Functional Unit*

Most of the identified studies employ a functional unit representing one bottle of 0,75 L of wine or an equivalent of that (Aranda et al., 2005; Ardente et al., 2006; Point, 2008). However, alternative functional units are also employed. Clavijo Izquierdo et al. (2005) appoint a functional unit of 1000 litres of wine packed in 75 cl glass bottles. Gonzales et al. (2006) deviate from the commonly used functional unit by using a reference of 1 L of wine to which the in- and outflows of the system correlate. Pizzigallo et al. (2008), apply a functional unit of 1 ton of final product (table 5.1). Except for Clavijo Izquierdo et al. (2005), none of the studies include further details on the functional unit like geographical scope and activity, which is considered important for assessing the South African – European wine supply chain. A functional unit should describe all the functions and services related to that product.

#### *System boundaries*

Various geographical boundaries have been employed in the collected assessments (table 5.1). Though the agricultural and production phases are situated in the old wine countries (Spain, Italy and France), with the exception of the assessment on the Nova Scotia wine supply chain in Canada, the geographical boundaries of the supply chain itself varies from regional, national and international. Four of the collected studies employ an international boundary with subsequent phases in export countries. The different employed geographic boundary can also be partly explained by the technical boundaries employed. Three of the four LCAs conducted on international scale employ a Cradle to Grave boundary. Gonzales et al. specifically focus their assessment on Western European Scale (France → Sweden). Clavijo Izquierdo et al. (2005) include both a national and international scenario (Spain → UK) for the shipping, consumption and waste phase. Aranda et al. (2005) include transport within Europe and to American countries whereas the waste phase is only included for importing European countries. Ardente et al. (2006), employ a Cradle to Whole Sale boundary and does includes national transport and the international shipping to European and Non European whole sale distributors and excludes the subsequent consumer and waste phase. Point also employs a Cradle to Grave boundary but limits her assessment to the Nova Scotia wine supply chain (which is small and does not export). Notarnicola et al. (2003) and Pizzigallo et al. (2008) focus their assessment on the Cradle to Gate processes. Assessing only agricultural and industrial processes of wine making leads subsequently to a more regional/national focus. Gonzales et al. (2006) and Clavijo Izquierdo et al. (2005) both include a temporal boundary in their assessment, determined by the time it takes to

produce a bottle of wine including the aging period of wine. Their time boundaries are defined as 5 and at least 2 years respectively. No specific mention of temporal boundaries was made in the other assessments. However, LCA goals to determine the environmental impact of the wine supply chain were implying a retrospective approach. Supplementary objectives in Point's assessment state to explore possible changes in the supply chain that might impact the results of the assessment (Point, 2008) and Aranda et al.'s assessment describes and analyses implemented innovative solutions (Aranda et al., 2005). This could be understood as a prospective approach looking for alternatives.

<b>Goal, Scope, Functional Unit and Boundaries in selected LCA studies</b>				
<b>Study</b>	<b>Goal</b>	<b>Scope</b>	<b>FU</b>	<b>Boundaries</b>
<i>Aranda et al.</i>	To analyse the improvements obtained by implementation of eco-efficiency in the wine production. The principal aim is to achieve the rational energy material consumption in the whole wine production process implementing LCA methodology.	A wine farm in Italy exporting to Europe and Non-European countries	0.75 Litre of wine	Cradle to Grave
<i>Ardente et al.</i>	To evaluate and organic and semi-industrial agro-industrial productive processes in their entirety, focusing on the comparison of impact derived from the inputs and outputs of the system (LCA), integrated with a physical evaluation of the resources and natural services on a common basis (energy).	1 wine farm Sicily exporting to Europe and North/South America	0.75 L bottle of red wine	Cradle to Wholesale
<i>Gonzales et al.</i>	To conclude whether or not an ecological product, such as wine, is truly more sustainable or comparatively equal to its normal counterpart.	Production (France) and consumption (Sweden) in Western Europe	1 L of wine	Cradle to Grave
<i>Clavijo Izquierdo et al.</i>	Giving an overview of the system life cycle traditional wine production in this region to make an initial determination of the processes of greatest environmental impact in the production chain.	Wine farms in Rioja and surrounding area	1000 litres of wine packed in 75 cl glass bottles	Cradle to Grave
<i>Notarnicola et al.</i>	To build up an environmental profile of the four wines, in order to identify the environmental hotspots of the system.	A medium small sized winery localised in the South of Italy	One bottle of 0.75 L of wine	Cradle to Gate
<i>Pizzigallo et al.</i>	Aim to evaluate the productive processes of two wine farms (organic/semi-industrial) focusing on the comparison of impacts derived from the inputs and outputs of the system (LCA)	An organic and a semi-industrial wine farms located in Tuscany:	1 Ton of final product	Cradle to Gate
<i>Point</i>	Determine the life cycle environmental impacts for the FU of one 750ml bottle of wine (red or white), made entirely from NS grapes in 2006, and consumed by a Halifax resident in their home	Wine produced and consumed in Nova Scotia	one 750ml bottle of wine (red or white)	Cradle to Grave

Table 5.1: Goal, Scope, Functional Unit, and Boundaries in selected LCA studies

### *Cut-offs and Allocations*

*Cut-off criteria: processes excluded from the assessment.* Within the collected studies, several processes are not considered part of the assessed life cycle (table 5.2). The several different identified cut-offs do, however, differ between studies. Reasons for these exclusions are not always explicated. Aranda et al. (2005), for instance, exclude the production of electricity from the life cycle. This might be because electricity is considered a product in itself. However, the processes in the wine industry cannot be run without electricity and it is therefore a significant inflow in the system. Furthermore, Aranda et al. (2005) choose to exclude components with an economic value less than 1% of the total economic value of the product and processes that contribute less than 1% to the inventory analysis or to the environmental analysis. Gonzales et al. (2006) exclude the consumption phase due to negligible environmental impacts.

Gonzales et al. (2006), Notarnicola et al. (2003) and Point (2008) all mention encountering problems retrieving data or lack of available data. Inflows in the production process, production of clarification agents, ascorbic acid, and fossil flours, have been excluded from the system for that reason (Notarnicola et al., 2003). Gonzales et al. (2006) recognized lack of available data for emissions and materials used in the system. For some of these emissions and materials assumptions have been made. Subsidiary products like glue and ink have been excluded due to the small amount used for a functional unit. Pizzigallo et al. (2008) additionally exclude cork and labels in the bottling phase as these inflows hardly contribute to the total emissions. Point (2008) excludes field level emissions caused by herbicides and fungicides due to lack of data availability. Cleaning products and post production materials like pallets for transporting wine and activities relating to retail have not been included (Point, 2008). Farm buildings and equipment have been cut-off due to lack of available

information. However, Pizzigallo et al. (2008) do include steel as an inflow for equipment and machinery used in the wine's life cycle. Most questionable in Point's assessment is the exclusion of water consumption from the system. Water consumption was not measured at Nova Scotia vineyards and wineries at the time of the assessment and could therefore not be quantified (Point, 2008).

Both Point (2008) and Notarnicola et al. (2003) exclude the emissions of CO<sub>2</sub> during fermentation. Point reasons that carbon is only temporarily sequestered from the natural carbon cycle (Point, 2008). The waste disposal and waste management phase are excluded by Ardente et al. (2006). This phase is obviously also excluded by Notarnicola et al. (2003) and Pizzigallo et al. (2008) since they assess the wine production within the Cradle to Gate boundaries, but waste is produced in the production phase as well. Notarnicola et al. (2003), Ardente et al. (2006) and Point (2008) acknowledge this waste; though perceive them as co-products that are inflows for another system. These co-products, rasps, marc and lees, are considered solid waste for which no disposal system is necessary since they are raw materials for other products (Notarnicola et al., 2003) and therefore allocated to the other system as the transport of manure is allocated to the wine system. This opinion is shared with Aranda et al. (2005) who also allocate the possible impacts of these co-products to the system that uses these co-products as raw materials. Clavijo Izquierdo et al. (2005) acknowledge these products need to be allocated but only allocate them partially as is further explained in the next section.

Clavijo Izquierdo et al. (2005) specifically exclude site preparation. Site preparation should not be confused with land preparation that is included in some studies. Land preparation is the work that needs to be done annually before the grape growing season starts. Site preparation is defined as all the work that needs to be done before the first grapes can be planted and is performed only once for a strain of grapes. Once a site is prepared the site is arable for 30 to 70 years (Clavijo Izquierdo et al., 2005). Though none of the studies exclusively exclude site preparation, any specific information implying inclusion is absent in all but Aranda et al.'s (2005) and Point's (2008) study. It is therefore assumed that all other LCA executioners excluded the site preparation phase. However, Point (2008) only addresses tile drain as an inflow for land preparation. These tile drains are assumed to last for 25 years. Trellis wire, grape rods, and wooden vineyard posts are assumed to last for 25, 25 and 15 years respectively thus perceived as site preparation, however, are in Point's assessment, included in the trellising process. Aranda et al. (2005) perceive, land preparation, planting and the wiring of vines in spaliers as an inflow for land preparation and states these activities are done once each 50 years.

*Allocation procedures.* Though allocation is a common concept in LCA, only three out of the seven studies consider allocation to be necessary (Table 5.2). Gonzales et al. (2006) simply state that there are no allocation problems since only the in- and outflows related to the wine LCA have been included. If the allocations procedures employed by Point are considered, the statement made by Gonzales et al. (2006) seems highly improbable. Point (2008) employs only allocations that are transport related and all but one are relevant after the gate is closed. This would explain for the majority of these allocations why they have not been employed in the Cradle to Gate assessments. However, the Cradle to Wholesaler and the Cradle to Grave assessments could have considered these allocations. The transport of manure is allocated completely to the wine system. Although manure is a by-product from another system it is also a necessary input for grape growing. Other allocations include consumer travelling to buy wine. This is completely allocated to the wine chain even though it is likely a consumer acquires more groceries that need to be transported than only a bottle of wine. Bottle delivery is allocated as a one way trip from the factory, and wine transport to retail is allocated to the wine supply chain as a round trip (Point, 2008).

Contrary to Aranda et al. (2005) and Notarnicola et al. (2003), Clavijo Izquierdo et al. (2005) do not completely allocate co-products with an economic value like rasps, marc, lees, as inputs for other

products. Clavijo Izquierdo et al. (2005) use allocation factors to assign the environmental burden of these products to the wine system. Moreover, Clavijo Izquierdo et al. (2005) are the only ones considering eggs as input in the wine production phase. However, only egg whites are used for wine making the yolks are allocated as input for another product (Clavijo Izquierdo et al., 2005). Another allocation employed by Notarnicola et al. (2003) focuses on the impacts caused by premium wine and second pressing wine. An allocation of environmental burdens between wines needs to be done if one wants to determine the environmental impact of different wines. For every 10 bottles of high premium wine one second pressed wine will be produced. However, this allocation will not be considered for this secondary analysis since no distinction is made between premium and second press wine.

Cut-offs and allocation in selected LCA studies		
Study	Cut-off	Allocation
Aranda et al.	<ul style="list-style-type: none"> <li>- Electricity production and transport</li> <li>- Waste from processes in the system</li> <li>- Components with economic value less than 1%</li> <li>- Processes contributing less than 1% to the inventory analysis</li> </ul>	
Ardente et al.	<ul style="list-style-type: none"> <li>- Disposal and waste management</li> <li>- Cleaning products</li> </ul>	
Gonzales et al.	<ul style="list-style-type: none"> <li>- Consumption</li> </ul>	
Clavijo Izquierdo et al.	<ul style="list-style-type: none"> <li>- Site preparation</li> </ul>	<ul style="list-style-type: none"> <li>- Energy recovery from waste incineration.</li> <li>- Co-products leaving the system (marc, lees, press, yolks)</li> </ul>
Notarnicola et al.	<ul style="list-style-type: none"> <li>- Production of clarification agents</li> <li>- Ascorbic acid</li> <li>- Fossil flours</li> <li>- Emission of carbon dioxide during fermentation</li> <li>- Co-products leaving the system (marc, lees, rasps)</li> </ul>	<ul style="list-style-type: none"> <li>- Impacts to premium and second press wine</li> </ul>
Pizzigallo et al.	<ul style="list-style-type: none"> <li>- Cork, labels, ink, aluminium capsules etc.</li> </ul>	
Point	<ul style="list-style-type: none"> <li>- Farm buildings and wine making equipment</li> <li>- Water consumption</li> <li>- Field level emission of herbicides and fungicides</li> <li>- Emissions of CO<sub>2</sub> during fermentation</li> <li>- Cleaning products</li> <li>- Pallets to transport wine</li> </ul>	<ul style="list-style-type: none"> <li>- Transport of manure</li> <li>- Impacts related to the Consumer transport</li> <li>- Transport for bottle delivery</li> <li>- Wine delivery from winery to retail</li> </ul>

Table 5.2: Cut-offs and allocations in selected LCA studies

#### Inventory analysis: data collection

The accuracy of inputs used to assess the system is highly dependent on the retrieval of data. Site specific data in this respect is believed to be more accurate than secondary data and databases. However, all studies have used secondary data and databases next to site specific data. Secondary data and data bases have been used to obtain background information, that is, information on secondary processes, or on data not directly accessible or available from the studied site. Databases used for secondary data are, when disclosed in the study, depicted in table 5.3.

Employed databases in selected LCAs						
Aranda et al.	Ardente et al.	Clavijo Izquierdo et al.	Gonzales et al.	Notarnicola et al.	Pizzigallo et al.	Point
BUWAL 250 ETH-ESU 96 IDEMAT 2001	GEMIS BOUSTEAD	BUWAL 250 EcoInvent IKP	BUWAL 250 IDEMAT 2001 IDEMAT 2002 EcoInvent ETH-ESU 96	LCA databases	SimaPro 6	BUWAL 250 EcoInvent 2.0 Franklin LCA Food

Table 5.3: Employed databases in selected LCAs

#### Impact Assessment Methods and indicator categories

A variation of impact categories used in the selected LCA studies can be identified (table 5.4) since LCA allows you to specify impact categories most relevant for the goal and scope definition of the assessment. Both Aranda et al. and Gonzales et al. use the Eco Indicator 99 data base. Clavijo Izquierdo et al. (2005), Notarnicola et al. (2003) and Point (2008) all use CML impact categories; however, variations in used indicators within these impact categories can be noticed. While Notarnicola et al. (2003) and Point (2008) include Ozone Depletion Potential and Eco-toxicity Potential, Clavijo Izquierdo et al. (2005) excludes these. Point (2008), however, divides the Eco-

toxicity potential in Aquatic Eco-toxicity potential and Terrestrial Eco-toxicity potential. While Notarnicola et al. (2003) adds Human Eco-toxicity potential in his impact categories, he excludes Abiotic Resource Depletion included in both Clavijo Izquierdo et al.'s (2005) and Point's (2008) impact categories. Ardente et al. (2006), equally to Clavijo Izquierdo et al. (2005), Notarnicola et al. (2003) and Point (2008), includes Energy Consumption as one of his impact categories though all other chosen impact categories are different. Pizzigallo et al. (2008) use "emergy" to present the impact of each process in the supply chain. Emergy is defined as the quantity of solar energy directly or indirectly necessary to support a given system and its level of organisation (Odum, 1996 in Pizzigallo et al., 2008).

Life Cycle Impact Assessment (LCIA) Methods and Impact Categories							
Executer	Aranda et al.	Ardente et al.	Gonzales et al.	Clavijo Izquierdo et al.	Notarnicola et al.	Pizzigallo et al.	Point
LCIA Method	Eco Indicator 99	Customized Categories	Eco Indicator 99	CML 1999	CML 2000/ CML 1992	Customized Categories	CML 2000
Impact Categories	<ul style="list-style-type: none"> <li>- Carcinogens</li> <li>- Respiratory organics</li> <li>- Respiratory inorganics</li> <li>- Climate change</li> <li>- Radiation</li> <li>- Ozone layer</li> <li>- Eco toxicity</li> <li>- Acidification/ Eutrophication</li> <li>- Land use</li> <li>- Minerals</li> <li>- Fossil Fuels</li> </ul>	<ul style="list-style-type: none"> <li>- Energy consumption</li> <li>- Electricity consumption</li> <li>- Air emission / CO2</li> <li>- Water consumption</li> </ul>	<ul style="list-style-type: none"> <li>- Carcinogens</li> <li>- Respiratory organics</li> <li>- Respiratory inorganics</li> <li>- Climate change</li> <li>- Radiation</li> <li>- Ozone layer</li> <li>- Eco toxicity</li> <li>- Acidification/ Eutrophication</li> <li>- Land use</li> <li>- Minerals</li> <li>- Fossil Fuels</li> </ul>	<ul style="list-style-type: none"> <li>- Abiotic resource depletion potential</li> <li>- Acidification Potential</li> <li>- Eutrophication Potential</li> <li>- Global Warming Potential</li> <li>- Photo-oxidant formation potential</li> <li>- Energy Consumption</li> <li>- Water Consumption</li> </ul>	<ul style="list-style-type: none"> <li>- Acidification Potential</li> <li>- Nutrification Potential</li> <li>- Global Warming Potential</li> <li>- Ozone depletion Potential</li> <li>- Eco-toxicity Potential</li> <li>- Human Toxicity Potential</li> <li>- Photo Chemical Oxidant Creation Potential</li> <li>- Energy Consumption</li> </ul>	<ul style="list-style-type: none"> <li>- Emergy</li> </ul>	<ul style="list-style-type: none"> <li>- Abiotic resource depletion potential</li> <li>- Acidification potential</li> <li>- Eutrophication potential</li> <li>- Global warming potential</li> <li>- Ozone depletion potential</li> <li>- Aquatic eco-toxicity potential</li> <li>- Terrestrial eco-toxicity potential</li> <li>- Photo-oxidant formation potential</li> <li>- Cumulative energy demand</li> </ul>

Table 5.4: Impact Assessment Methods and respective Impact Categories employed in selected LCA studies

### 5.1.1 Conclusion executioners choices

As expected, the identified LCAs are often executed in different ways. Even though LCA is a standardized method, the method allows executers to use it in such a way that it corresponds with the goal and scope of the study. Choices on the procedure are, if explicated, not at all times clearly explicated. When clearly explicated, variations between studies are rather large. The largest differences can be detected for functional unit, cut-off criteria and allocations, employed databases, and chosen impact assessment method including the respective impact categories. If these differences actually affect overall conclusion will be discussed in the next section.

## 5.2 Results individual LCAs

Though results are not directly comparable each LCA study still presents its own results. While individual results do show which of the sections in the supply chain have the most detrimental effect on the environment, they might not always correlate. The most severe environmental impacts on sections of the supply chain for each study are described. Environmental impacts of international shipping are included when appropriate. Moreover, only results on conventional wine production are described when comparative LCAs were conducted, since no study has been done on the sustainability performance of alternative wine production like Fair Trade or eco wine.

### Aranda et al. (2005):

Aranda et al. conclude that the contribution of different stages in the wine supply chain to the environmental impact is 31% for the vineyard, 27% for the winery, and 42% for shipping.

The main impact on the vineyard is caused by fertilizers and pesticides, about 39% of the total environmental impact. Agricultural tasks make up for 27% of the impacts while irrigation is responsible for 20%. The remaining environmental impacts are caused by 'other materials'. Within these phases, the main impacts caused by vineyard processes are the depletion of minerals (98%),

emission of radiation (66%) and land use (64%). Moreover the vineyard contributes significantly to the emission of carcinogens (52%), climate change (31%) and the consumption of fossil fuels (38%). The winery's main impact on the environment is caused by bottling. Bottling has such a high environmental impact because of the use of glass. General processes in the winery, such as pressing, sulphuration, fermentation, clarification, stabilization, and, filtering, required for making wine account for the second highest impact. Climate control and lightening are responsible for 6% and 1% of the environmental impact caused by the winery respectively. The activities in this section contribute, with 80%, most significantly to eco-toxicity. The winery processes have less impact, but still making a significant contribution to the emission of carcinogens (42%), climate change (36%), land use (36%), ozone layer depletion (35%) and the consumption of fossil fuels (30%). Transport, responsible for the main environmental impact according Aranda et al.'s assessment, is most detrimental when it concerns international shipping. Though only 32% of wine is exported, it accounts for 77% of the environmental impact. This 77% is the total environmental impact of transport within Europe by truck and shipping overseas by ship. From this can be concluded that shipping causes the largest environmental impact. These impacts can be identified as significant contributions to respiratory organics and inorganics, 58% and 63% respectively. Moreover, a considerable contribution is made to climate change (33%) and fossil fuel consumption (32%).

*Ardente et al. (2006):*

The results described by Ardente et al. are based on their own set of impacts indicators. The main conclusions Ardente et al. extract from their assessment is that most significant impacts result from secondary processes. Production and packaging of bottles contribute 44.8% to the global impact. Other significant contributions are related to shipping of wine, the use of energy, mainly required for winery processes (72.1%), and consumption of fertilizers and biocides<sup>18</sup> for vineyard processes. Water consumption is with 73.0% highest for vineyard processes due to irrigation, fertilization and pesticide treatment.

*Clavijo Izquierdo et al. (2005):*

Clavijo Izquierdo et al. recognize four sections in the supply chain: Vineyard, Winery, Cellar/Exporter including shipping, and Disposal. The most significant environmental impacts are caused by processes in the vineyard and winery. However, the use of glass and the processes required to produce glass are proven to have an important impact on environment as well. Transportation is concluded to be less detrimental for the environment, but it does have a large impact on the depletion of resources and energy consumption. A closer look into supply chain processes shows that processes in the winery are responsible for 70.5% of the depletion of abiotic resources. However, this does include fossil fuel consumption required for the production of glass bottles. The remaining depletion of abiotic resources are caused by the Vineyard, Disposal and the Wine cellar including shipping, 14.0%, 1.4% and 14.2% respectively. Of the 14.2% abiotic resource depletion, 9.0% concerns shipping of wine.

54.0 % of the emitted greenhouse gasses are due to vineyard processes. However, the application of fertilizers is responsible for 47.6% of the total greenhouse gas emission. The Winery is responsible for 37.8% of greenhouse gasses. Again, production of bottles, 27.1%, contributes largely to global warming. Barrel production and wine aging also contribute 7.5% to this category. The cellar/exporter is responsible for 7.5% of emitted greenhouse gasses, though, 4.2% needs to be contributed to the transport of wine while 1.5% is emitted during the production of cardboard. Emissions associated with disposal only account for 0.7% of the total supply chain.

<sup>18</sup> Biocides is the collective noun for pesticides, fungicides, insecticides

The vineyard is with 98.6% the largest contributor to the eutrophication potential due to the application of fertilizers. All other sections in the supply chain have almost negligible effect on eutrophication of land, water and air (Winery, 0.97%, Cellar/exporter, 0.33% and disposal, 0.05%).

The vineyard and winery emit most acidifying substances, 41.6% and 47.4% respectively. Among winery processes most acidifying substance are emitted during bottle production, 24.0%, and barrel production, 20.4%. In case of vineyard processes fertilizing contributes most, 32.8%, to acidification. The emissions associated with the cellar and exports are mostly in the shipping process, 6.1% of the total 9.6%. The disposal phase accounts for only 1.4% of emitting acidifying substance in the total supply chain

The Photo oxidant formation potential is with 66.9% the largest in the winery followed by the cellar / exporter with 16.4%. Most of these emissions, 12.6%, occur during transport. The vineyard accounts for 13.8% of the emissions divided over all processes in that section as they all use fossil fuels. Compared to the other sections the contribution of disposal is with 2.9% rather low.

The winery uses 67.1% of the total energy consumption in the supply chain. Of the processes within the winery section, bottle production consumes 51.2% of the total energy while another 7.54% is used to make barrels. The Cellar/Exporter uses 20.3% energy; most of this is used for transportation and to a lesser extent for manufacturing cardboard packaging. The transport of fertilizer ammonium nitrate production and use of tractors in different processes, mainly responsible for the energy consumption in the vineyard, require 11.4% of the total energy. The disposal phase requires less energy, representing 1.2% of the total energy bill.

The vineyard accounts for 82.0% of the total water use in the supply chain. The processes in the winery section contribute about 15.0% to the total water consumption, mainly due to the cleaning of the barrels and the harvesting of wood for barrel production. The cellar/exporter and disposal consume 2.6% and 0.05% water respectively.

*Gonzales et al. (2006):*

Gonzales et al. employ five supply chain sections: Vineyard, Winery, Bottling and Bottle production, Shipping, and Disposal. The results of the assessment on the complete wine supply chain show that fossil fuels have the largest environmental impact followed by the respiratory inorganics and the climate change category. When looking closer to the fossil fuel consumption it shows that the vineyards contribute 31.3% to the total consumption of fossil fuels while winery processes use another 6.2%. The bottling and bottle production phase of the supply chain accounts for 38.1% of the total fossil fuel use. Shipping completes it with 31.3%. This leads to a total fossil fuel consumption of 106.9%, however, 6.9% can be deducted as of the positive effect of bottle recycling.

Shipping of wine contributes with 67.3% most to the inorganic respiratory category. The bottling and bottle production adds another 27.9% to the total inorganic respiratory emissions. Vineyard processes are responsible for 14.7% of the total contribution while the winery processes contribute another 1.5%. Recycling of wine bottles decreases the total impact by 11.4%.

The largest contribution towards climate change is caused by processes in the winery, responsible for 55.9% of the total contribution. The vineyard follows with 25.6%. The bottling phase and shipping contribute almost equally to climate change, with 13.7% and 13.8% respectively. Bottle recycling reduces the total impact on climate change with 9.0%.

Though, these are the impact categories having most significant impact on the environment, this LCA additionally concludes that processes in the wine supply chain contribute to the carcinogens, ecotoxicity, land use, acidification/eutrophication, and minerals categories as well. However, these additional conclusions are not explicated in detail. Still the production of bottles and the bottling of

wine do contribute 2.4% to each the carcinogen, acidification/eutrophication and minerals category while a larger contribution is made to land use and eco toxicity, 3.7% and 4.9% respectively. In the bottling phase, contributions can be detected for the same impacts categories. 2.1% for carcinogens, 2.7% for eco toxicity, 4.2% for acidification, 6.9% for land use, and 1.4% for minerals. The shipping phase shows only significant contributions to the acidification/eutrophication category, 11.1%, and land use, 1.7%. Contributions of supply chain processes to other impact categories are negligible.

Though differences between impact categories can be noticed for the different supply chain sections the overall impact is similar. However, impacts of shipping are relative. When shipping distances increase the contribution to the environmental impact does as well.

*Notarnicola et al. (2003):*

Notarnicola et al. assessed two red and two white wines, for each a premium and a regular wine. The environmental performances of the processes are however similar therefore only one of the LCA results is included. Since average white wine is produced mostly in South Africa it was decided to include this assessment in this secondary LCA analysis. The sections Notarnicola et al. includes in his assessment are the vineyard, winery and bottle production.

The most burdening processes for most of the impact categories are identified as the vineyard and bottle production. Processes in the vineyard contribute more than 97% to Aquatic and Terrestrial toxicity and 30% to Human toxicity due to the use of pesticides affecting water and causing soil and human toxicity. Moreover vineyard processes contribute about 80% to nitrification and slightly less than 40% acidification due to the use of nitrogen and phosphatic fertilizers. Second most detrimental is the production of glass bottles. The production of glass bottles uses slightly more than 60% of the total energy consumption of the wine supply chain while it also contributes 60.0% to the total global warming potential, 50% to Human toxicity and 40% to the total acidification potential. Winery processes only make a significant contribution (82%) to the Photochemical Ozone Creation Potential category due to the emissions of VOCs occurring during the alcoholic fermentation. Though the winery uses energy, this is to a lesser extent detrimental when compared to the energy consumption of bottle production. Production of wine barrels, cork tap, aluminium capsule and paper label has very little impact on the environment.

*Pizzigallo et al. (2008):*

Since Pizzigallo et al. measure all inputs in emjoules (sej) it can only be concluded which of the inputs are consumed most during wine supply chain processes. The actual effect of wine supply chain processes on the environment is however somewhat harder to conclude from Pizzigallo et al.'s study.

Glass, associated with the bottling process in the winery, is with 50% by far the most significant input in the wine supply chain. Other Significant inputs related to vineyard processes are nitrogen and phosphate fertilizers, with 10.2% and 9.1% respectively. Moreover, pesticides (2.8%), wood (4.55%), and diesel and lubricants (6.8%) have been identified as inputs. Steel (4.6%) is included as an input as well though perceived to be an input in both the vineyard and the winery. Pizzigallo et al. measures human labour (11.4%) as an input as well, though in this study labour is understood as a social sustainability aspect and will not be included in the LCA.

*Point (2008):*

Point concludes that the largest environmental impacts are caused by processes in the vineyard, bottle production, and consumer transport.

The largest contribution of vineyard processes to the environmental impact is 69.0% to the total eutrophication potential. Other substantial contributions can be identified for the eco-toxicity potential (54.0%), aquatic eco-toxicity potential (37.0%), acidification potential (29.0%), and global

warming potential (18.0%). Processes that contribute to a lesser extent to the environmental impact are energy consumption (12.0%), abiotic resource depletion potential (11.0), and ozone depletion potential (9.0%). The vineyard has a negative effect on the formation of photo oxidants in the troposphere due to nitro oxygen emissions from nitrogen fertilizer application.

The bottle production and their subsequent transport to wineries contribute 66.0% of the total potential photo oxidant creation. Other large contributions can be found for acidification (53.0%), cumulative energy demand (45.0%), abiotic resource depletion (43.0%), and global warming (37.0%). The wine bottle production contributes to a lesser extent to terrestrial eco-toxicity potential (21.0%), aquatic eco-toxicity potential (21.0%), and eutrophication potential (18.0%) while the 7.0% contribution to ozone depletion potential is relatively small.

The consumer transport required for the purchase of wine has a substantial effect on the environment. The largest contribution can be noticed for ozone depletion potential (63.0%). Smaller but still significantly detrimental are the contributions to photo-oxidant formation (33.0%), the cumulative energy demand (31.0%) and the wine supply chain's global warming potential (30.0%). Smaller contributions are made to the terrestrial and aquatic eco-toxicity potential (16.0% and 14.0% respectively), and acidification (8.4%) and eutrophication (7.2%).

Additionally, Point concludes that that the supply chain sections transport and disposal only contribute very little to the impact categories. However, wine is not exported abroad and therefore only shipped within Nova Scotia. The impact caused by shipping is mainly due to the fossil fuel consumption of trucks. The provision of cardboard boxes, used to ship wine, does have relatively little impact on the environment. Moreover recycling of glass contributes less than 2.0% to all impact categories except for aquatic eco toxicity potential on which it contributes a 6.0% of the total impact. Finally, consumer's actions in the wine supply chain have, except for their trip required to buy wine, no significant impact on the environment.

### **5.3 Conclusions LCA comparison**

The secondary LCA analysis results in two conclusions. Firstly, the supply chain sections whose processes are responsible for the most detrimental effect on the environment and secondly, the actual environmental impacts for each of those sections. These two conclusions give an answer on sub question b1:

*What are the most severe environmental impacts in the current South African – European wine supply chain from an objective-empirical approach?*

#### *Supply chain section with the largest impact on the environment*

All executors conclude the sections of the wine supply chain have the most detrimental impact on the environmental performance of the wine supply chain. However, the assessments do not always conclude that the same section is most responsible for the environmental impact. These differences in end results can be explained by the difference in the executor's choice, explained in section 5.1. What generally can be concluded is that most detrimental impacts are associated with processes on the supply side of the supply chain (table 5.5). Moreover, comparing the results from all assessments it can be concluded that in general, processes in the vineyard and the winery contribute the most to the environmental impact, though no large difference in impact can be noticed between them. However, it should be stressed that bottle production, in many assessments integrated in winery processes, is most responsible for the environmental impact caused by the winery. Bottle production is perceived as part of the winery as bottles are an inflow in winery processes. This does not imply that bottles are produced at the winery, only that the impact of bottle production is allocated to the winery. Additionally, shipping contributes significantly to the environmental impact when wine is transported over a long distance, as this is the case for the South African - European wine supply

chain. Point's conclusion on the impact of consumer activities is surprising. Even though Gonzales et al. explicitly cut off consumer activities, assuming these would have no significant impact, and no mention of consumer activities was made by other LCA executers, Point clearly shows that consumers contribute to the environmental impact when driving to the liquor store to buy wine. Other sections in the wine supply chain have, according to the secondary LCA analysis, a marginal impact on the environment.

#### *Environmental impacts caused by processes in the sections of the wine supply chain*

In order to make a comparison with the SPA results a closer look at the sections with the largest impacts is required to explain the contribution of the wine supply chain processes to the environmental impact categories. Since none of the LCAs conclude contributions to impact categories. Identically, the most commonly concluded significant environmental impacts have been identified. The significant environmental impacts are categorised according to the applicable environmental main aspects employed in the SPA (box 1) to make a comparison with SPA results possible.

Since none of the LCAs conclude significant impacts for the main aspect 'Nuisances', this main aspect is left blank in table 5.5. Most noticeable are the significant environmental impacts for the vineyard and winery as these can be identified for all main aspects. However, most of the significant environmental impacts caused by the winery are due to bottle production and to a lesser extent, processes in the winery itself. This abundance of impacts is in accordance with the previous conclusion stating that the vineyard and winery are the sections with the most detrimental effect on the environment. Shipping has mainly a negative effect on Energy & Resources and Atmosphere. Since shipping abroad requires larger amounts of energy, it produces a larger amount of emissions in the atmosphere. The Consumer's impact on the environment, as a result of energy consumption due to car use when purchasing wine, also has a negative impact on the Atmosphere.

#### *Range in concluded environmental impacts*

The secondary LCA analysis concluded the most significant environmental impacts for each section in the wine supply chain. For most of the impact categories the LCAs present no large difference in the range of environmental impact and could easily result from choices made during the LCA to attain the established goal. However, it needs to be acknowledged that for some of the impact categories substantial differences in environmental impacts are presented (table 5.5). Even if LCA is a method that allows executers to employ the assessment in such a way that corresponds with the established goal and scope; LCA is still a standardized methodology for assessing environmental impacts. Hence, one would not expect that different LCAs on a similar subject present such diverging results. It can be noticed that for some of the impact categories, even if a large difference is presented, the presented environmental impact is still high on both ends of the range. However, for most of the impact categories presenting a large range, the environmental impact is deemed very high in one study while another study concludes this environmental impact considerably less detrimental. Moreover, some environmental impacts are only measured and concluded significant by one LCA whilst the remaining LCAs did not measure this impact at all or found no results for that specific supply chain section.

It can be concluded that even if LCA is a standardised method for assessing environmental impacts substantial differences in results can be observed. The question remains that if these differences in results emerged unintentionally because of choices made in the beginning of the LCA which corresponded with the goal and scope or if there is a bias towards achieving certain results. Since most of the LCAs were not commercially conducted it is expected that these results emerged unintentionally. However, if this is the case should we question the validity of LCA results?

Supply Chain Sections	Main Environmental Aspects					
	Land Use		Atmosphere		Water	
	Impact	Range %	Impact	Range %	Impact	Range %
<i>Vineyard</i>	- Eutrophication - Acidification <sup>19</sup> - Land Use	<b>69.0 – 98.6</b> 29.0 – 41.6 64.0	- Climate Change - Acidification	<b>18.0 – 54.0</b> 29.0 – 41.6	- Aquatic toxicity - Water use - Acidification	<b>37.0 – 97.0</b> 73.0 – 82.0 29.0 – 41.6
<i>Winery (incl. bottle production)</i>	- Acidification	47.4 – 53.0	- Climate change - Acidification - Photo oxidant formation - Global Warming	37.8 – 69.6 47.4 – 53.0 66.0 – 82.0 27.1 – 60.0	- Acidification	47.4 – 53.0
<i>Wine Cellar/ Exporter</i>	X		X		X	
<i>Shipping</i>			- Climate change - Acidification - Respiratory inorganic - Respiratory organics	13.8 – 33.0 <b>11.1 – 62.0</b> 63.0 – 67.3 <b>0.0 – 58.0</b>		
<i>Importer/ Retailer</i>	X		X		X	
<i>Consumer</i>			- Ozone depletion - Photo oxidant formation - Global warming	63.0 33.0 30.0		
<i>Disposal</i>	X		X		X	

Supply Chain Sections	Main Environmental Aspects					
	Biodiversity		Energy & Resources		Nuisances	
	Impact	Range %	Impact	Range %	Impact	Range %
<i>Vineyard</i>	- Terrestrial toxicity - Eco-toxicity - Human toxicity	97 54 30	- Energy consumption - Abiotic resource depletion	12.0 – 31.3 <b>11.0 – 98.0</b>		
<i>Winery (incl. bottle production)</i>	- Human toxicity - Eco-toxicity	40.0 – 50.0 <b>3.0 – 80.0</b>	- Abiotic resource depletion - Energy consumption	43.0 – 70.5 44.3 – 72.1		
<i>Wine Cellar/ Exporter</i>	X		X			
<i>Shipping</i>			- Energy consumption	31.3 – 32.0		
<i>Importer/ Retailer</i>	X		X			
<i>Consumer</i>			- Energy consumption	31.0		
<i>Disposal</i>	X		X			

Table 5.5: Significant range of impacts in the wine supply chain concluded from the LCAs

### The dynamics deficient in LCA results

As mentioned before, LCA is a good method for assessing the environmental impact of a product throughout its life cycle. While LCA is a standardised methodology it is concluded that results for similar products can not be generalized, as these results depend on the various system boundaries employed but also on choices made during the execution of the LCA. These choices determine which supply chain processes are included in the LCAs, hence, which inputs and outputs are included. However, results presented in LCA are rather static and specific. Choices are made to correspond with the goal and scope of the assessment. Hence, these choices define the results of the LCA. Assessing a similar supply chain entails a completely new assessment without the possibility to adapt results from previously conducted LCAs.

Even if different results have been concluded, the secondary LCA analysis on wine supply chains provides us with a better understanding of the inputs and outputs of the wine supply chain. With the inputs and outputs of supply chain processes, a generic model can be formed. With such a generic

<sup>19</sup> Acidification is equal for all main aspects since acidification is a comprehensive category which makes no distinction between land use, water, or atmosphere.

model we can vary some of the inputs to see what the effect will be on the output, hence, the environmental impact. For instance, shipping is perceived as having a substantial impact on the environmental performance of the wine supply chain. However, not all of the analysed studies include shipping, and when they do, not all of them include long distance shipping. In such a generic model shipping can be added as a process and the distance of shipping can be adjusted. Subsequently, the environmental impact of shipping would change according to the increase or decrease in shipping distance.

Even if this is a very basic idea at the moment, if information about inputs and outputs of the different processes in supply chains is available a generic model like this could be possible for other (global) supply chains. A supply chain for consumer commodities like palm oil, grain, beef, fruit, etc. can be beneficial to determine where the most environmental gain can be achieved.

#### *SSCG focus on sustainable performance*

Another advantage of having a generic model is to gain a better understanding of the actual environmental impacts caused by the supply chain. When improvements towards the sustainability performance need to be implemented; Sustainable Supply Chain Governance (SSCG) systems and Sustainable Supply Chain Management (SSCM) systems focus on the supply side of the supply chain where the product is produced instead of the sections on the demand side where the product is consumed. However, the secondary LCA analysis on wine supply chains shows that environmental impacts caused by the supply chain do not only originate in the Vineyard and Winery. Even if those sections in the supply chain cause environmental impacts on all main environmental aspects, except Nuisances, sections such as Shipping and Consumer have a negative impact on the environment as well. Moreover, Bottling and other packaging materials are often not mentioned in SSCG manuals for sustainable development.

## 6 Results A: Sustainability Perception Analysis

In this chapter data obtained from perceptionnaires is analysed to determine the perceptions of societal spheres towards improving the sustainability performance of the South African – European wine supply chain. Since the sustainability performance is measured on different levels (fig. 3.2) Sustainability Perception Analysis (SPA) is divided in two parts. The first part of the SPA determines the societal spheres' perceptions towards Sustainable Development on an aggregated level. The second part of the SPA determines the societal spheres' perceptions on a main sustainability aspects level. The term 'societal spheres', in general used to address State, Market and Civil Society, is throughout this analysis also used to addresses the Scientific Community, and where applicable, the Consumer. The South – African wine supply chain is from hereon addressed as the 'supply chain'.

### 6.1 Perceptions towards a sustainable supply chain on an aggregated level

The first part of the SPA compares the perceptions of involved societal spheres towards Sustainable Development on an aggregated level. The SPA will conclude; which sustainability aspects are perceived relevant; which supply chain sections are perceived relevant; and who is perceived responsible for improving the sustainability performance of the supply chain by verifying the related hypothesis established in section 1.4.

The mean perceptions of the supply- and demand side, as well as the perceptions of each societal sphere on either side of the supply chain are depicted in graphs. The mean perceptions of the supply- and demand side are determined first and used as a benchmark to conclude possible differences in perception between societal spheres. Additionally, perceptions of societal spheres are compared with perceptions of their counterparts on the opposite side of the chain. However, no such comparison has been made between consumers, as South African consumers are outside the scope of this research.

#### 6.1.1 Perceived relevance of the sustainability dimensions

To determine if perceptions on Sustainable Development changed during the interview, the perceived relevance towards Sustainable Development is measured at the beginning and the end of the perceptionnaire. Subsequently these perceptions are compared. For the initial perceived relevance as well as for the concluding perceived relevance it is determined; [b2] which sustainability aspects societal spheres perceive to be most relevant in order to improve the sustainability performance of the South African – European wine supply chain to conclude if the established hypothesis can be verified.

*h1: Societal spheres on the supply side of the supply chain perceive Social and Socio-economic aspects as most relevant for attaining a more sustainable supply chain while societal spheres on demand side of the supply chain consider the Environmental aspects most relevant to attain a more sustainable supply chain.*

*h2: Societal spheres operating on the same side of the supply chain differ extensively in perception towards relevance of the sustainability aspects for improving the sustainability performance of the supply chain.*

*h3: Societal spheres on the demand side differ extensively in perception towards relevance of the sustainability aspects for improving the sustainability performance of the supply chain, as opposed to their counterparts on the supply side.*

#### *Initial perceptions towards relevance on an aggregated level*

Figure 6.1 presents how often societal spheres associate different sustainability dimensions with Sustainable Development. The societal spheres' perception on sustainable development can be a combination of sustainability dimensions, explaining why a higher number of sustainability dimensions appears on the demand side.

Figure 6.1 clearly shows that on both sides of the supply chain the environmental dimension is associated most with Sustainable Development while the Social and Economic dimension are associated second and third respectively. Future Generations is least associated with Sustainable Development. However, the supply side perceives Future Generations as an integral part of Sustainable Development with greater frequency. Future Generations, in general not recognized as a sustainability dimension, has been mentioned a substantial aspect for Sustainable Development by some of the interviewed chain actors and is therefore added to the analysis. The remainder of the SPA will not include Future Generations.

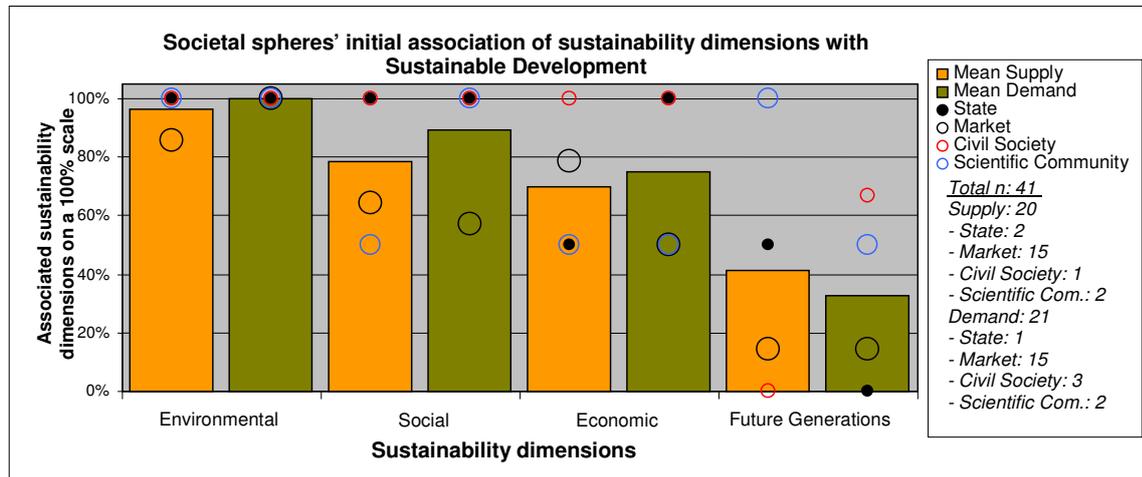


Figure 6.1: Initial perceptions on Sustainable Development

Whereas a clear pattern in association can be detected for the supply- and demand side, the societal spheres' association of the different sustainability dimensions with Sustainable Development is less straightforward. Although each societal sphere associates the environmental dimension most with Sustainable Development, larger variation in perceived association can be observed for the other sustainability dimensions and Future Generations. Though most societal spheres show a similar pattern or associate sustainability dimensions equally with Sustainable Development, deviations from this pattern can be noted. Market on the supply side perceives the Economic dimension more associated with Sustainable Development as opposed to the social dimension. Notable is that the Scientific Community on the supply side associates Future Generations more with Sustainable Development than they associate the Social and Economic Dimension. Moreover, Civil Society on the demand side associates Future Generations highly with Sustainable Development. While Future Generations is still associated for 50% by State on the supply side and by the Scientific Community on the demand side, both Markets associate Future Generations less often with Sustainable Development. No association of Future Generations with Sustainable Development is made by Civil Society on the supply side and State on the demand side.

#### Concluding perceptions towards relevance on an aggregated level

In figure 6.2 can be observed that the downward pattern in perceived association has disappeared after filling out the questionnaire. Though, distinctions in perceived relevance can be noticed between the supply and the demand side, these distinctions are rather small. The socio-economic dimension is perceived slightly more relevant on the supply side while the environmental dimension is perceived somewhat more relevant on the demand side. Moreover, the social dimension is perceived the least relevant dimension on both sides of the supply chain. Sustainability dimensions are perceived much more equally relevant for achieving Sustainable Development. A closer look at the societal spheres presents a larger difference in perceptions.

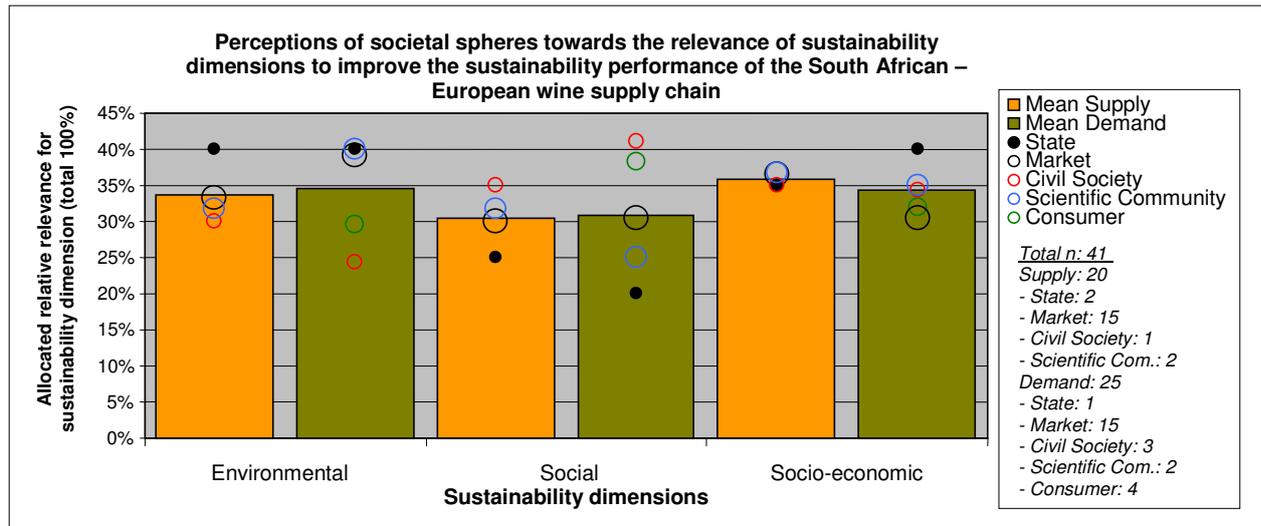


Figure 6.2: Perceived relevance sustainability dimensions

On the supply side both State and Civil Society deviate most from the mean perceived relevance while the Scientific Community and Market perceive the sustainability dimensions more equally relevant to each other. State shows a preference for the environmental dimension while Civil Society perceives the social dimension as more relevant. The socio-economic dimension is perceived rather equally relevant by all societal spheres. It is, however, only Civil Society that perceives the Social and socio-economic dimension more relevant than the environmental dimension, though, only marginal. Societal spheres on the demand side deviate somewhat more in perception from the demand side's mean perceived relevance. The environmental dimension is perceived more relevant by State, Market, and the Scientific Community while Civil Society and the Consumer perceive the social dimension as more relevant. On the relevance of the socio-economic dimension the societal spheres are more in agreement. The environmental dimension is perceived most relevant by State, Market and the Scientific Community. State, however, perceives the environmental dimension equally relevant as the socio-economic dimension. Civil Society and the Consumer perceive the social and socio-economic dimension more relevant. Moreover, Civil Society and the Consumer have a very similar perception towards the relevance of the sustainability dimensions.

#### *The Consumers' perception on Sustainable Development*

Though, consumers have an impact on the sustainability performance of the supply chain, as they have the ability to steer demand towards a more sustainable product, it is questionable if consumers have the correct information required while choosing a more sustainable products. None of the responding consumers assumed to have a comprehensive view on the possible effects the supply chain may have on the environment the current social situation and the current socio-economic situation. Moreover, while discussing the content of the perceptionnaire with organisers of wine tasting sessions they shared their concern if consumers do consider sustainability relevant and moreover, believed that the content of the perceptionnaire might be too complex. On return of the perceptionnaires one respondent added the following, "The main importance for wine is its taste. None of the above [sustainability] aspects will influence this. Sorry"<sup>20</sup>. Even if consumers do not have a clear view on the sustainability performance of the South African-European wine supply chain and perceive sustainability less relevant than quality, their perception towards sustainability influences consumer behaviour.

<sup>20</sup> Translated from Dutch

*Results: Perceived relevance of sustainability dimensions*

While societal spheres on the supply side deviate most from each other on the initial perception, the demand side presented more variations in perception for the concluding perception. Differences can be noticed between the initial and concluding perception on Sustainable Development. Although the initial perception mentioned the relevance of the economic dimension instead of the measured socio-economic dimension and included Future Generations, which is not assessed in the remainder of the SPA, it can be concluded that differences between the initial perception and concluding perception did shift while answering the perceptionnaire. This could be explained by eliciting awareness during the interview. Often respondents filling out the perceptionnaire acknowledged they had not considered some of the sustainability aspects included. This certainly could have had an effect on their perception towards the relevance of the individual sustainability dimensions for achieving a more sustainable supply chain.

On both sides of the supply chain the environmental dimension was initially associated the most with sustainable development, followed by the social and economic dimension respectively. In the concluding perception this has changed. Sustainability dimensions show some variations in perceived relevance, however, are considered much more equally relevant.

Nonetheless, it must be acknowledged that the economic and socio-economic dimensions are not directly comparable. Although both dimensions involve an economic characteristic considered relevant on both sides of the supply chain, only one includes a social characteristic. One needs to consider the possibility that the social dimension would have been perceived more relevant if the socio-economic dimension did not include a social characteristic. For the moment this possibility remains inconclusive.

Even though perceptions did change while filling out the perceptionnaire the hypothesis [h1] cannot be proven for the initial or for the concluding perception. Initially, the environmental dimension is perceived most relevant for improving the sustainability performance of the wine supply chain. However, the environmental dimension is perceived most relevant on both sides of the supply chain. The concluding perceptions are much more equal. Demonstrating that the environmental dimension and the socio-economic dimension are perceived most relevant on both sided of the chain while the social dimension is perceived slightly less relevant for the improvement of the sustainability performance of the supply chain.

When verifying the hypothesis [h1] for the individual societal spheres only a slight preference for the environmental dimension can be observed for Market and the Scientific Community on the demand side while Market, Civil Society and the Scientific Community on the supply side have a slight preference for the socio-economic dimension. However, these preferences are rather small. Subsequently, it demonstrates that not all societal spheres on the demand side perceive the environmental dimension most relevant. Moreover, not all societal spheres on the supply side perceive the social and socio-economic dimension most relevant. Hence, the hypothesis [h2] can be proven. Though, societal spheres on the demand side perceive the sustainability dimension much more unequal than the societal spheres on the supply side.

Difference in perceived relevance between societal spheres and their counterparts on the opposite side of the supply chain can be observed. However, inequalities in perceived relevance towards sustainability dimensions are often marginal. Moreover, a difference in perceived relevance does not always demonstrate that a sustainability dimension is perceived more or less relevant than another sustainability dimension. In the strictest sense the hypothesis [h3] can be verified though not for all societal spheres and not for all sustainability dimensions.

*6.1.2 Perceived relevance of supply chain sections*

In the following part, it is for each sustainability dimension determined [b2a] which sections are perceived most relevant for improving the sustainability performance of the South African – European wine supply chain. By determining which sections are perceived relevant it can subsequently be concluded [h4] if the sections on the supply side are perceived most relevant.

Moreover, it can be determined if societal spheres on the demand side perceive sections on the supply side more relevant opposed to their counterparts on the supply side and vice versa.

*Supply chain section relevance: Environmental dimension*

Figure 6.3 demonstrates that the supply- and the demand side perceive the supply side sections Vineyard and Winery most relevant for improving the sustainability performance of the supply chain. Though, both these supply chain sections are considered slightly more relevant by the demand side. The Wine Cellar/Exporter and Shipping are, by both sides of the supply chain, perceived more relevant than sections on the demand side. However, the supply side perceives the Wine Cellar/Exporter more relevant while the demand side considers Shipping more relevant. Sections on the supply side are perceived the least relevant for enhancing the environmental performance of the supply chain. Nonetheless, the Importer/Retailer and Consumer are perceived more relevant by the supply side whereas Disposal is perceived slightly more relevant by the demand side. Even if most of the societal spheres’ perceptions correspond with the mean perceived relevance deviations are observed.

For sections on the supply side deviations in perceived relevance can be observed for the Scientific Community that perceives the Vineyard the most relevant section while perceiving the Winery more relevant opposed to their counterpart as well. Moreover, the Winery is perceived slightly more relevant by Civil Society on the supply side while the Wine Cellar/Exporter is considered slightly more relevant by Civil Society on the demand side.

The Scientific Community deviates slightly from the mean perceived responsibility for Shipping, perceiving this section slightly more relevant than its counterpart on the demand side.

Civil Society and the Scientific Community deviate from the mean perceived relevance for sections on the demand side. Civil Society on the demand side perceives the Importer/Retailer and Consumer slightly more relevant while the Scientific Community on the supply side perceive Disposal considerably more relevant than its counterpart.

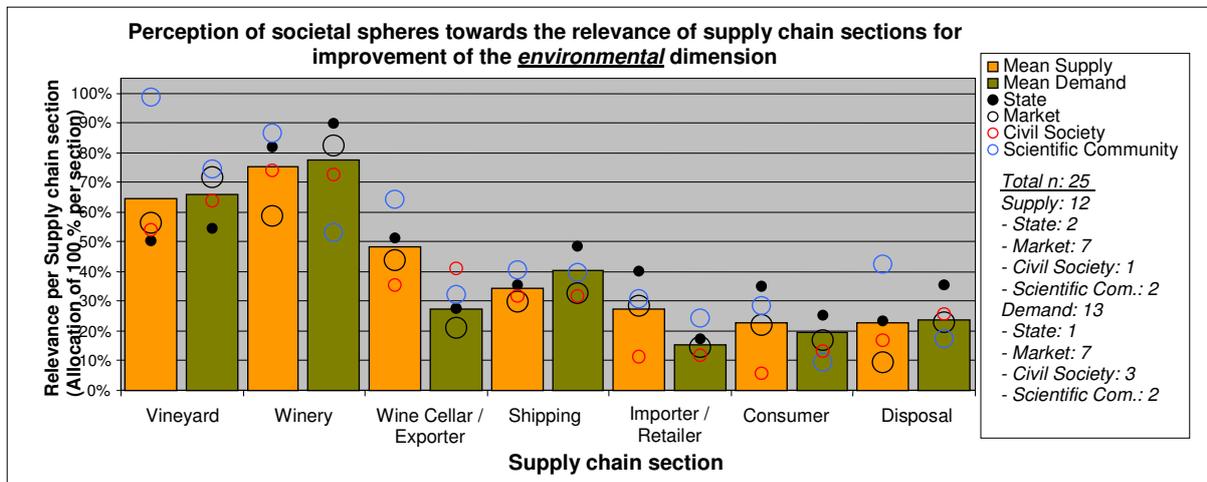


Figure 6.3: Perceived relevance supply chain sections for the environmental dimension

*Supply chain section relevance: Social Dimension*

Sections on the supply side of the supply chain are perceived most relevant for improving the supply chain’s social performance (figure 6.4). While the Vineyard and Winery are perceived slightly more relevant at the demand side is the Wine Cellar/Exporter perceived more relevant by the supply side. Furthermore, the supply side considers sections on the demand side more relevant for improving the sustainability performance of the supply chain while shipping is considered slightly more relevant by the demand side.

However, deviations from the mean perceived relevance can be detected for some of the societal spheres. The Scientific Community on the supply side perceives the Vineyard and Winery more

relevant than its counterpart while State on the demand side perceives the Wine Cellar more relevant compared to State on the supply side.

For Shipping, the Scientific Community and State differ from the mean perceived relevance. Both societal spheres on the supply side perceive Shipping more relevant than their counterparts on the demand side. Civil Society deviates from the mean perceived relevance for the sections on the demand side. Each section is considered more relevant by Civil Society on the demand side.

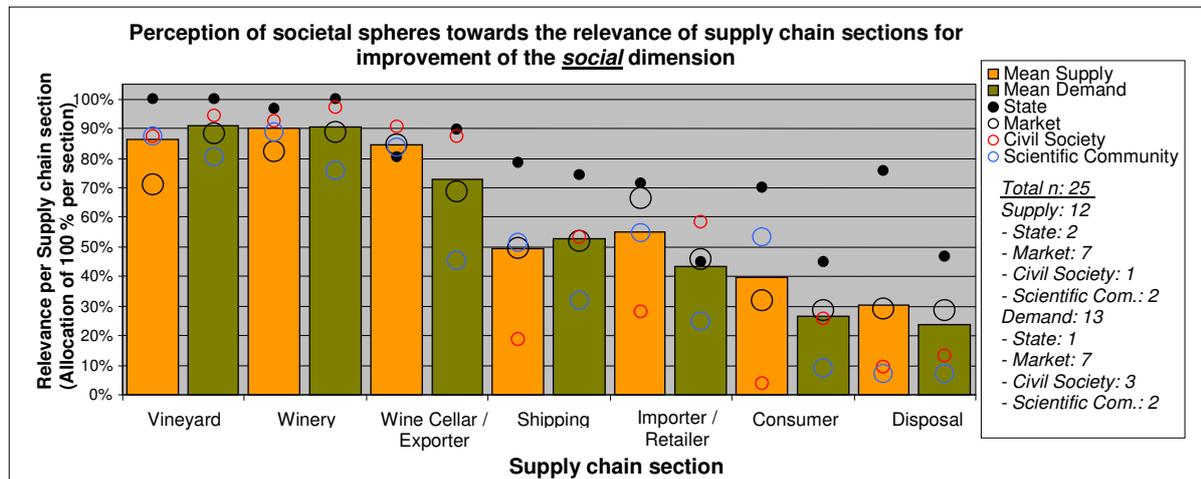


Figure 6.4: Perceived relevance supply chain sections for the social dimension

#### Supply chain section relevance: Socio-economic dimension

Both the supply- as well as the demand side perceives sections on the supply side most relevant for improving the sustainability performance of the wine supply chain (figure 6.5). Nonetheless, the demand side regards the Vineyard and Winery somewhat more relevant, while the Wine Cellar/Exporter is perceived equally relevant. Furthermore, Shipping and Disposal are perceived more relevant by the demand side whereas the supply side regards the Importer/Retailer and Consumer more relevant for improving the socio-economic performance of the supply chain. However, figure 6.5 also shows that societal spheres deviate from this mean perceived relevance. The Vineyard and Winery are perceived more relevant by the Scientific Community on the demand side, whereas the Wine Cellar/Exporter is considered more relevant by the societal spheres on the supply side, with the exception of State. State on the demand side perceives this section considerably more relevant than its counterpart. Shipping, perceived somewhat more relevant by the demand side, is however, compared to their counterparts, perceived more relevant by Market and Civil Society on the supply side. State on the demand side additionally perceives the Importer/Retailer and Consumer more relevant opposed to its counterparts. A similar observation can be made for Civil Society. Civil Society on the supply side considers the Consumer not at all relevant for improving the socio-economic performance of the supply chain though its counterpart does. Disposal is, contrary to the demand side's mean perceived relevance, considered less relevant by Market and the Scientific Community on the demand side.

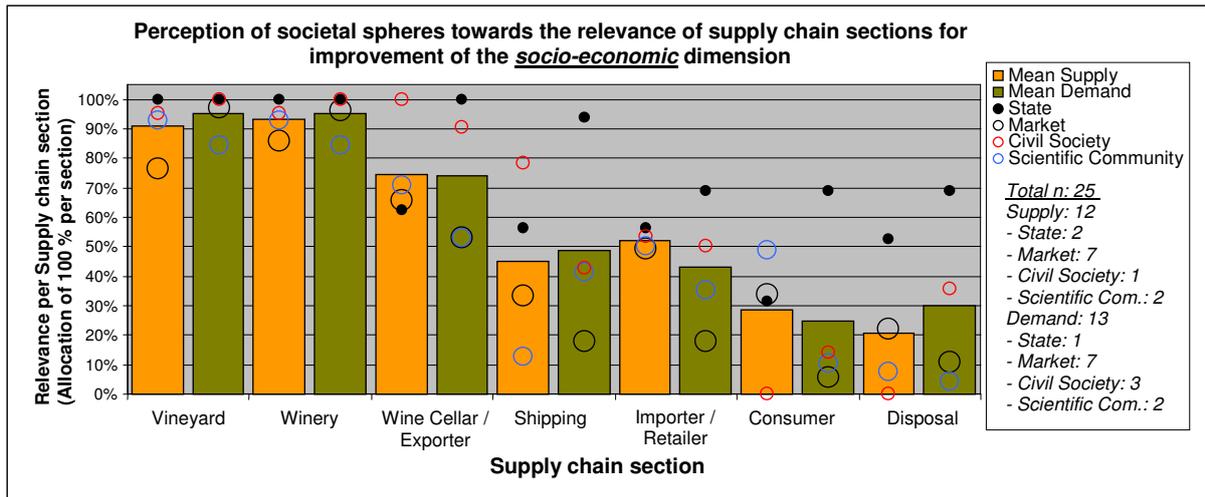


Figure 6.5: Perceived relevance supply chain sections for the socio-economic dimension

### Results: Supply chain section relevance

From the previous analysis it can be concluded that sections on the supply side are perceived most relevant for improving the sustainability performance of the South African – European wine supply chain. Moreover, the demand side perceives Winery and Vineyard more relevant than the supply side perceives them. However, the Wine Cellar/Exporter is considered more relevant by the supply side. Furthermore, Shipping, perceived more relevant by the demand side, is perceived more relevant than Wine Cellar/Exporter concerning the environmental performance. Supply chain sections on the demand side are, as assumed, perceived more relevant by the supply side. Though, an exception can be observed for Disposal. Only for improving the social performance is disposal regarded more relevant by the supply side while improving the environmental and socio-economic performance is Disposal considered more relevant by the demand side. Nonetheless, the hypothesis [h4] can be verified for the larger part. However, the hypothesis is less verifiable for the individual societal spheres. Societal spheres on either side of the supply chain perceive sections on the supply side more relevant than Shipping and the sections on the demand side. However, deviations from the mean perceived relevance do occur. Hence, it cannot be stated that all societal spheres on the demand side perceive sections on the supply side more relevant than their counterparts, nor do societal spheres on the supply side always perceive sections on the demand side more relevant than their counterparts. Civil Society on the demand side often perceives sections in general more relevant than its counterpart while the Scientific Community on the demand side considers sections often less relevant for improvements compared to the Scientific Community on the supply side.

### 6.1.3 Perceived responsibility for improving sustainability dimensions

In the coming section is per sustainability dimension determined which [b2b] societal sphere, or combination of societal spheres, is considered to be mostly responsible for improving the sustainability performance of the South African – European wine supply chain. By concluding which societal sphere or partnership is assigned most responsibility it can be determined [h5] if societal spheres on the supply side assign most responsibility to State while societal spheres on the demand side assign most responsibility to partnerships.

#### Responsibility: Environmental dimension

In figure 6.6 can be observed that the demand side perceives Market mainly responsible for improving the environmental performance of the supply chain while the supply side assigns most responsibility to a State/Market/Civil Society partnership. Both sides of the supply chain do, however, assign considerable responsibility to a State/Market partnership as well.

Some of the societal spheres on the supply side do deviate from the mean perceived responsibility. Civil Society considers a State/Market partnership and Market more responsible. The Scientific

Community, perceiving a State/Market partnership most responsible, does not consider a State/Market partnership to be responsible at all. However, it assigns State considerable responsibility. Moreover, State does not deviate from the mean perceived responsibility but it should be noted that it assigns considerable responsibility to itself as well.

Deviations from the mean perceived responsibility can also be noticed for societal spheres on the demand side. Market considers a State/Market partnership most responsible while considering a State/Market/Civil Society partnership to be more responsible than Market. Civil Society perceives a State/Market/Civil Society partnership slightly more responsible than a State/Market partnership.

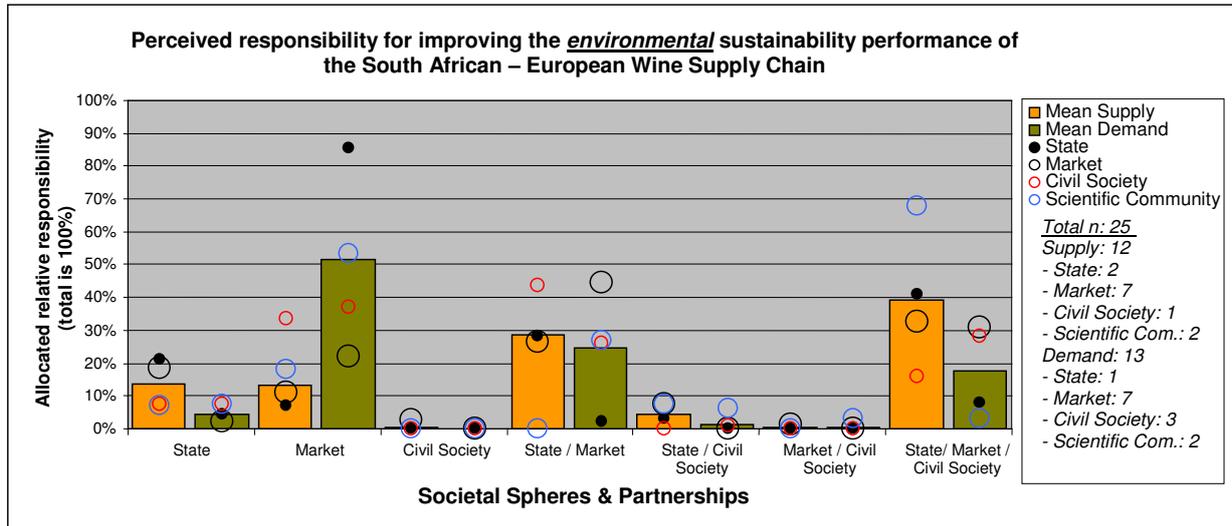


Figure 6.6: Assigned responsibility for the environmental dimension

**Responsibility: Social dimension**

Responsibility to improve the social performance of the supply chain is by the supply side mostly assigned to a State/Market/Civil Society partnership most responsible, though, a State/Market partnership is perceived to be responsible as well. A State/Market/Civil Society partnership is perceived hugely responsible by the demand side as well, however, just slightly less responsible than Market that is considered most responsible.

Deviation in perceived responsibility can be observed for societal spheres on the supply side as well as on the demand side. On the supply side Civil Society deviates most. A State/Market/Civil Society partnership has been perceived hardly responsible, though, Market is assigned considerable responsibility while a State/Market partnership is perceived mainly responsible. The Scientific Community, perceiving a State/Market/Civil Society partnership most responsible, does not regard any responsibility for a State/Market partnership, in stead assigns considerable responsibility to a Market/Civil Society partnership.

Market and the Scientific Community deviate from the demand side’s mean perceived relevance in the sense that a State/Market/Civil Society partnership is perceived mainly responsible whereas Market is perceived secondly most responsible. Civil Society does not deviate from the mean perceived responsibility, however, additionally assigns considerable responsibility to a Market/Civil Society partnership.

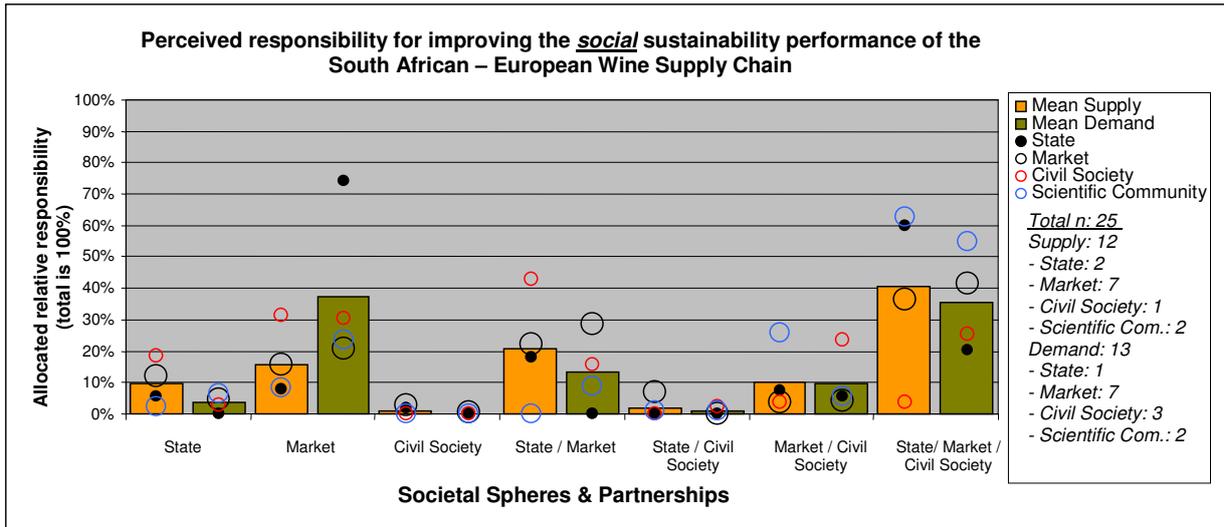


Figure 6.7: Assigned responsibility for the social dimension

**Responsibility: Socio-economic dimension**

Enhancing the sustainability performance of the supply chain concerning socio-economic aspects is perceived mainly a responsibility of a State/Market/Civil Society partnership on the supply side. However, some noticeable responsibility is assigned to a State/Market partnership as well. The demand side considers the socio-economic dimension to be mainly the responsibility of a State/Market partnership, however, assigning considerable responsibility to Market as well. Perceptions deviating from the mean perceived responsibility can be observed for the supply-and demand side. On the supply side the Scientific Community deviates most, perceiving a State/Market/Civil Society partnership not responsible at all, main responsibility is assigned to a State/Market partnership while Market and State are perceived considerable responsible as well. The Scientific Community and Market, while both perceiving a State/Market/Civil Society partnership most responsible, do assign considerable responsibility to other parties than the mean perceived responsibility presents. The Scientific Community assigns in addition to a State/Market partnership considerable responsibility to a Market Civil Society partnership whereas Market perceives a State Civil Society partnership and State considerable responsible as well.

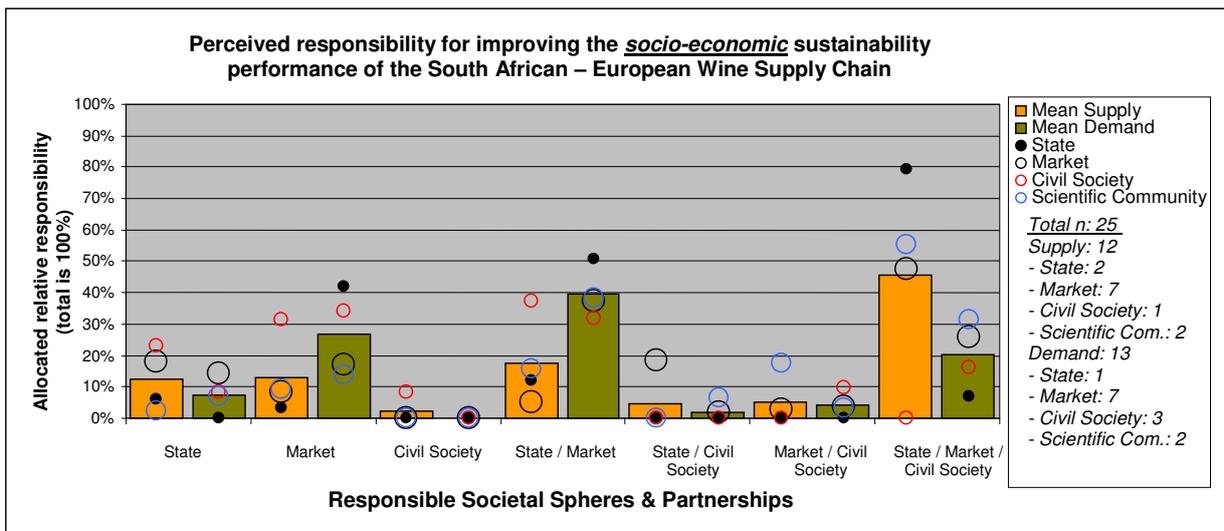


Figure 6.8: Assigned responsibility for the socio-economic dimension

**Results: responsibility on an aggregated level**

It can be concluded that, on an aggregated level, responsibility for improving the sustainability performance is often perceived differently than hypothesised [h5]. Opposed to the general

assumption that the 'South' assigns most responsibility to State must be concluded that in case of the South African – European wine supply chain the supply side assigns most responsibility to partnerships. Especially a partnership between State/Market/Civil Society is perceived most applicable for improving the sustainability performance of the supply chain while a State/Market partnership is assigned second most responsibility. Individual societal spheres on the supply side concur in general with the mean perception, nonetheless, differences have been observed. Civil Society and the Scientific Community deviate from the mean perception only to assign no responsibility to a State/Market/Civil Society partnership or State/Market partnership respectively. However, both consider partnerships more responsible than solely State.

The demand side considers Market most responsibility for improving the environmental and social performance of the supply chain while improving the socio-economic performance is regarded mainly a responsibility of a State/Market partnership. However, considerable responsibility is assigned to partnerships for the environmental and social performance as well. It must, however, be concluded that the 'North' assigns only most responsibility to a partnership concerning the socio-economic dimension. However, individual societal spheres on the demand side deviate more from the mean perceived responsibility. Market perceives partnerships more responsible for improving the sustainability performance of the supply chain regarding all sustainability dimensions. The Scientific Community considers partnerships more responsible for the social and socio-economic performance of the supply chain while State considers a State/Market partnership most responsible for the socio-economic dimension.

## **6.2 Perceptions towards a sustainable supply chain on a main aspect level**

In the second part of the SPA perceptions of involved societal spheres towards Sustainable Development are compared on a main aspect level. Similar to the first part of the SPA this second part examines the in section 1.4 established hypothesis on a main aspect level by determining which sustainability aspects are perceived relevant; which supply chain sections are perceived relevant; and who is perceived responsible; for improving the sustainability performance of the supply chain.

For each of the main sustainability aspects the mean perceived relevance of the supply- and the demand side and the perceived relevance of each societal sphere are presented in graphs. Differences in perceived relevance between societal spheres are determined for each side of the supply chain and between societal spheres and their counterparts on the opposite side of the chain. A comparison between consumers has not been conducted, since South African consumers are outside the scope of this research. The mean perceived relevance of the supply- and demand side is used as a benchmark to determine differences in perceived relevance between societal spheres. Since relevance is measured relatively, allocating a total of 100 points between main sustainability aspects, it represents the relevance of main sustainability aspects in relation to other main sustainability aspect. However, each main sustainability aspect is subdivided in a number of detailed sustainability aspects (appendix II). The relevance of these detailed sustainability aspects are measured on a Likert scale, hence, not measured in relation to other detailed sustainability aspects. The perceived relevance on detailed sustainability aspects (appendix VI) is used to demonstrate if outliers emerge because societal spheres perceive certain detailed sustainability aspects more or less relevant or if this does not affect the allocation of relevance. Deviating perceptions of Consumer can, however, not be explained using detailed sustainability aspect as these were not measured for Consumers. Detailed sustainability aspects employed for each main sustainability aspect are summed up in the enclosed boxes.

The perceived relevance of supply chain sections for improving the sustainability performance of the wine supply chain are also presented in graphs. The graph shows besides the mean perception of the supply- and demand side also the perceptions of the societal spheres on their respective side of the supply chain. First the supply chains' mean perceived section relevance is determined for the supply- and demand side. Thereafter, perceptions of chain actors are determined, using the mean perception

as a benchmark, concluding if perceptions of societal spheres deviate from the mean perception in relation to their counterpart's perception.

The societal spheres' perceived responsibility to improve the sustainability performance is presented in similar graphs, presenting the mean perceived responsibility and the perceptions of the societal spheres. The mean perceived responsibility is determined and used as a benchmark to determine if perceptions of societal spheres deviate from that mean perception opposed to their counterpart's perception.

### 6.2.1 Perceptions on a main environmental aspect level

In the forthcoming sections are the perceptions of societal spheres described for the main environmental aspects. In subsequent order are the societal spheres' perceptions towards the relevance of main environmental aspects, the relevance of the supply chain sections, and the responsibility for improving the sustainability performance determined.

#### 6.2.1.1 Perceived relevance for main environmental aspects

In this section it is determined [b2] which of the main sustainability aspects societal spheres are perceived to be most relevant in order to improve the sustainability performance of the South African – European wine supply chain. In addition it will be concluded if [h2] societal spheres operating on the same side of the supply chain differ extensively in perception towards relevance of the (environmental) sustainability aspects for improving the sustainability performance of the supply chain. Additionally, it is determined if [h3] differ extensively in perception towards relevance of the (environmental) sustainability aspects for improving the sustainability performance of the supply chain, as opposed to their counterparts on the supply side.

Figure 6.9 shows that both sides of the supply chain perceive the main environmental sustainability aspects Water and Energy & Resources most relevant to improve in order to enhance the environmental performance of the supply chain. Additionally, the demand side considers Land Use an important main environmental sustainability aspect. Even though some differences can be observed no extensive differences in relevance are apparent between the supply- and demand side.

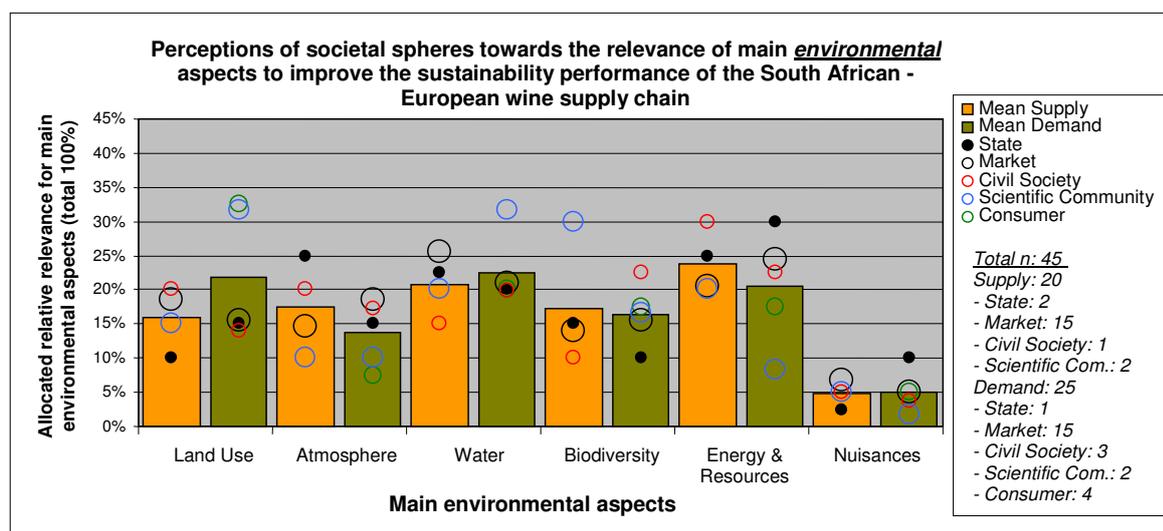


Figure 6.9: Perceptions of societal sphere towards the relevance of main environmental aspects

Even if no apparent differences between supply- and demand side exist figure 6.9 presents some larger differences between societal spheres. In the rest of this section perceptions of societal spheres regarding the environmental performance are compared for each of the main environmental aspects.

### Land Use

Figure 6.9 shows that Land Use is perceived more relevant by the demand side opposed to the supply side mainly because of the Scientific Community and the Consumer. Both perceive this main aspect considerably more relevant opposed to the other societal spheres on the demand side that perceive Land Use of similar relevance. However, no detailed sustainability aspect is perceived obviously more relevant and thus there is no explanation for the extensive difference in relevance.

The societal spheres on the supply side deviate to some extent in perceived relevance for Land Use. Deviating most from the mean perception is State, perceiving all detailed sustainability aspects related to Land Use less relevant but especially a3 the acidification of farmland.

Differences in perception between societal spheres and their counterparts, not corresponding with the mean perceptions, can be observed for Market and Civil Society. Both societal spheres at the supply side perceive Land Use more relevant opposed to their counterparts. However, the largest difference can be observed for the Scientific Community. The Scientific Community on the demand side regards Land Use considerably more relevant opposed to its counterpart. Additionally, a1 is often perceived as a relevant sustainability aspect. However, many of the chain actors on the supply and the demand side state that natural areas decrease for a different reason. Natural areas do not decrease because of farmland expansion but because of increasing residential areas, tourist residencies, and golf courses.

#### **Detailed Sustainability Aspects: Land Use**

- a1. Decreasing natural areas as result of farmland expansion
- a2. The farmland's (declining) productive capabilities as a result of vineyard processes
- a3. The acidification of farmland caused by grape growing processes
- a4. The soil compaction of farmland caused by the use of heavy machinery
- a5. Other forms of soil degradation like erosion, dryland salinity, etc. caused by vineyard processes

### Atmosphere

Atmosphere is perceived more relevant by the supply side opposed to the demand side (figure 6.9). Perceptions of societal spheres do deviate from the respective mean perceived relevance. Outliers on the supply side are the Scientific Community and State. State perceives Atmosphere equally to Energy & Resources the most relevant main environmental sustainability aspect while the Scientific Community regards Atmosphere the least relevant opposed to the mean perceived relevance. However, no apparent reason can be found for their deviation in relevance as every societal sphere on the supply side perceives the detailed sustainability aspects related to Atmosphere relevant or most relevant.

No real outliers can be distinguished on the demand side; however, Market and the Consumer deviate most from the mean perception. Market on the demand side perceives Atmosphere most relevant while the Consumer perceives this sustainability aspect least relevant. Market perceives all detailed sustainability aspects relevant while the other societal spheres are more divided, though perceiving a6 and a8 most relevant.

When societal spheres deviate from their counterparts they only do this slightly. Largest deviation can, however, be noticed between State while a slighter deviation can be observed for Civil Society. Both deviations are in accordance with the mean perceived relevance. Market also perceives Atmosphere slightly different than its counterpart. However, this deviation is not corresponding with the mean perceived relevance.

#### **Detailed Sustainability Aspects: Atmosphere**

- a6. The discharge of harmful emissions by supply chain processes causing climate change (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, etc.)
- a7. Ozone depleting substances emitted by processes in the supply chain (CFC, HCFC, Halon, etc.)
- a8. The emission of harmful substances by processes in the supply chain reducing air quality (SMOG, Carbon, VOC, particles, ashes)
- a9. The production of excessive heat in supply chain processes that is not necessary for the process but discharged in the atmosphere

### Water

The demand side perceives the Water slightly more relevant than the supply side. Deviating mostly from each other on the supply side are Market and Civil Society. Market perceives Water the most relevant of all main aspects. Civil Society perceives Water less relevant. Though Market perceives Water the most relevant main environmental aspect none of the detailed sustainability aspect is perceived considerably more relevant opposed to the other societal spheres explaining why Water is perceived the most relevant main environmental aspect by Market.

The demand side presents a clearer outlier, this explains why the demand side perceives Water as slightly more relevant opposed to the supply side. Water is perceived more relevant by the Scientific Community while all other societal spheres perceive this aspect equally though slightly less relevant than the mean perceived relevance. However, the Scientific Community's perception towards the detailed sustainability aspects is in general lower than that of State and Market and therefore offers no explanation why the Scientific Community perceives Water most relevant. However, it can be observed that the societal spheres in general perceive a14 and a15 to be most relevant for improving the sustainability performance of the supply chain regarding water. Deviations between societal spheres and their counterparts do not always correspond with the mean relevance perception. Difference can be noticed for the Scientific Community and Civil Society, though in correspondence while the Market shows largest difference in perception not corresponding with the mean relevance perception. A small difference can be observed between States, though this does not correspond with the mean perception.

#### **Detailed Sustainability Aspects: Water**

- a10. The use of water in supply chain processes contributing to water shortages
- a11. The use of cooling water in supply chain processes
- a12. The use of cleaning water in supply chain processes
- a13. Wastewater treatment for water used in the supply chain processes
- a14. The disposal of wastewater
- a15. The eutrophication of water caused by substances, like nutrients and fertilizers, used in supply chain processes
- a16. Droughts resulting in an increased chance of fire hazards

### Biodiversity

The supply side perceives Biodiversity slightly more relevant for improving the sustainability performance of the supply chain. However, this is mainly due to the Scientific Community, perceiving Biodiversity the most relevant main environmental aspect. The other societal spheres perceive Biodiversity less relevant than the mean perceived relevance. However, perceptions towards the relevance of the detailed sustainability aspects do not reveal that the Scientific Community considers Biodiversity more relevant compared to the other societal spheres. Nonetheless, societal spheres on the supply side perceive a17, a18, and a25 the most relevant detailed sustainability aspects.

The demand side presents two societal spheres deviating from the mean perceived relevance. Civil Society perceives Biodiversity, equally to Energy & Resources, the most relevant of all sustainability aspects while State perceives this main environmental aspect least relevant. However, according to the perceived relevance on the detailed sustainability aspects it is Market and State that perceive these individual aspects in general more relevant. Though, similar as to the supply side, detailed sustainability aspects a17, a18, and a25 are perceived most relevant while a20 is additionally perceived considerable relevant.

Largest differences can be determined for the Scientific Community and Civil Society. The Scientific Community on the supply side perceives Water considerably more relevant as does its counterpart. Civil Society on the demand side perceives, contrary to the demand side's mean perception, Water considerably more relevant than its equivalent. While a difference in perceived relevance can also be noticed for the other two societal spheres these are, especially between Markets, less extensive.

#### **Detailed Sustainability Aspects: Biodiversity**

- a17. The use of herbicides, pesticides and fungicides to control pests and diseases in supply chain processes
- a18. The use of fertilizers and growth regulators in supply chain processes
- a19. The use of hazardous materials in the supply chain processes (i.e. disinfectants, cleaning agents)
- a20. Processes in the supply chain producing toxins harmful to human and animal life
- a21. The use of GMOs in the supply chain processes
- a22. Processes in the supply chain negatively affecting wild life
- a23. The invasion of alien species (plants) caused by supply chain shipments
- a24. The production and disposal of solid waste in supply chain processes
- a25. Damage to the ecosystem and habitats caused by processes in the supply chain

### Energy & Resources

Both sides of the supply chain perceive Energy & Resources an important main environmental aspect for improving the sustainability performance of the chain. However, Energy & Resources is perceived most relevant by the supply side. Most of the societal spheres' perceived relevance relates closely to the mean perceived relevance. Civil Society, however, deviates from this perception, considering Energy & Resources the most relevant sustainability aspect. What is noticeable is that, other societal spheres perceive this main environmental aspect considerably relevant as well. This can moreover be concluded from the detailed sustainability aspects, that each of these are perceived considerably relevant.

The demand side presents two clear outliers. While the perceptions of Market, Consumer and Civil Society are rather equal to the mean perceived relevance, State and the Scientific Community are clearly deviating from that perception. These deviating perceptions can be explained by how relevant State and the Scientific Community perceive the detailed sustainability to be. State perceives all detailed sustainability aspects except a27 and a30 equally or more relevant opposed to Market and Civil Society while the Scientific Community perceives the detailed sustainability aspects in general less relevant opposed to Market and Civil Society.

The difference in perception between societal spheres and their counterparts can clearly be noticed. Interestingly, Civil Society on both sides of the supply chain perceive Energy & Resources as the most relevant main environmental aspect though perceived less relevant on the demand side opposed to the supply side. Contrary to the mean perceived relevance Market and State perceive Energy & Resources more relevant than its counterpart on the supply side. Moreover, the Scientific Community, on both sides perceiving Energy & Resources less relevant than the other societal spheres, still show a considerable difference in relevance. The Scientific Community on the demand side perceives Energy & Resources considerably less relevant.

#### Detailed Sustainability Aspects: Energy & Resources

- a26. The amount of abiotic (non-living) materials used in the wine supply chain processes (i.e. packaging)
- a27. The amount of biotic (living) materials used in the wine supply chain processes (i.e. seeds, wine plants)
- a28. The use of (more) recycled materials in the supply chain processes
- a29. The use of (more) renewable materials in the supply chain processes
- a30. The reduction of energy intensive processes in the supply chain
- a31. The implementation of new, less energy intensive technologies
- a32. Increased employer/employee awareness towards energy use to reduce the energy use in the wine supply chain
- a33. The use of renewable energy in wine supply chain processes to reduce negative impacts caused by conventional energy

### Nuisances

The main environmental aspect Nuisances is perceived equally relevant on both side of the supply chain. However, figure 6.9 also depicts clearly that Nuisances is perceived the least relevant of all main environmental aspects. On the supply side only Market perceives Nuisances slightly more relevant than the mean perceived relevance while State considers this main environmental aspect the least relevant. Though perceived hardly relevant, examining the detailed sustainability aspects shows that the scientific community perceives the detailed sustainability aspects relevant while a36 is perceived relevant by most other societal spheres as well.

Societal spheres on the demand side do not perceive Nuisances a very relevant main environmental aspect either for improving the sustainability performance of the supply chain, even if State perceives Nuisances slightly more relevant opposed to the other societal spheres. Even though State perceives the detailed sustainability aspects slightly more relevant compared to the other societal spheres additional reasons has been mentioned. Public drinking and alcohol abuse have also been perceived as nuisances that might affect the sustainability performance of the supply chain even more than the suggested detailed sustainability aspects. However, public drinking and alcohol abuse in this respect are not environmental aspects and therefore are better suited as social aspects categorized under Health & Safety.

Some difference in perception can be distinguished between societal spheres and their counterparts. However, none of the societal spheres perceive that the supply chain causes extensive Nuisances

#### Detailed Sustainability Aspects: Nuisances

- a34. The excessive noise produced by processes in the supply chain
- a35. The excessive smell produced by processes in the supply chain
- a36. Landscape pollution as a result of storage and production buildings and other facilities used in the supply chain

which are subject to improvement in order to enhance the sustainability performance of the supply chain. Therefore any differences that do occur are rather small.

*Results: relevance main environmental sustainability aspects*

Even though some differences can be noticed in perceived relevance both the supply- and demand side perceive the main environmental aspects Water and Energy & Resources most relevant for improving the environmental performance of the supply chain. The demand side considers Land Use additionally relevant as well. The hypothesis [h2] cannot be proven convincingly. Even if societal spheres perceive a main environmental aspect differently relevant they in general agree on the relevance of that main environmental aspects opposed to other main environmental aspects. Each of the societal spheres on the supply side perceives Water and Energy & Resources amongst the most relevant main environmental sustainability aspects. Though, some societal spheres deviate slightly. The Scientific Community perceives Biodiversity most relevant while State and Civil Society consider Atmosphere more relevant than Water. Societal spheres on the demand side deviate similarly in perception. The Scientific Community regards Energy & Resources not relevant while Land Use is perceived considerably relevant only by the Scientific Community and Consumer. Thus, societal spheres do deviate in perceived relevance but in general perceive the same environmental sustainability aspects most relevant even if deviations can be noticed.

As hypothesised [h3] societal spheres do differ in perceived relevance from their counterparts on the opposite of the chain. Differences are noticeable in two forms, societal spheres differ from their counterpart corresponding or not corresponding with the mean perceived relevance. For both forms differences in perceived relevance can be observed, though differences are often not extensive. The largest difference in perceived relevance can be found between the Scientific Communities.

However, the differences in perceived relevance appear to be larger between societal spheres operating on the same side of the supply side than between societal spheres and their counterparts on the opposite of the supply chain.

Moreover, the outlying positions of a societal sphere's perception towards the relevance of a main environmental aspect is in general not explained by the perceived relevance towards the detailed sustainability aspects belonging to that main environmental aspect. Letting us believe that perceived relevance is not arbitrary but highly dependent on the freedom to appoint relevance.

*6.2.1.2 Relevant supply chain sections for main environmental aspects*

For each main environmental aspect is determined [b2a] which sections of the South African – European wine supply chain are perceived relevant to improve the environmental performance of the supply chain. Subsequently it can be concluded if [h4] societal spheres on both sides of the supply chain perceive supply side sections most relevant for improvement. Additionally it is concluded if societal spheres on the supply side perceive sections on the demand side more relevant while societal spheres on the demand side perceive sections on the supply side more relevant. The graphs depicting the mean perceived relevance of the supply- and demand side and the perceived relevance of each societal sphere can be found in appendix VII.

*Land Use*

Both the supply- and the demand side perceive the Vineyard and the Winery the most relevant sections for improvements that enhance the sustainability performance regarding Land Use. Importer/ Retailer and Consumer are considered slightly relevant though only by the supply side. Other supply chain sections are not perceived noticeably relevant.

Sections on the supply side are perceived more or equally relevant by societal spheres on the demand side. The exception is the Scientific Community on the supply side, perceiving the Winery and Wine Cellar/Exporter more relevant than its counterpart.

Sections on the demand side perceived relevant are considered more relevant by societal spheres on the supply side. Shipping is not perceived relevant for improvements regarding Land Use by any of the societal spheres on either side of the supply chain.

### *Atmosphere*

The supply- as well as the demand side considers the Winery and Shipping most relevant for improvements regarding Atmospheres. All sections except the Wine Cellar/Exporter and Disposal are perceived more relevant by the supply side, although this difference in perceived relevance is minimal for the Vineyard. However, for some sections societal spheres deviate from that mean perceived relevance.

Deviations concerning sections on the supply side can be observed for Market and Civil Society on the demand side, perceiving the Vineyard and the Winery more relevant. Moreover, Civil Society on the supply side and State on the demand side consider the Vineyard not relevant at all for improvement. The Wine Cellar/Exporter is perceived more relevant by all societal spheres on the supply side, except Civil Society. Civil society on the supply side perceives Wine Cellar/Exporter not relevant at all while its counterpart perceives the Wine Cellar/Exporter considerably more relevant and even more relevant than the Winery.

Shipping is considered more relevant by State on the supply side while the Scientific Community considers this equally relevant compared to its counterpart.

Deviating from the mean perceived relevance for sections on the demand side is Civil Society for the Importer/Retailer and Consumer. Civil Society on the supply side perceives these sections not relevant for improvement. Moreover, Disposal is perceived more relevant by the Scientific Community on the supply side than its equivalent on the demand side.

### *Water*

Both sides of the supply chain perceive sections on the supply side more relevant for improvement, though, the supply side perceives these sections more relevant compared to the demand side. Sections on the demand side and shipping are considered considerably less relevant for improvement. Even if perceived less relevant, these sections are considered more relevant by the supply side than the demand side.

Sections on the supply side are perceived more relevant by societal spheres on the supply side. However, few exceptions can be noticed. Market on the demand side perceives both the Vineyard and the Winery more relevant. Furthermore, the Scientific Community on the demand side perceives Wine Cellar/Exporter more relevant than its counterpart that perceives this section not relevant.

Societal spheres on the supply side do in general perceive sections on the demand side more or equally (not) relevant compared to their counterparts on the demand side, though, exceptions can be found. Disposal is perceived more relevant by Market and Civil Society on the demand side while Shipping and the Importer/Retailer State are perceived more relevant by State on the demand side.

### *Biodiversity*

Both sides of the supply chain perceive sections on the supply side more relevant for improving the sustainability performance regarding biodiversity. However, the supply side perceives all sections on the supply- and the demand side, with exception of the Winery and Disposal, more relevant than the demand side. Subsequently, societal spheres correspond mostly with this perception, nevertheless, differences in perceived applicability can be observed.

Even though, compared to the demand side, the supply side's mean perceived relevance is larger for the Vineyard this section is perceived slightly less relevant by Market and State. Similar differences can be observed for Civil Society regarding the Wine Cellar/Exporter. A similar observation can be made for the Winery. Even though the demand side generally perceives the Winery more relevant the Scientific Community on the supply side considers this section more relevant for improvements than its counterpart.

Differences from the mean perceived relevance can also be observed for Shipping and sections on the demand side. Most obvious is the Scientific Community's contradicting perception compared to the mean perceived applicability for all sections except Consumer. Civil Society deviates from the mean perceived applicability as well. The Consumer is not perceived relevant on the supply side, contrary to a slight perceived relevance on the demand side.

Additionally, it should be mentioned that State on the demand side perceives Disposal more relevant than the Wine Cellar/Exporter for improvements regarding Biodiversity.

#### *Energy & Resources*

Improvements enhancing the sustainability performance regarding Energy & Resources are perceived of considerable relevance relevant for all supply chain sections, however, most it is most relevant for the Winery and Wine Cellar/Exporter. Moreover, Disposal is considered more relevant for improving the sustainability performance than the Vineyard while a similar observation can be made for Shipping, though only perceived like that by the demand side. The supply side perceives sections in general more relevant, as only the Winery and Shipping are perceived more relevant by the demand side. Because, Energy & Resources is perceived considerably relevant for all sections, deviations from the mean perception are evident. Societal spheres not corresponding with the mean perception or not perceiving sections equally relevant in relation to their counterparts can be recognized for all sections.

For sections on the supply side deviations can be noticed for Market on the supply side perceiving the Vineyard less relevant than its counterpart. Furthermore, the Scientific Community perceives the Vineyard similar to the Winery the most relevant section. The Scientific Community on the supply side perceives the Winery more relevant than its equivalent while State on the supply side perceived the Wine Cellar/Exporter less relevant than State on the demand side. Civil Society and State on the supply side perceive Shipping more relevant than their counterparts.

Sections on the demand side present deviations from the mean perceived relevance as well. The Importer/Retailer is perceived slightly more relevant by the Scientific Community on the demand side while the consumer, who is perceived most relevant on the supply side, is perceived slightly more relevant by Civil Society on the demand side. Disposal is perceived considerable more relevant by Market on the demand side. Moreover, Civil Society on the supply side and State on the supply as well as on the demand side perceive Disposal together with Winery and Wine Cellar/Exporter the most relevant section for increasing the sustainability performance of the supply chain. Additionally, State on the supply side perceives the Consumer more relevant than the Winery.

#### *Nuisances*

Supply chain sections are, when perceived relevant, perceived most relevant by the demand side. However, the demand side perceives only the Winery, Vineyard, Shipping and Consumer relevant for improvements regarding Nuisances. The Consumer is, however, perceived the least relevant section. Moreover, Civil Society and the Scientific Community perceive Nuisances not relevant at all, hence, considering none of the sections relevant for improvement. The supply side perceives all sections relevant to some extent, though, the Winery and Wine Cellar/Exporter are perceived most relevant. Societal spheres perceive sections on the supply side equally relevant or in correspondence with the mean perceived relevance. However, the Scientific Community on the supply side considers the Vineyard and Winery the most relevant sections while considering the Wine Cellar and Shipping considerable relevant as well. Civil Society perceives the Winery and Wine Cellar/Exporter the most relevant sections in the supply chain for improving the sustainability performance regarding Nuisances. State on the demand side considers Shipping and Consumer together with the Winery the most relevant sections. Market on the demand side considers Shipping and Consumer less relevant than its counterpart. Disposal is only perceived relevant for improving the sustainability performance concerning Nuisances by the Scientific Community on the supply side.

#### *Results: relevance supply chain sections for improving the main environmental aspects*

For main environmental aspects the hypothesis [h4] can be proven for the main part. Sections on the supply side are perceived more relevant by both sides of the supply chain for most main environmental aspects. Energy & Resources and Atmosphere are, however, considered relevant for sections on the demand side as well. Atmosphere is perceived relevant for Shipping while Energy &

Resources is considered relevant for improving the sustainability performance regarding the supply chain sections Shipping and Disposal.

It cannot be proven that the demand side perceives sections on the supply side structurally more relevant for improvement than the supply side as the supply side often perceives these sections more relevant. As assumed, the supply side perceives sections on the demand side in general more relevant for improving the sustainability performance. Though, deviations can be observed for Disposal which is perceived more relevant by the demand side for some environmental main aspects. Moreover, sections on the demand side regarding Nuisances are, when perceived relevant, perceived more relevant by the demand side.

The hypothesis is less verifiable for individual societal spheres. Even if societal spheres' perceptions in general correspond with the mean perceived relevance and a similar conclusion could be made for those societal spheres, deviations can be clearly noted for societal spheres towards one or some of the sections in the supply chain. It can, however, not be concluded that one of the societal spheres is consistently deviating from the mean perceived relevance, perceiving a section more or less relevant opposed to the other societal spheres. This deviation of societal spheres on the perceived relevance is depending on the main environmental aspect.

#### *6.2.1.3 Responsibility improving environmental aspects*

In the following section it is determined [b2b] which societal sphere, or combination of societal spheres, is considered most responsible for improving the sustainability performance of the South African – European wine supply chain and if [h5] the societal spheres on the supply side assign most responsibility to State while the societal spheres on the demand side assign this responsibility to partnerships. The graphs depicting the mean perceived responsibility of the demand and supply side and the perceptions of each societal sphere can be found in appendix X.

#### *Land Use*

Improving the sustainability performance regarding Land Use is regarded a responsibility of the Market according the demand side, while the supply side assigns most responsibility to a State/Market partnership. However, Societal Spheres do deviate from that mean perceived responsibility.

Both Market and the Scientific Community on the supply side perceive responsibility differently. Market Assigns most responsibility to Market, and considers State considerably responsible as well. The Scientific Community assigns most responsibility to a State/Market/Civil Society partnership and State.

On the demand side it is Civil Society that perceives responsibility differently, assigning most responsibility to a State/Market partnership and a State/Market/Civil Society partnership respectively.

#### *Atmosphere*

Responsibility for improving the sustainability performance regarding Atmosphere is according the demand side mostly Market's while the supply side perceives a State/Market partnership most responsible, however, only slightly more responsible than a State/Market/Civil Society partnership.

Societal spheres on the supply side do deviate between assigning responsibility to the two partnerships. Civil Society and State perceive a State/Market partnership most responsible. Though, State assigns considerable responsibility to a State/Market/Civil Society partnership as well. Market and the Scientific Community assign most responsibility to a State/Market/Civil Society partnership but do consider State a responsible party as well.

Societal Spheres on the demand side, except Market, assign most responsibility to Market. Market considers a State/Market/Civil Society partnership most responsible while Civil Society assigns considerable responsibility to this partnership as well. Additionally, Market assigns noticeable responsibility to a State/Market partnership.

*Water*

The supply- and demand side each assign most responsibility to Market. However, the demand side assigns considerably more responsibility to Market. The supply side assigns only slightly more responsibility to Market than to a State/Market/Civil Society partnership.

Of all societal spheres on the supply side only Civil Society perceives Market solely responsible. Market and the Scientific Community consider a State/Market/Civil Society partnership more responsible while State assigns most responsibility to State and a State/Market partnership respectively.

On the demand side the societal spheres are more in harmony in assigning responsibility. All Societal Spheres perceive Market most responsible. However, Civil Society assigns equal responsibility to a State/Market/Civil Society partnership while Market assigns equal responsibility to a State/Market partnership.

*Biodiversity*

Responsibility for improving the supply chain's sustainability performance is according to the supply side mostly assigned to a State/Market/Civil Society partnership while the demand side considers Market most responsible. Nonetheless, both sides assign considerable responsibility to a State/Market partnership as well.

The Scientific Community and Civil Society on the supply side assign responsibility different from the mean perceived responsibility. The Scientific Community assigns responsibility completely to a State/Market/Civil Society partnership while Civil Society assigns responsibility completely to a State/Market partnership.

Some societal spheres on the demand side perceive responsibility slightly different opposed to the mean perceived responsibility. Both Market and Civil Society perceive a State/Market partnership but also a State/Market/Civil Society partnership more responsible than Market. The Scientific Community additionally assigns considerable responsibility to a Market/Civil Society partnership.

*Energy & Resources*

The responsibility to improve the sustainability performance of the supply chain regarding Energy & Resources mainly assigned to Market on the demand side while the supply side regards this matter mostly a responsibility for a State/Market/Civil Society partnership.

Individual societal spheres on each side of the supply chain do deviate slightly from this mean perceived responsibility. On the supply side considers Civil Society a State/Market partnership equally responsible while State regards this partnership considerably responsible as well.

On the supply side is Market perceived solely responsible by State, however, Market and Civil Society assign this responsibility differently. Both assign more responsibility to a State/Market/Civil Society partnership and a State/Market partnership.

*Nuisances*

Reducing Nuisances is by the supply side is perceived as the responsibility for a State/Market/Civil Society partnership and, to a lesser extent, Market. The demand side considers Nuisances mainly the responsibility for Market and a State/Market partnership respectively. However, on the demand side is responsibility only assigned by State and Market since Civil Society and the Scientific Community do not perceive this main environmental aspect relevant.

On the supply side consider both State and the Scientific Community a State/Market/Civil Society partnership solely responsible, however, Civil Society considers Market solely responsible. Market, perceiving a State/Market/Civil Society partnership mainly responsible assigns noticeable responsibility to a State/Civil Society partnership as well.

State on the demand side perceives Market mainly responsible while assigning considerable responsibility to a State/Market/Civil Society partnership as well. Market assigns most responsibility to a State/Market partnership while assigning considerable responsibility to State and Market respectively.

*Results: responsibility main environmental aspects*

Contrary to the hypothesis [h5] the supply side never perceives State most responsible for improving the sustainability performance of the supply chain. Depending on the main environmental aspect, main responsibility is always assigned to a State/Market/Civil Society or State/Market partnership. Water, however, forms the exception, the responsibility to improve the sustainability performance concerning Water is mainly assigned to Market. Societal spheres on the supply side deviate from the mean perceived responsibility, however, never assign most responsibility solely to State.

The assumption that the demand side assigns most responsibility to partnerships cannot be verified either. Even if the demand side assigns responsibility to partnerships Market is perceived mainly responsible for each main environmental aspect. However, it is especially State assigning responsibility to Market. Other societal spheres do deviate from the demand side's mean perceived responsibility. Market and Civil Society consider for some main environmental aspects a State/Market partnership or a State/Market/Civil Society partnership more responsible. Nonetheless, societal spheres on the demand side overall consider Market mainly responsible to improve the sustainability performance of the supply chain.

*6.2.2 Perceptions on a main social aspect level*

In the next sections the perceptions of societal spheres are described for each of the main social aspects. Perceptions are determined between societal spheres on the supply as well as the demand side. Additionally perceptions of societal spheres are compared to their counterparts on the opposite side of the supply chain. The largest differences in perception are described using the mean perceptions of each side of the supply chain as a benchmark. In subsequent order are the perceptions towards the relevance of the main social aspect, the relevance of the supply chain section, and responsibility towards improving the social performance determined.

*6.2.2.1 Perceived relevance for main social aspects*

To conclude if [h2] societal spheres operating on the same side of the supply chain differ extensively in perception towards relevance of the sustainability aspects for improving the (social) sustainability performance of the supply chain, and if [h3] societal spheres on the demand side differ extensively in perception towards relevance of the (social) sustainability aspects for improving the sustainability performance of the supply chain, as opposed to their counterparts on the supply side will this section determine [b2] which main social aspect societal spheres perceive to be most relevant for improving the social sustainability performance of the supply chain.

The supply and demand side's mean perceived relevance towards main social aspects deviates from each other; however these differences are not extraordinary large (figure 6.10). Both sides acknowledge the relevance of Health & Safety for a more sustainable supply chain. However, the supply side considers Training & Education the most relevant main social aspect and perceives Employment considerably relevant as well. The demand side, however, has a stronger preference for Consumer Interest while sharing the supply side's perception on Training & Education though to a lesser degree.

Even though the differences presented in figure 6.10 are visible they are relatively small. Larger differences in perceived relevance can be observed between societal spheres. For each main social aspect it is determined which differences in relevance can be distinguished.

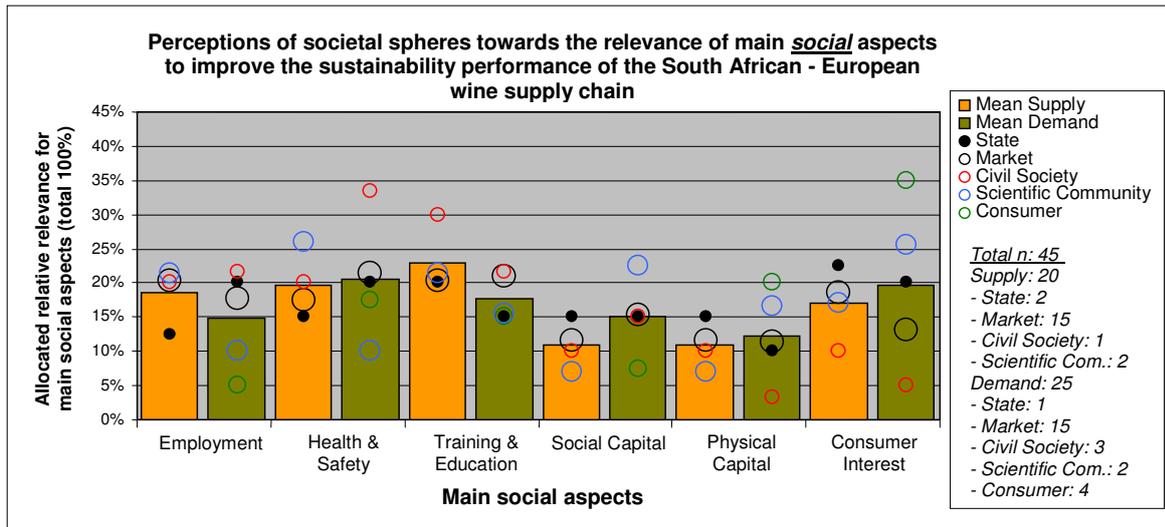


Figure 6.10: Perceptions of societal sphere towards the relevance of main social aspects.

### Employment

Employment is perceived a more relevant main social aspect for the sustainability performance on the supply side than on the demand side.

On the supply side is State the only societal sphere perceiving Employment clearly less relevant while the other societal spheres have a similar perception regarding Employment. It is, however, not apparent that State perceives detailed sustainability aspects consistently less relevant. Though a37 to a40 and a46-47 are perceived less relevant these are not perceived less relevant exclusively by State. Moreover, it can be observed that Civil Society perceives these detailed aspects in general more relevant opposed to the other societal spheres.

The societal spheres on the demand side are much more divided in their perceptions towards the relevance of Employment for improving the social performance of the supply chain. None of the societal spheres perception equals the mean perceived relevance. Civil Society perceives this main social aspect most relevant in comparison to the other societal spheres while the Consumer regards Employment the least relevant of all main social aspects. Civil Society's perception corresponds with the perceived relevance on the detailed sustainability aspects, regarded in most cases very relevant. The Scientific Community's perceived relevance can be explained as well as they perceive these detailed sustainability aspect considerably less relevant.

Societal spheres do deviate in perceived relevance from their counterparts, though this is most apparent for the Scientific Community and State. Smaller differences are observed for Market and Civil Society. However, the differences between the Scientific Communities and Markets correspond with the mean perceived relevance the difference in perceived relevance between States and Civil Societies does not.

#### Detailed Sustainability Aspects: Employment

- a37. The labour hours for employees in the supply chain
- a38. The amount of allowed overtime for employees in the supply chain
- a39. The workload for employees in the supply chain
- a40. Increasing job security for employees in the supply chain
- a41. Increasing job security for seasonal workers in the supply chain
- a42. Employee satisfaction with their occupation
- a43. Empowerment opportunities for employees
- a44. Equal access to labour in the supply chain
- a45. Equal labour conditions for employees in the supply chain
- a46. The prohibition of forced labour
- a47. Allowed maternity leave
- a48. Monitoring by labour inspection to ensure labour is performed according to the basic conditions of employment

### Health & Safety

The demand side perceives Health & Safety slightly more relevant for improving the sustainability performance of the supply chain than the supply side.

Societal spheres on the supply side deviate in perceived relevance. However, the Scientific Community deviates most, perceiving Health & Safety

#### Detailed Sustainability Aspects: Health & Safety

- a49. Health and safety in the workplace
- a50. Health and safety in the community
- a51. Time of absence when ill or due to illness of a family member
- a52. Healthcare (facilities) within the community wherein the supply chain operates

more relevant than the mean perceived relevance and the perception of the other societal spheres. Moreover, the Scientific Community perceives Health & Safety most relevant of all main social aspects. The Scientific Community's perception corresponds with its perception on the detailed sustainability aspect, perceiving these considerably more relevant than State and Market. However, Civil Society does perceive these detailed sustainability aspects considerable relevant as well.

Outliers are more apparent on the demand side. While State, Market, and the Consumer perceive Health & Safety equally relevant to each other and the mean perceived relevance the Scientific Community and Civil Society perceive this main social aspect clearly unequally relevant. Though Civil Society perceives Health & Safety the most relevant main social aspect compared to other main social aspects the perceived relevance towards detailed sustainability aspects show no large differences compared to State and Market. The Scientific Community's perceived relevance, however, corresponds more with the perceived relevance of the detailed sustainability aspects. The Scientific Community perceives Health & Safety considerable less relevant and accordingly perceives all detailed sustainability aspects less relevant.

Differences between societal spheres and their counterparts can be distinguished for all societal spheres. However, the difference between both Markets and States correspond with the mean perceived relevance and are considerably less than the differences between Civil Society and its counterpart, though corresponding with the mean perceived relevance as well. The Scientific Community deviates mostly from its counterpart. Moreover, this difference in relevance is not corresponding with the mean perceived relevance toward Health & Safety.

### *Training & Education*

The supply side perceives Training & Education more relevant for improving the sustainability performance of the supply chain than the demand side does. Societal spheres on the supply side perceive Training & Education as equally relevant. The only outlier is Civil Society, perceiving Training & Education considerably more relevant. When examining Civil Society's

#### **Detailed Sustainability Aspects: Training & Education**

- a53. Health and Safety training for employees*
- a54. On job training for employee skill development*
- a55. The opportunity for employees to develop through education and training outside the work place*
- a56. Opportunities for employees regarding job promotions within the supply chain*
- a57. Increasing the level of adult education in the community in which the supply chain operates*
- a58. Increasing the level of child education in the community in which the supply chain operates*

perception towards the relevance of the detailed sustainability aspects it can be determined that each of these are considered considerably relevant for enhancing the sustainability performance. However, the other societal spheres perceive these detailed sustainability aspects only slightly less relevant.

The demand side presents a slight deviation between perceptions of societal spheres. Civil Society and Market perceive Training & Education slightly more relevant compared to the mean perceived relevance while the Consumer, Scientific Community and State perceive this main social aspect slightly less relevant. Furthermore, Civil Society and Market also perceive the detailed sustainability aspects more relevant opposed to the other societal spheres. Moreover, Market perceives Training & Education like Health & Safety the most relevant main social aspect.

Differences between societal spheres and their counterparts can be observed. Even though a considerable difference can be observed between Civil Societies is this difference, similar as the difference between the Scientific Communities and States, corresponding with the mean perceived relevance. The difference in perceived relevance between Market on the supply- and demand side does not correspond with the mean perceived relevance; however, this difference is marginal.

### *Social Capital: Coherence & Trust*

Social Capital is perceived more relevant by the demand side than the supply side.

Not all societal spheres on the supply side perceive social capital equally relevant. However, differences are not extensive. Most deviating from the mean perceived relevance are State, perceiving this main social aspect most relevant, and the Scientific Community, perceiving Social Capital least relevant. Both Market and the Civil Society perceive Social Capital similarly relevant as the main perceived relevance. Even though State perceives Social Capital more relevant State's perceptions towards the relevance of the detailed sustainability aspects does not correspond with that perception. All other societal spheres perceive these detailed sustainability aspect equally or more relevant. However, these sustainability aspects are perceived less relevant by the Scientific Community opposed to Market and Civil Society who perceive these aspects considerably relevant.

The Scientific Community and the Consumer can be recognized as outliers on the demand side while the other societal spheres' perception is similar to the mean perceived relevance. While the Scientific Community perceives Social Capital considerable relevant for improving the sustainability performance of the supply chain the Consumer regards this aspects the least relevant. Even though the Scientific Community perceives the detailed sustainability aspect correspondingly relevant as well, these aspects are also perceived equally or more relevant by the other societal spheres. While State perceives Social Capital equally relevant differences between other societal spheres and their counterpart on the opposite of the chain can be distinguished. Differences are most apparent for the Scientific Community. The Scientific Community on the supply side perceives Social Capital least relevant while this aspect is perceived most relevant by the Scientific Community on the demand side. Smaller, though still noticeable, are the differences between Market and Civil Society and their counterparts on the opposite of the supply chain. All differences are, however, corresponding with the mean perceived relevance.

The Scientific Community and the Consumer can be recognized as outliers on the demand side while the other societal spheres' perception is similar to the mean perceived relevance. While the Scientific Community perceives Social Capital considerable relevant for improving the sustainability performance of the supply chain the Consumer regards this aspects the least relevant. Even though the Scientific Community perceives the detailed sustainability aspect correspondingly relevant as well, these aspects are also perceived equally or more relevant by the other societal spheres.

While State perceives Social Capital equally relevant differences between other societal spheres and their counterpart on the opposite of the chain can be distinguished. Differences are most apparent for the Scientific Community. The Scientific Community on the supply side perceives Social Capital least relevant while this aspect is perceived most relevant by the Scientific Community on the demand side. Smaller, though still noticeable, are the differences between Market and Civil Society and their counterparts on the opposite of the supply chain. All differences are, however, corresponding with the mean perceived relevance.

#### **Detailed Sustainability Aspects: Social Capital**

- a59. Collective bargaining
- a60. The freedom of association
- a61. Cooperation of Market with Government and Society to improve the sustainability performance of the supply chain and its processes
- a62. Information sharing among supply chain actors
- a63. Information sharing with the public
- a64. The involvement of employees in chain improvement processes
- a65. Open communication with, and transparency towards, chain actors
- a66. Promoting and communicating ethical, environmental and financial integrity throughout the chain
- a67. Ensuring ethical, environmental and financial integrity within the chain

### *Physical Capital*

The demand side perceives Physical Capital slightly more relevant than the supply side. Remarkably the societal spheres on the supply side perceive Physical Capital equally relevant as Social Capital. Compared to the mean perceived relevance are State and the Scientific Community again the outliers while Market and Civil Society's perception similar as the mean perceived relevance. Nevertheless, if the detailed sustainability aspects are examined it cannot be concluded that State perceives these detailed sustainability aspects considerably more relevant opposed to the other societal spheres, nor could be concluded that the Scientific Community perceives these detailed sustainability aspects less relevant.

On the demand side the perceptions differ towards the relevance of Physical Capital more extensively. Consumer, Scientific Community and Civil Society deviate most from the mean perceived relevance. Even though the Consumer and the Scientific Community perceive Physical Capital more relevant for attaining a more sustainable supply chain the Scientific Community considers the detailed sustainability aspects not considerably relevant. Civil Society, perceiving this main social aspect the least relevant of all main social aspects perceives the detailed sustainability aspects not relevant either, however, not considerably less relevant than the Scientific Community or Market. In

#### **Detailed Sustainability Aspects: Physical Capital**

- a68. Availability of housing for employees in the supply chain
- a69. Availability of mobility infrastructure to increase accessibility to the community employees live in
- a70. Availability of mobility infrastructure to increase accessibility for the supply chain
- a71. Access to tools and equipment to increase the efficiency of supply chain processes
- a72. Access to tools and equipment to improve working conditions in the supply chain

additional should be mentioned that State perceives the detailed sustainability aspects a70, a71, and a72 very relevant for improving the sustainability performance regarding Physical Capital. Differences between societal spheres and their counterparts can be noticed for each societal sphere except Market. Difference is largest between the Scientific Community, though in correspondence with the mean perceived relevance. Societal spheres differing from their counterparts and not corresponding with the mean perceived relevance are State and Civil Society.

### *Consumer Interest*

Consumer Interest is perceived most relevant by the demand side of the supply chain.

For the societal spheres on the supply side are two societal spheres deviating considerable from the mean perceived relevance. State

**Detailed Sustainability Aspects: Consumer Interest**

a73. Consumer safety of products

a74. Customer complaints regarding the product or the production process

a75. Providing the consumer with environmental and social sustainability information on the product and its processes

regards Consumer Interest the most relevant main social aspect while Civil Society considers Consumer Interest one of the least relevant main social aspects for improving the sustainability performance of the supply chain. However, when detailed sustainability aspects are observed not only State perceives these aspects very relevant, other societal spheres do so as well. Civil Society, however, excludes a74 as relevant considering this aspect only to be slightly relevant for improving the sustainability performance of the supply chain.

The societal spheres on the demand side perceive Consumer Interest more unequally relevant compared to the societal spheres on the supply side. Only State perceives Consumer Interest equally relevant as the mean perceived relevance, however, equal to Health & Safety also the most relevant of all main social aspects. Obvious outliers are Civil Society and the Consumer. But the Scientific Community and Market deviate substantially from the mean perceived relevance as well. The Scientific Community considers Consumer Interest more relevant while the consumer regards this the most relevant main social aspect. Though, the Scientific Community does not perceive any of the detailed sustainability aspects considerably more relevant. Civil Society and Market, considering Consumer Interest less relevant compared to the other societal spheres, have a similar perception towards the relevance of the detailed sustainability aspects. However, State, regarding Consumer Interest as one of the most relevant main social aspects, perceives all detailed sustainability aspects very relevant for the sustainability performance of the supply chain.

All societal spheres differ in perception from their counterparts on the opposite side of the chain. However, none of them, except the Scientific Community, differ corresponding with the mean perceived relevance. Hence the largest difference in perception between counterparts can be found for the Scientific Community. The Smallest difference in perception can be observed between States.

### *Results: relevance main social sustainability aspects*

The supply- as well as the demand side perceives Health & Safety a considerable relevant social sustainability aspect. The supply side however considers Training & Education most relevant while the demand side additionally regards Consumer Interest considerably relevant for improving the social performance of the supply chain.

As hypothesised [h2] societal spheres on each side of the supply chain do differ in perceived relevance from each other. However, this difference is less extensive on the supply side than on the demand side. On the demand side the Scientific Community, Civil Society and the Consumer have most outlying perceptions; subsequently, often don't agree on the relevance of the difference main social sustainability aspects. Hence, societal spheres on the demand side perceive social sustainability aspects more often unequally relevant opposed to their equivalents on the supply side. Societal Spheres on the supply side do deviate in perceived relevance, however, all societal spheres do perceive those main social sustainability aspects perceived most relevant most relevant.

As assumed [h3] differences in perceived relevance between societal spheres and their counterparts can also be observed. These differences are both corresponding and not corresponding with the mean perceived relevance. However, even if differences in perceived relevance are observed it does

not always imply an unequal perception towards the relevance of the main social aspects. However, even if large differences can be observed social sustainability aspects are often perceived similarly relevant. Though, observable Civil Society and the Scientific Community often deviate most from each other's perception. Moreover, differences in perceived relevance appear to be larger between societal spheres operating on the same side of the supply side than between societal spheres and their counterparts on the opposite of the supply chain.

The outlying perceptions societal spheres have towards the relevance of some main social sustainability aspects can often not be explained by their perception towards the relevance of the detailed sustainability aspects. The detailed sustainability aspects for each main social aspect are in general perceived relevant even if the main social aspect is perceived less relevant. It seems, as with the environmental aspect, that these perceptions are detached from each other.

#### 6.2.2.2 *Relevant supply chain sections for improving main social aspects*

In the next section, it is for each main social aspect determined [b2a] which sections of the South African – European wine supply chain are perceived relevant to improve the environmental performance of the supply chain. Subsequently is concluded if [h4] societal spheres on both sides of the supply chain perceive supply side sections as most relevant for improvement, and if societal spheres on the supply side perceive sections on the demand side more relevant while societal spheres on the demand side perceive sections on the supply side more relevant. The graphs depicting the mean perceived relevance of the supply- and demand side and the perceived relevance of each societal sphere can be found in appendix VIII.

#### *Employment*

Both the supply- and the demand side consider sections on the supply side more relevant for improving the supply chain's sustainability performance regarding Employment. Nonetheless, the supply side perceives these sections more relevant than the demand side, even if this difference is marginal. The demand side sections Disposal and Consumer are also considered more relevant by the supply side while Shipping and Importer/Retailer are perceived more relevant by the demand side.

The societal spheres on the supply side perceive the sections on the supply side and the section Consumer and Disposal equally or more relevant than their counterparts on the demand side. However, an exception can be observed. State on the demand side perceives the Winery more relevant than its equivalent on the opposite side of the supply chain. Though Shipping and Importer/Retailer are considered more relevant by the demand side these sections are considered more relevant by State and Market on the supply side.

#### *Health & Safety*

Both, the supply- as well as the demand side, consider the sections on the supply side of the supply chain more relevant for enhancing Health & Safety than sections on the demand side. The Winery and Wine Cellar/Exporter are perceived more relevant by the supply side. However, the Vineyard is perceived slightly more relevant by the demand side. A similar observation can be made for Shipping. Sections on the demand side are all perceived more relevant by the supply side.

For sections on the supply side the perceived relevance of the societal spheres correspond with the mean perceived applicability. The Vineyard is perceived slightly more relevant by Market on the demand side and equally relevant by the other societal spheres. However, for the Winery and Wine Cellar/Exporter some deviating perceptions can be observed. Though most societal spheres on the supply side perceive these sections more or equally relevant than their counterparts the Winery is considered slightly more relevant by Market on the demand side. Furthermore, State on the demand side perceives the Wine Cellar/Exporter considerably more relevant opposed to its counterpart on the supply side.

Shipping, which is perceived slightly more at the demand side, shows a large variation in perceived applicability. Because Civil Society considers Shipping not relevant for improvements regarding

Health & Safety can it be explained why all the other societal spheres on the supply side perceive this aspect more relevant than their equivalents on the demand side.

The societal spheres on the supply side perceive sections on the demand side equally or more relevant compared to the societal spheres on the demand side. However, an exception can be noticed for Civil Society, considering none of the sections on the demand side nor Shipping relevant while Shipping and the Importer/Retailer is perceived considerable relevant by Civil Society on the demand side.

#### *Training & Education*

Not only the sections on the demand side are perceived more relevant by the supply side, the sections on the supply side and Shipping are perceived more relevant as well. However, the difference in perceived relevance is considerably smaller for sections on the supply side and for Shipping. The perceived relevance of the societal spheres in general corresponds with the mean perceived relevance of their respective side of the supply chain. However, societal sphere perceptions deviating from that mean perceived relevance are present.

Opposed to their counterparts is the Vineyard perceived slightly more relevant by Market on the demand side and is the Wine Cellar/Exporter perceived considerably more relevant by State on the demand side. Additionally, Shipping is perceived more relevant by State on the demand side compared to its counterpart. The sections on the supply side are, corresponding with the mean perceived relevance, perceived more relevant by the societal spheres on the supply side.

#### *Social Capital: Coherence & Trust*

Improving the sustainability performance of the supply chain regarding Social Capital is considered most relevant for sections on the supply side and the Importer/Retailer. However, the Vineyard, Winery and Disposal are perceived slightly more relevant by the demand side while remaining sections are perceived more relevant by the supply side. Societal spheres in general correspond with the mean perceived relevance, though deviations can be observed.

For both the Vineyard and Winery, the Scientific Community deviates from the mean perceived applicability. The Scientific Community on the demand side perceive these sections less relevant than its counterpart. Shipping is perceived more relevant by the Market and Civil Society on the demand side. Deviations from the mean perceived relevance on the demand side can be observed for the Importer/Retailer, this section is considered slightly more relevant by the Civil Society on the demand side. Moreover, the Consumer is perceived more applicable by Market and Civil Society on the demand side while disposal is considered more relevant by State on the supply side. Additionally, State on the supply side perceives all sections on the demand side and Shipping equally relevant for improvements regarding Social Capital than sections on the supply side.

#### *Physical Capital*

Improvements regarding Physical Capital are most relevant for the sections on the supply side. Though deviating only slightly from each other is the Vineyard perceived more relevant by the demand side while the Winery and Wine Cellar/Exporter is perceived more relevant by the supply side. Even though societal spheres perceive the sections relevant corresponding with the mean perceived relevance or equal to their counterparts, some deviating perceptions can be observed.

The Vineyard is perceived more relevant by the Scientific Community on the supply side. Both Market and State on the demand side perceive the Winery more relevant while State on the demand side perceives the Wine Cellar/Exporter more relevant as well. Shipping is perceived more relevant by Civil Society on the demand side.

For sections on the demand side only Disposal presents a deviating perception from the mean perceived relevance. The Scientific Community on the demand side perceives this section more slightly relevant than its counterpart.

### *Consumer Interest*

The section that is perceived most relevant for improvements regarding Consumer Interest is the Importer/Retailer. Moreover, the Winery is perceived considerable relevant by the demand side, whereas the Wine Cellar/Exporter is considered more applicable for improvements by the supply side. However, it is also noticeable that the demand side perceives all sections, except the Wine Cellar/Exporter, more relevant for improving the sustainability performance opposed to the supply side. While most of the individual societal spheres correspond with this mean perception, or perceive sections equally relevant as their counterparts, some deviations can be observed.

The Wine Cellar/Exporter is perceived more relevant by the Scientific Community on the demand side whereas the Scientific Community on the supply side considers the Consumer very relevant. Furthermore, the Market on the supply side considers Importer/Retailer more relevant than its counterpart.

What is remarkable is the perception of State towards Consumer Interest. On both sides of the supply chain State perceives all sections 100% relevant, except the Consumer. The Consumer is perceived less relevant, though only by State on the supply side.

### *Results: relevance supply chain sections for improving main social aspects*

As hypothesised [h4], both the supply- as well as the demand side perceives sections on the supply side as generally more relevant for improving the main social aspects. However, deviations in perception can be noticed for some of the main social aspects. The Importer/Retailer is perceived a considerable relevant section as well when enhancing the social sustainability performance regarding Social Capital and Consumer Interest. Moreover, the sections Shipping, regarding Employment, and the Consumer, regarding Consumer Interest, are considered relevant sections for improving the supply chain's social sustainability performance. It can, however, not be demonstrated that the demand side structurally regards sections on the supply side more relevant. Nonetheless, the supply side considers sections on the demand side more relevant for improvement. An exception can be noted for Consumer Interest. For this main social aspect are the sections on the demand side perceived more relevant for improving the social sustainability performance by the demand side.

Though societal spheres usually correspond with the mean perceived relevance they deviate for some of the sections. Therefore, it cannot be concluded that the hypothesis is completely verifiable. Even if sections on the supply chain are, in general, perceived more relevant a clear distinction is observable for Consumer Capital. For Consumer Capital, societal spheres, both on the supply- as well as the demand side, perceive sections on the supply side more relevant. Moreover, for other main social aspects it can be observed that sections on the demand side are perceived equally relevant as sections on the supply side. As it can not be concluded that the demand side perceives sections on the supply side more relevant compared to the supply side's opinion, consequently it cannot be concluded that all societal spheres on the demand side perceive sections on the supply side more relevant. Sections on the supply side are perceived equally relevant by societal spheres on both sides but societal spheres on the supply side perceive sections for some of the main social aspects more relevant than their counterparts do. The same conclusions can be made for sections on the demand side. In general, societal spheres on the supply side perceive these main social aspects more relevant for improvement. However, for some of the main social aspects can be observed that sections are perceived equally relevant or more relevant by societal spheres on the demand side. However no deviating pattern can be distinguished regarding the hypothesis.

#### *6.2.2.3 Responsibility improving main social aspects*

In the following section it is determined [b2b] which societal sphere, or combination of societal spheres, is considered most responsible for improving the sustainability performance of the South African – European wine supply chain and [h5] if the societal spheres on the supply side assign most responsibility to state while the societal spheres on the demand side assign this responsibility to partnerships. The graphs depicting the mean perceived responsibility of the demand and supply side and the perceptions of each societal sphere can be found in appendix XI.

*Employment*

The responsibility to improve the sustainability performance of the supply chain regarding Employment is on both sides of the supply chain mainly assigned to a State/Market/Civil Society partnership. Furthermore, the demand side assigns considerable responsibility to Market while the supply side considers State and a State/Market partnership to have some responsibility as well. However, societal spheres do deviate from the mean perceived applicability of their respective side of the supply chain.

Civil Society on the supply side perceives a State/Market partnership and State most responsible respectively and considers a State/Market/Civil Society partnership not responsible at all. Market perceives besides a State/Market/Civil Society partnership a State/Market Partnership responsible as well.

On the demand side the Scientific Community and Market mainly perceive a State/Market/Civil Society partnership responsible. State and Civil Society assign more responsibility to Market. However, State considers Market solely responsible while Civil Society divides this responsibility mainly between a Market/Civil Society partnership and a State/Market partnership.

*Health & Safety*

The supply side mainly assigns responsibility to enhance the sustainability performance regarding Health & Safety to a State/Market/Civil Society partnership and a State/Market partnership respectively. A similar observation can be made for the demand side, however, both partnerships are perceived equally responsible. A more profound look at the societal spheres shows some differences from the mean perceived applicability.

The Scientific Community on the supply side considers a State/Market/Civil Society partnership solely responsible for sustainability issues regarding Health & Safety while Civil Society perceives this partnership not responsible at all. Civil Society considers a State/Market partnership mainly responsible.

On the demand side similar differences can be distinguished. State and Civil Society consider a State/Market/Civil Society partnership not at all responsible. While State perceives Market solely responsible it divides Civil Society responsibility between Market, as State/Market partnership, and a Market/Civil Society partnership, assigning most responsibility to the latter. The Scientific Community considers a State/Market/Civil Society partnership solely responsible. Though Market assigns considerable responsibility to State/Market/Civil Society partnership it perceived a State/Market partnership more responsible, while assigning little responsibility to itself.

*Training & Education*

The supply side perceives a State/Market/Civil Society partnership mainly responsible and to a lesser extent Market and a State/Market partnership. The demand side considers Market mainly responsible but assigns considerable responsibility to a State/Market/Civil Society partnership as well. However, some societal spheres on each side of the supply chain deviate from the mean perceived responsibility.

On the supply side Civil Society deviates most obviously, assigning no responsibility to a State/Market/Civil Society partnership, however, regarding Market and a State/Market partnership most responsible respectively. The Scientific Community exclusively considers a State/Market/Civil Society partnership responsible, regarding no other societal spheres or partnerships responsible at all.

On the demand side State considers Market solely responsible. Even though the other societal spheres assign considerable responsibility to Market, the Scientific Community and Civil Society perceive a State/Market/Civil Society partnership more responsible. Market, however, perceives State/Market/Civil Society partnership slightly less responsible than Market.

*Social Capital: Coherence and Trust*

Both sides of the supply chain consider a State/Market/Civil Society partnership most responsible for enhancing the sustainability performance regarding Social Capital. However, Market and a Market/Civil Society partnership are considered to have some responsibility as well.

On the supply side it is only Civil Society deviating from the mean perceived responsibility. Civil Society considers Market more responsible and perceives a Market/Civil Society partnership equally responsible as State/Market/Civil Society partnership. Even though the Scientific Community perceives a State/Market/Civil Society partnership most responsible a Market/Civil Society partnership is considered substantially responsible as well. Market on the other hand perceives next to a State/Market/Civil Society partnership Market responsible and assigns only minor responsibility to a Market/Civil Society partnership.

On the demand side variations in perceived responsibility can be observed as well. The Scientific Community deviates most from the mean perceived responsibility, assigning most responsibility to a State/Market partnership and subsequently to Market and a Market/Civil Society partnership. State considers Market and a Market/Civil Society partnership to be mainly responsible instead of a State/Market/Civil Society partnership.

*Physical Capital*

The main responsibility for improvements regarding Physical Capital is on the demand side assigned to a State/Market/Civil Society partnership and to a lesser degree Market. On the supply side this responsibility is more divided. Most responsibility is assigned to a State/Market/Civil Society partnership while State, a State/Market partnership and a Market/Civil Society partnership are assigned almost equal responsibility.

The societal spheres on the supply side perceive responsibility rather unequally. State considers a State/Market/Civil Society partnership most responsible while assigning some responsibility to a State/Market partnership. The Scientific Community considers a Market/Civil Society partnership most responsible followed by a State/Market/Civil Society partnership. A State/Market partnership and State are perceived most responsible according Market and Civil Society.

On the supply side State perceives the State/Market/Civil Society partnership to be solely responsible while Civil Society assigns no responsibility to this partnership. Civil Society perceives Market and a Market/Civil Society partnership most responsible respectively. Both Market and the Scientific Community deviate slightly. The Scientific Community perceives a State/Market/Civil Society partnership, a State/Market partnership, and Market equally responsible. Market considers a State/Market partnership mainly responsible while assigning equal responsibility to Market and a State/Market/Civil Society partnership.

*Consumer Interest*

Both sides of the supply chain perceive the Market to be mainly responsible for improvements regarding Consumer Interest increasing the sustainability performance of the supply chain.

The societal spheres on the supply side, however, assign responsibility differently. State regards a State/Market/Civil Society partnership most responsible while assigning equal responsibility to Market, a State/Market, and a State/Market/Civil Society partnership. Market assigns considerable responsibility to itself, however, it perceives a State/Market/Civil Society partnership to be mainly responsible. Civil Society assigns most responsibility to a State/Market partnership and to a lesser degree to Market. The Scientific Community considers Market equally responsible as a Market/Civil Society partnership.

On the demand side responsibility is similarly divided. Nonetheless, State considers Market solely responsible. However, the Scientific Community perceives Market mainly responsible while equally dividing considerable responsibility between a State/Market partnership, a Market/Civil Society partnership, and a State/Market/Civil Society partnership. Civil Society considers, Market, a State/Market partnership, and a State/Market/Civil Society partnership equally responsible. Market

assigns most responsibility to a State/Market/Civil Society partnership, however, considering a State/Market partnership and Market considerably responsible as well.

*Results: responsibility main social aspects*

Similarly to the perceived responsibility for improving main environmental aspects it must be concluded that the supply side does not perceive State the main responsible party to improve the social sustainability performance of the supply chain. Most responsibility is assigned to a State/Market/Civil Society partnership for all main social aspects except Consumer Interest, which is considered mainly Market's responsibility. However, societal spheres do deviate from the mean perceived relevance. Though, State is never perceived most responsible by either one of the societal spheres Civil Society, Market, and the Scientific Community consider State/Market partnerships and Market/Civil Society partnerships most responsible for some of the main social aspects.

The demand side considers a State/Market/Civil Society partnership most responsible for main social aspects like Employment, Social Capital and Physical Capital for the remaining main social aspects Market is considered most responsible. The assigned responsibility is more divided and depends on the main social aspect if it is assigned to a partnership of Market. Societal spheres deviate similarly, assigning responsibility for some of the main social aspects responsibility to a State/Market/Civil Society partnership or a State/Market partnership, while for other main social aspects Market is considered to be responsibility. However, individual societal spheres more often assign responsibility to partnerships. Hence, it can be concluded that the societal spheres on the demand side consider a partnership more responsible for improving the social performance of the supply chain, however, not all societal spheres do agree for all main social aspects. Hence, the hypothesis [h5] is falsified for the supply side but not for the demand side as most responsibility is assigned to partnerships.

*6.2.3 Perceptions on a main socio-economic aspect level*

In the forthcoming sections are the perceptions of societal spheres described for the main socio-economic aspects. Perceptions are determined between societal spheres on the supply as well as the demand side. Additionally perceptions of societal spheres are compared to their counterparts on the opposite side of the supply chain. The largest differences in perception are described using the mean relevance of the supply sides as a benchmark. In subsequent order are the perceptions towards the relevance, applicability, and responsibility determined.

*6.2.3.1 Perceived relevance for main socio-economic aspects*

To conclude if [h2] societal spheres operating on the same side of the supply chain differ extensively in perception towards relevance of the (socio-economic) sustainability aspects for improving the sustainability performance of the supply, and if [h3] societal spheres on the demand side differ extensively in perception towards relevance of the (socio-economic) sustainability aspects for improving the sustainability performance of the supply chain, as opposed to their counterparts on the supply side will the subsequent section determine [b2] which main socio-economic aspect societal spheres perceive to be most relevant for improving the socio-economic sustainability performance of the supply chain.

Even though the difference in mean perceived relevance can be observed between the supply- and the demand side these differences are rather small (figure 6.11). However, both sides of the supply chain perceive Wages and Social Safety Net either most or second most relevant for the sustainability performance of the wine supply chain. Moreover, it can be concluded that the supply side perceives Trade & Finance the least relevant main socio-economic aspect while the demand side perceives Community Prosperity the least relevant main socio-economic aspects.

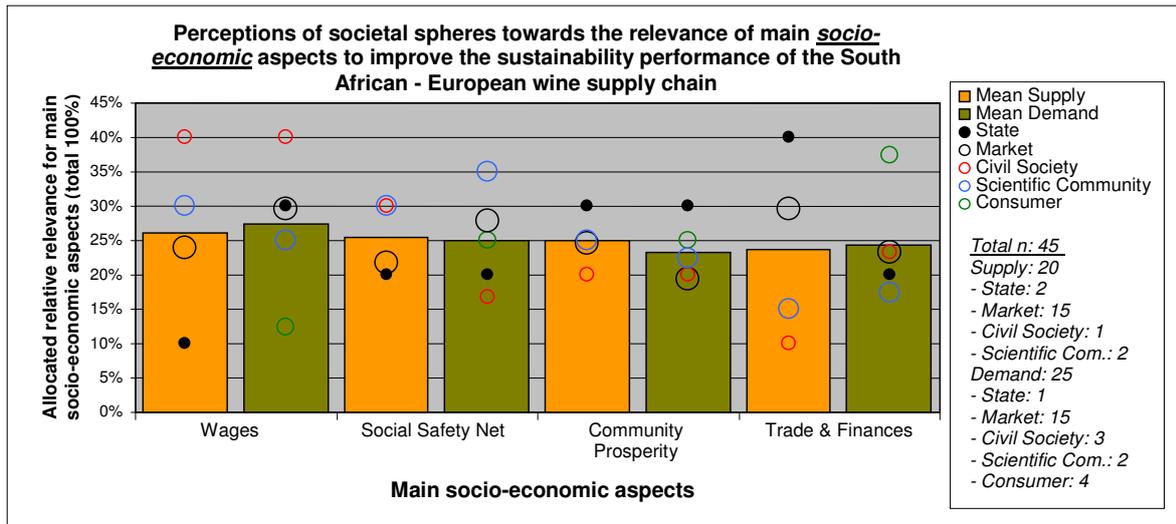


Figure 6.11: Perceptions of societal sphere towards the relevance of main socio-economic aspects

Even though differences in perceived relevance between supply sides are almost negligible; differences between societal spheres are larger. The remainder of this section analyses for each main socio-economic aspect, the difference in perceived relevance between societal spheres.

### Wages

In figure 6.11 can be seen that the demand side perceives the main socio-economic aspect Wages slightly more relevant opposed to the supply side. Moreover, difference in perceptions can be clearly noticed between societal spheres on the supply side. While the Scientific Community's and Market's perception are closely corresponding with the mean perceived relevance Civil Society and State are outliers. Civil Society perceives Wages the most relevant, while State perceives Wages the least relevant of all main socio-economic aspects. This deviation in perception can be recognized in the perception towards the relevance of the detailed sustainability aspects.

#### **Detailed Sustainability Aspects: Wages**

- a76. The wage level of employees in the supply chain
- a77. The compensation employees receive for overtime
- a78. The written particulars of employment and remunerations
- a79. The regular payment of wages

State perceives these aspects hardly relevant while Civil Society and also the Scientific Community perceive these aspects very relevant. Market's perception on these aspects corresponds with its perception towards the relevance of Wages, perceiving these aspects relevant though less as Civil Society and the Scientific Community but more than Market.

Wages is perceived unequally relevant on the demand side as well. Though State, Market and the Scientific Community perception deviate slightly from the mean perceived relevance the Consumer and Civil Society deviate substantially. Civil Society and Market consider Wages the most relevant main socio-economic aspect compared to all others. The Consumer, however, regards Wages the least relevant of all other main socio-economic aspects. Looking at the perceived relevance of the detailed sustainability aspects shows that Civil Society considers these aspects somewhat more relevant opposed to Market and the Scientific Community, however, State perceives these aspects the most relevant.

Civil Society on the supply side perceives Wages equally relevant as does its counterpart on the demand side. However, differences in perceived relevance between societal spheres and their counterparts can be observed for other societal spheres, though, most noticeable for State. State on the supply side perceives Wages clearly less relevant than its counterpart.

### *Social Safety Net*

Differences in perception between the supply- and the demand side towards the relevance of the Social Safety Net are almost negligible (figure 6.11). However, societal spheres do perceive this main socio-economic aspect somewhat more unequally from each other. On the supply side both State and Market perceive the Social Safety Net similar relevant, though less than the mean perceived relevance. Civil Society and the Scientific Community perceive the Social Safety Net equally relevant. Moreover, both perceive them more relevant than the mean perceived relevance. This alone means perceived relevance can be recognized when examining the detailed sustainability aspects. Both Civil Society and the Scientific Community perceive these aspects considerably relevant for the sustainability performance of the supply chain. However, Market regards these aspects noticeably relevant as well while State only perceived a82 to a84 relevant.

#### **Detailed Sustainability Aspects: Social Safety Net**

- a80. Unemployment benefits
- a81. Paid maternity leave for women working in the supply chain
- a82. Old-Age pensions for people who have worked in the supply chain
- a83. Disability benefits for employees injured in the supply chain
- a84. Illness / temporary disability benefits for employees injured in the supply chain
- a85. Social grants/welfare for employees in the supply chain unable to meet the needs of their family

Two outliers can be detected on the demand side. The Scientific Community, perceiving the Social Safety Net the most relevant of all main socio-economic aspects and Civil Society, perceiving this the least relevant of all main socio-economic aspects. However, if all the detailed sustainability aspects are examined, no crucial differences in perceived relevance can be noticed. All societal spheres, regarding their perception towards the main socio-economic aspects Social Safety Net consider the detailed sustainability aspects equally relevant.

State on the supply- and demand side perceives the Social Safety Net equally relevant. However, for the other societal spheres differences with their counterparts can be concluded. Largest difference exists between Civil Society, perceived considerably more relevant at the supply side. Smaller, though still noticeable is the difference in perceived relevance between the other societal spheres and their counterparts.

### *Community Prosperity*

Figure 6.11 demonstrates that Community Prosperity is perceived slightly more relevant by the supply side. State and Civil Society deviate most from the mean perceived relevance. However, deviations in perceived relevance are not very extensive. If the detailed sustainability aspects are observed it can be noticed that State, in correspondence with its perception on the main aspect, perceives the detailed sustainability aspects considerably more relevant. However, the Scientific Community perceives these aspects slightly more relevant than State, while perceiving Community Prosperity less relevant. Market perceives the detailed sustainability aspects relevant as well. Civil Society, perceiving Community Prosperity less relevant opposed to the mean perceived relevance, perceives detailed sustainability aspect a88 and a89 relevant for improving the sustainability performance of the supply chain. However, a86 and a87 are perceived considerably less relevant by Civil Society.

#### **Detailed Sustainability Aspects: Community Prosperity**

- a86. Number of employees from the community the supply chain operates in
- a87. Involving local and community business in supply chain processes
- a88. Monetary investments for community development
- a89. Monetary investments for environmental development

On the demand side, societal spheres deviate somewhat in perceived relevance. However, State's perception is removed furthest from the mean perceived relevance. State perceives Community Prosperity with the Social Safety Net the most relevant main socio-economic aspect for improving the sustainability performance. The remaining societal spheres perceive the relevance of Community Prosperity more equal to the mean perceived relevance. If detailed sustainability aspects are examined it can be concluded that State, in accordance with its perception towards Community Prosperity, perceives these detailed sustainability aspects, and especially a87 and a86, more relevant than the other societal spheres.

Societal spheres perceive Community prosperity quite similarly relevant to their counterparts. Still, differences in perceived relevance can be observed between Markets and the Scientific Community while both State and Civil Society perceive Community Prosperity equally relevant.

### *Trade & Finances*

In figure 6.11 it can be observed that the demand side perceives Trade & Finance slightly more relevant, as opposed to the supply side. The societal spheres on the supply side deviate largely in perceived relevance for Trade & Finances. Both the Scientific Community and Civil Society perceive this main socio-economic aspect clearly less relevant than the mean perceived relevance while Market and especially State perceives Trade & Finance considerably more relevant. Moreover, both State and Market consider Trade & Finances the most relevant main socio-economic aspect compared to the other main socio-economic aspects. Similar as to the observed deviation in perceived relevance of main socio-economic aspects, societal spheres perceive the detailed sustainability aspects unequally relevant for improving the sustainability performance of the supply chain. Market perceives all detailed aspects relevant but the other societal spheres deviate in relevance, perceiving sustainability aspects unequally relevant for the sustainability performance of the supply chain. Detailed sustainability aspects perceived relevant by all societal spheres are a90 and a95.

#### **Detailed Sustainability Aspects: Trade & Finances**

- a90. The allocation of value generated by companies in the supply chain
- a91. The allocation of financial risks for market actors in supply chain
- a92. The integration of externalized costs, like environmental damage, in product price
- a93. Absence of protective trade barriers in international trade
- a94. Absence of competition disrupting subsidies
- a95. Partner investments to develop company and community performance
- a96. External financing from outside the supply chain to develop company and community performance

On the demand side the Consumer is clearly deviating from the mean perceived relevance, perceiving Trade & Finances the most relevant socio-economic aspect. The perceptions of the other societal spheres deviate less from each other and the mean perceived relevance. Though slight differences are apparent, the Scientific Community considers Trade & Finances the least relevant main socio-economic aspect. If the detailed sustainability aspects are observed this can also be noticed. The other societal spheres perceive detailed sustainability aspects unequally relevant for improving the sustainability performance of the supply chain.

All societal spheres differ in perceived relevance from their counterpart. However, largest differences can be found between Civil Society and State. Civil Society on the supply side perceives Trade & Finance considerably less relevant than its counterpart. Trade & Finances is considered considerably relevant by State on the supply side, however, noticeably less by its counterpart on the demand side. The detailed sustainability aspects a93 and a94 are often seen as relevant also acknowledged to have benefits for the economy. However, in most cases it is believed that trade barriers and subsidies are more an advantage for the European Market than the South African.

### *Results: relevance main socio-economic aspects*

Even if slight deviations can be noticed main socio-economic aspects are considered equally relevant compared to each other and compared between supply- and demand side.

Differences in perceived relevance can be noticed between societal spheres for all main socio-economic aspects. However, they are most obvious for the main social aspect Wages and Trade & Finance while societal spheres on the demand side perceive Social Safety Net rather unequally relevant as well. Since the mean perceived relevance on both sides is rather equal small variations in perceived relevance indicate that societal spheres perceive main socio-economic sustainability aspects unequally relevant. The hypothesis [h2] can therefore be proven for the main socio-economic aspects.

Differences in perceived relevance between societal spheres and their counterparts appear corresponding and not corresponding with the mean perceived relevance. However, societal spheres in general do not deviate extensively. Most deviating are; State, for Wages and Trade & Finances, and Civil Society, for Social Safety Net and Trade and Finances. Hence, the hypothesis [h3] can be proven. Though, in general societal spheres do not extensively differ in their perception towards the relevance of socio-economic aspects to improve the socio-economic performance of the supply chain. The differences in perceived relevance appear to be larger between societal spheres operating on the same side of the supply side than between societal spheres and their counterparts on the opposite of the supply chain.

Similar to the main environmental aspects and the main social aspects perceptions towards the relevance of the detailed socio-economic aspects demonstrate no large differences that explain outlying perceptions for the main socio-economic aspect.

### 6.2.3.2 *Relevant supply chain sections for main socio-economic aspects*

In the coming section it is for each main social aspect determined [b2a] which sections of the South African – European wine supply chain are perceived relevant to improve the environmental performance of the supply chain. Subsequently it will be concluded if [h4] societal spheres on both side of the supply chain perceive supply side sections most relevant for improvement, and if societal spheres on the supply side perceive sections on the demand side more relevant while societal spheres on the demand side perceive sections on the supply side more relevant. The graphs depicting the mean perceived relevance of the supply- and demand side and the perceived relevance of each societal sphere can be found in appendix IX.

#### *Wages*

Both the supply- and the demand side perceive the sections on the supply side most relevant for improving sustainability aspects regarding Wages. Though, the Vineyard and Wine Cellar/Exporter is perceived slightly more relevant by the demand side while the supply side perceives the Winery slightly more relevant. Shipping at both sides is perceived more relevant than sections on the demand side, however, it is perceived slightly more relevant by the demand side. Sections on the demand side are perceived slightly more relevant by the demand side, except the Consumer which is not considered relevant at all by the demand side. The Vineyard and Winery are perceived relevant in correspondence with the mean perceived relevance. Larger deviations can be found for the Wine Cellar/Exporter, all societal spheres, except State, perceive this section more relevant for improvements than their counterparts. However State perceives the Wine Cellar/Exporter not relevant at all.

Market and especially Civil Society on the supply side perceive Shipping more relevant than their counterparts while the Scientific Community and State on the supply side perceive this section not relevant at all. Moreover, the Scientific Community on the demand side perceives Shipping considerably more relevant for improvements concerning wages than the Wine Cellar/Exporter. Importer/Retailer and Disposal are perceived not relevant by societal spheres on the supply side except Market. Market perceives these sections considerably more relevant than its counterpart and more relevant than Shipping. These sections are perceived more relevant by the demand side are, however, not perceived relevant by State. Moreover, the Scientific Community considers Disposal irrelevant for improvements. The Consumer is only perceived relevant by Market and the Scientific Community.

#### *Social Safety Net*

Sections on the supply side are considered more applicable for improvement than Shipping and sections on the demand side. However the Vineyard and Winery are perceived slightly more relevant by the demand side while the Wine Cellar/Exporter is considered more relevant by the supply side. Shipping and Disposal are also considered more relevant by the supply side while Importer/Retailer and Consumer are perceived more relevant by the demand side.

Sections on the supply side are perceived in correspondence with the mean perceived relevance or equally to their counterparts. However, a slight deviation from this mean perception can be noticed for Market on the demand side, perceiving the Wine Cellar/Exporter more relevant than Market on the supply side.

Civil Society and Market deviate from the mean perceived relevance for Shipping. Both societal spheres perceive this section more relevant than their counterparts.

State deviates from the mean perceived relevance for the Importer/Retailer and Consumer, perceiving these sections most relevant opposed to its counterparts. Moreover, the Scientific Community on the supply side perceives Importer/Retailer more relevant than Shipping and the

Wine Cellar/Exporter. The Market on the supply side deviates in perception for Disposal, perceiving this section more relevant than its counterpart. Moreover, it should be mentioned that State on the demand side not only perceives the sections on the supply side most relevant for improvement, sections on the demand side are considered equally relevant.

#### *Community Prosperity*

Both the supply- as well as the demand side perceives sections on the supply side more relevant for improvements to increase the sustainability performance of the supply chain regarding Community Prosperity. Differences in perceived relevance between the supply and demand can be observed for Vineyard and Wine Cellar/Exporter. The Vineyard is perceived more relevant while the Wine Cellar/Exporter is considered less relevant by the demand side, though these differences are marginal. Shipping and sections on the demand side are perceived more relevant by the supply side, though these differences are only marginal for Shipping and Disposal.

It can be observed that the Scientific Community on the supply side perceives sections on the supply side more relevant compared to its counterpart while Market on the supply side perceives these sections less relevant than its counterpart on the opposite side of the chain. However, the opposite can be observed for Wine Cellar/Exporter where the Market on the supply side and the Scientific Community on the demand side perceive this section more relevant opposed to their counterparts. Moreover, State and Civil Society perceive relevance of supply side sections equal to their counterparts.

State and the Scientific Community deviate from the mean perceived relevance. Both these societal spheres on the demand side perceive Shipping more relevant.

For sections on the demand side a deviation from the mean perceived relevance can only be observed for Disposal. Market on the demand side perceives Disposal more relevant than its counterpart. However, it should be mentioned that the Scientific Community on the supply side considers the Consumer the most relevant section in the supply chain for improving the sustainability performance regarding Community Prosperity.

#### *Trade & Finances*

Trade & Finances related sustainability issues are most applicable for sections on the supply side of the supply chain and the Importer/Retailer. These sections are perceived slightly more relevant by the demand side. However, Consumer and Disposal are perceived considerably more relevant by the demand side as well. Only Shipping is considered more relevant by the supply side.

For the sections on the supply side only the Scientific Community deviates from the mean perceived relevance. Both the Vineyard and Winery are considered more relevant by the Scientific Community on the supply side.

Perceptions of societal spheres on the supply and demand side towards the relevance of Shipping correspond with the mean perceived relevance or the relevance of Shipping is perceived equal compared to its counterpart.

Deviations from the mean perceived relevance for sections on the demand side can be observed for Market. Market on the supply side perceives the Importer/Retailer and the Consumer more relevant than its counterpart. Moreover, the Consumer is also perceived more relevant by the Scientific Community on the supply side compared to its counterpart.

Additionally, State considers all sections most relevant for improvements regarding Trade & Finances with the exception for Consumer. State on the supply side considers Consumer not relevant for improvement.

#### *Results: relevance supply chain sections for improving the main socio-economic aspects*

The supply- and the demand side consider sections on the supply side most relevant for improving the socio-economic sustainability performance of the supply chain. Though, the Vineyard and Winery are in general regarded more relevant than the Wine Cellar/Exporter. For the main socio-economic aspect Trade & Finances is the Wine Cellar/Exporter regarded equally relevant as the two other

sections on the supply side. Moreover, the Importer/Retailer is considered an important section for improving the socio-economic performance of the supply chain. Sections on the supply side are often perceived more relevant for improvement by the demand side though differences in perceived relevance between the supply- and demand side are not extensive. The supply side, however, does not consider sections on the demand side structurally more relevant for improving the socio-economic performance compared to the demand side's perception. Though, it can be noted that the demand side regards Disposal more relevant opposed to the supply side.

The societal spheres perceive sections on the supply side most relevant for improving the socio-economic performance of the supply chain. Moreover, societal spheres on demand side perceive sections on the supply side in general as slightly more relevant than their counterparts on the opposite side of the supply chain. However, deviations can be found, sections are often regarded equally relevant while for some socio-economic aspect sections on the supply side are perceived more relevant by societal spheres on the supply side.

The individual societal spheres on both the supply- as well as the demand side perceive sections on the supply side in general more relevant than the sections on the demand side. However, few deviations can be found perceiving Shipping or Importer/Retailer more relevant than the Wine Cellar/Exporter. Moreover, State and Civil Society regard some sections on the demand side as well as Shipping equally relevant to sections on the supply side. Additionally, it cannot be stated that sections on the demand side are considered more relevant by societal spheres on the supply side, as some societal spheres on the demand side regard these sections as more relevant or societal spheres perceive them equally relevant compared with their counterparts.

### 6.2.3.3 Responsibility improving main socio-economic aspects

In the following section it will be determined [b2b] which societal sphere, or combination of societal spheres, is considered most responsible for improving the sustainability performance of the South African – European wine supply chain, regarding the main socio-economic aspects. Subsequently it will be concluded [h5] whether the societal spheres on the supply side assign most responsibility to State or whether the societal spheres on the demand side assign this responsibility to partnerships. The graphs depicting the perceptions of the societal spheres and the mean perceived responsibility can be found in appendix XII.

#### Wages

The sustainability performance of the supply chain regarding Wages is on the supply side is perceived as mainly the responsibility of a State/Market/Civil Society partnership while the demand side consider the Market mainly responsible.

The perceptions of the societal spheres on the supply side do largely correspond with the mean perceived responsibility. However, Civil Society deviates mostly from this mean perception, perceiving a State/Market partnership mainly responsible while assigning considerable responsibility to State and Market. Market considers a State/Market/Civil Society partnership most responsible but also assigns noticeable responsibility to a State/Civil Society partnership. The Scientific Community considers a State/Market partnership equally responsible as a State/Market/Civil Society partnership. State regards a State/Market/Civil Society partnership to be solely responsible.

On the demand side it is the Scientific Community which deviates most from the mean perceived responsibility. The Scientific Community perceives Market responsible, however, a State/Market partnership and a State/Market/Civil Society partnership are considered mainly responsible. Market perceives it self responsible to some extent, however assigns more responsibility to itself in the form of a State/Market or a State/Market/Civil Society partnership. Both Civil Society and State perceive Market to be mainly responsible. However, Civil Society assigns considerable responsibility to a State/Market/Civil Society partnership while State assigns equal responsibility to a State/Market partnership.

*Social Safety Net*

Increasing the sustainability performance regarding the Social Safety Net is on the supply side perceived a responsibility of a State/Market/Civil Society partnership. Additional responsibility is, however, assigned to State. On the demand side most responsibility is assigned to a State/Market partnership while a State/Market/Civil Society partnership is considered to be responsible as well.

On the supply side the societal sphere's perceptions do deviate some from the mean perceived responsibility. Civil Society perceives State mainly responsible while assigning considerable responsibility to a State/Market partnership. Market additionally assigns considerable responsibility to a State/ Civil Society partnership. The Scientific Community considers State hardly responsible, however, assigns noticeable responsibility to a Market/Civil Society partnership. A similar observation can be made for State, instead of State is a State/Market partnership perceived more responsible for improving the Social Safety Net.

Societal Spheres on the demand side consider, in addition to a State/Market partnership, a State/Market/Civil Society partnership responsible as well. State, however, considers only a State/Market partnership responsible. Market assigns, in addition to a State/Market partnership and a State/Market/Civil Society partnership, considerable responsibility to State as well.

*Community Prosperity*

Community Prosperity is on the supply side perceived mainly a responsibility of a State/Market/Civil Society partnership while the demand side regards it the responsibility for a State/Market partnership.

On the supply side all societal spheres except Civil Society perceive a State/Market/Civil Society partnership mainly responsible. However, State, Market, and the Scientific Community each assign considerable responsibility to a different partnership or societal sphere as well; State to a State/Market partnership, Market to a State/ Civil Society partnership, and the Scientific Community to Market. Civil Society, assigning no responsibility to a State/Market/Civil Society partnership considers a State/Market partnership mainly responsible, though, it assigns considerable responsibility to Market as well.

All societal spheres on the demand side, with the exception of the Scientific Community consider a State/Market partnership mainly responsible. The Scientific Community considers a State/Market/Civil Society partnership most responsible. State perceives Market equally responsible as a State/Market partnership. Moreover, a State/Market partnership is assigned considerable responsibility by Market and Civil Society as well.

*Trade & Finances*

Responsibility towards the improvement of sustainability aspects regarding Trade & Finances is on the supply side considered mainly the responsibility of a State/Market/Civil Society partnership while the demand side perceives this a responsibility for Market.

On the supply side deviations from the mean perceived responsibility are most apparent for Civil Society. Civil Society considers Market to be mainly responsible; however, they assign considerable responsibility to themselves as well. Market additionally assigns considerable responsibility to State, while the Scientific Community perceives a Market/Civil Society partnership responsible as well. State perceives a State/Market/Civil Society partnership solely responsible for Trade & Finances related sustainability aspects.

On the demand side more responsibility is divided between partnerships and societal spheres. State and the Scientific Community consider Market as the most responsible party. However, State also considers a State/Market partnership and a State/Market/Civil Society partnership responsible while the Scientific Community perceives a State/Market partnership and Market considerable responsible. Market assigns the most responsibility to a State/Market partnership while Market and State are considered only slightly less responsible. Civil Society considers State to be mainly responsible, however, it assigns considerable responsibility to a Market/Civil Society partnership and Market as well.

*Results: responsibility main socio-economic aspects*

The hypothesis [h5] which states that the supply side assigns most responsibility for improving the sustainability performance of the supply chain to State cannot be concluded for main socio-economic aspects either. The mean perceived relevance shows that a State/Market/Civil Society partnership is perceived most responsible for all main socio-economic aspects. For the societal spheres on the supply side a similar conclusion can be made, even though, they diverge from the mean perceived responsibility. Civil Society prefers a State/Market partnership since it never assigns responsibility to a State/Market/Civil Society partnership. Moreover, Civil Society corresponds with the hypothesis for the main socio-economic aspect Social Safety Net, perceiving State most responsible for improving and maintaining the Social Safety Net.

The demand side's assigned responsibility depends more on the socio-economic aspect. However, either Market or a State/Market partnership is perceived most responsible for improving the socio-economic performance of the supply chain. The societal spheres have a different perception. Whereas State considers Market mainly responsible for all main socio-economic aspects except the Social Safety Net, the other societal spheres assign most responsibility to a State/Market partnership, or even a State/Market/Civil Society partnership. Hence, it can be concluded that with the exception of the State, societal spheres on the demand side consider partnerships more responsible for improving the socio-economic performance of the supply chain. Subsequently, the hypothesis [h5] can be proven for all societal spheres on the demand side except State.

## 7 Objective-empirical results versus Interpretative results

At the beginning of this research it is postulated that perceptions do not always reflect reality. It is feasible to assume that actors involved in the supply chain perceive certain main sustainability aspects unequally relevant opposed to empirically concluded results. A comparison between objective-empirical and interpretative results will determine if [h6] perceptions of societal spheres regarding the sustainability performance of the supply chain will deviate from natural scientific concluded results. However, section 2.1 reasons that a proper empirical method to assess the sustainability performance of supply chains is only available for the environmental dimension. The objective-empirical analysis, therefore, presents only results for the environmental dimension. Subsequently, an analysis between empirically determined LCA results and chain actor perceptions concluded from the SPA can only be conducted for the environmental dimension. Hence, the following chapter will determine if perception of chain actors coincide with empirically determined results.

### 7.1 Comparison between objective-empirical and interpretative results

Both the SPA and the secondary LCA analysis conclude that the environmental performance of the wine supply chain according the impact on the main environmental aspects and the section of the supply chain. However, there is an interpretational difference between SPA results and the results of the secondary LCA analysis. The results of the secondary LCA analysis demonstrate which main environmental aspects are most negatively affected and which sections in the supply chain are responsible for that. The results of the SPA demonstrate which main environmental aspects are perceived most relevant to improve in order to enhance the sustainability performance of the wine supply chain and which its sections are considered most relevant for these improvements. Nonetheless, in essence, both conclusions tell us the same; which sections have the most detrimental effect on the environment and need to be improved, and which main environmental aspects are most affected by those sections in the supply chain.

#### *Relevant main environmental aspects according the secondary LCA analysis*

The conclusions drawn from the secondary LCA analysis demonstrate that not all sections in the wine supply chain have a detrimental effect on the environment. The secondary LCA analysis demonstrates that of the seven sections in the wine supply chain the processes of the Vineyard, Winery, Shipping and Consumer have the most detrimental effect on the environment. However, the Vineyard and Winery have a harmful environmental impact on all main environmental aspects, except Nuisances, while Shipping and Consumer only have a negative environmental impact on the Atmosphere and Energy & Resources.

#### *Relevant main environmental aspects according the SPA*

From the SPA is concluded that societal spheres on supply side considers Water and Energy & Resources the most relevant main environmental aspects. Societal spheres on the demand side coincides with that perception, though, perceive Land Use considerable relevant as well. Other main environmental aspects are considered less relevant for improving the sustainability performance of the wine supply chain. However some societal spheres deviate from the mean perceived relevance, perceiving main environmental aspects more or less relevant. Hence, perceiving Atmosphere (State and Civil Society on the supply side) or Biodiversity (the Scientific Community on the demand side) more relevant opposed to one of the other main environmental aspects. Nuisances, however, is regarded hardly relevant by any of the societal spheres on either side of the supply chain.

However, the SPA also concludes that societal spheres on the supply- as well as on the demand side perceive sections on the supply side in general most relevant for improvement. Supply side sections also include the Wine Cellar/Exporter. Although SPA shows that this section is perceived less relevant than the Winery and Vineyard in general, it exceeds the perceived relevance of Shipping and sections

on the demand side. Moreover, Land Use is regarded only relevant for the Vineyard; hence, none of the other sections negatively affect Land Use.

Although Shipping in general is regarded as less relevant than the sections on the supply side the main environmental aspects Energy & Resources but specifically Atmosphere are perceived to be more relevant for improving the sustainability performance of the wine supply chain.

A similar conclusion is drawn for Disposal. While other sections on the demand side are not perceived considerably relevant for improving the sustainability performance Disposal is considered a relevant section regarding Energy & Resources.

## 7.2 Objective-empirical versus interpretative results

When the results of the objective-empirical secondary LCA analysis are compared with the interpretative SPA results it can be concluded that the perceptions of the chain actors do diverge to some extent from the empirical results (table 7.1). It can also be observed that Nuisances is ignored in this comparison. Because Nuisances is not mentioned in any of the selected LCAs and is concluded as irrelevant in the SPA it seemed feasible to exclude this main environmental aspect from the comparison. The differences in perceptions between societal spheres have been thoroughly disclosed in the SPA analysis. Since the individual perceptions do, in most instances, not differ enormously, the focus of this comparison will be on the mean perceptions of the supply- and demand side and the secondary LCA results in order to keep the comparison comprehensible.

Supply Chain Sections	Land Use			Atmosphere			Water			Biodiversity			Energy & Resources		
	LCA	SPA		LCA	SPA		LCA	SPA		LCA	SPA		LCA	SPA	
		S	D		S	D		S	D		S	D			
Vineyard	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Winery	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wine Cellar/Exporter					✓	✓		✓			✓			✓	✓
Shipping				✓	✓	✓							✓	✓	✓
Importer/Retailer					✓									✓	✓
Consumer				✓									✓	✓	
Disposal						✓								✓	✓

S = Supply Side / D = Demand Side

Table 7.1: Differences and similarities between objective-empirical concluded and perceived relevance of main environmental aspects

Concurring results can be disclosed between the SPA and the secondary LCA analysis. What is noticeable is that both analyses regard processes in the Vineyard and Winery most responsible for negative environmental impacts, hence most apt for improvement. However, chain actors, especially those on the supply side, additionally perceive the Wine Cellar/Exporter as having a negative effect on the environment.

Moreover, Energy & Resources is regarded most relevant from a secondary LCA analysis as well as an SPA perspective. Both analyses conclude that Energy & Resources is relevant for other sections in the supply chain besides the Vineyard and Winery. However, some slight differences are apparent. Where the secondary LCA analysis discloses, besides the Vineyard and Winery, Shipping and Consumers also relevant, societal spheres on both sides additionally consider the Wine Cellar/Exporter, Importer/Retailer and Disposal relevant sections for improvements concerning the environmental performance. Chain actors on the demand side however, do not regard the Consumer a very relevant section for improvements concerning Energy & Resources.

Although both sides of the supply chain do not perceive Atmosphere the most relevant main environmental aspect, societal spheres do concur with the secondary LCA analysis that this main environmental aspect is relevant for more sections than only those on the supply side. The results of the secondary LCA analysis conclude that the Atmosphere is negatively affected by processes in the Vineyard and Winery and additionally by Shipping and the Consumer. The supply side perceives the same sections relevant and additionally perceives Wine Cellar/Exporter and Importer/Retailer

relevant while excluding the Consumer. The demand side also excludes the Consumer as a relevant section as well while regarding the Wine Cellar/Exporter and Disposal relevant.

Even though Water is perceived a more relevant section by both the supply- and the demand side the secondary LCA analysis offers no evidence of a more substantial environmental impact on Water compared to the other main environmental aspects. However, according to the secondary LCA analysis and the SPA Water is only relevant for the Vineyard and Winery, while the supply side also perceives the Wine Cellar/Exporter a relevant section for improving environmental aspects concerning Water.

Detailed sustainability aspects regarding Land Use are only perceived substantially relevant for improving the environmental performance by the demand side. However, both the secondary LCA analysis and the SPA conclude that Land Use is only relevant for the Vineyard and the Winery while other sections of the supply chain hardly have a negative effect on land and related aspects.

Biodiversity is only perceived considerably relevant by the Scientific Community on the demand side and Civil Society on the supply side. Both side of the supply chain perceive Biodiversity, in accordance with the secondary LCA results as only relevant for the Vineyard and the Winery. The supply side, however, considers the Wine Cellar/Exporter also applicable for improving the sustainability performance regarding Biodiversity

### **7.3 Differences and similarities between objective-empirical and interpretative results**

It can be concluded that, even if some differences are apparent, the perceptions of societal spheres towards the relevance of main environmental aspects in general correspond with the environmental impacts concluded in the secondary LCA analysis. Hence, hypothesis [h6] can not be proven consistently. From both analyses it can be concluded that the Vineyard and Winery have the largest impact on all environmental aspects while Atmosphere and Energy & Resources are negatively affected by other supply chain sections as well. However, it should also be stressed that societal spheres connected to the supply chain have the tendency to perceive relevant main environmental aspects applicable for sections in the supply chain even if it is not empirically concluded that these main environmental aspects have a significant impact. Principally, the supply side perceives the Wine Cellar/Exporter often relevant regarding improving the environmental performance of the supply chain.

Other similarities in results can be distinguished. Both the secondary LCA analysis and the SPA conclude that Atmosphere and Energy & Resources are also considered relevant for sections other than the Vineyard and Winery. However, it must be stated that Atmosphere is only considered notably relevant by a few societal spheres on each side of the supply chain while the remaining societal spheres perceive this main environmental aspect less relevant for improving the environmental performance.

Both analyses also conclude that Nuisances is of no concern for the sustainability performance of the wine supply chain. While the SPA concludes that Nuisances have a trivial effect on the sustainability performance there is no mention in the secondary LCA analysis of Nuisances whatsoever.

## 8 Towards a more sustainable South African – European wine supply chain

The main goal of this research is to make a contribution to the ongoing research on how to manage Global Supply Chains in a more sustainable fashion. The conclusions of this research offer additional knowledge on how to realise a more sustainable (global) supply chain.

However, Sustainable Development is a broad and ambiguous area of research with many different ideas and perspectives on achieving Sustainable Development. Nevertheless, it is generally acknowledged that Sustainable Development consists of three sustainability dimensions; environmental, social, and (socio)-economic. In order to improve the sustainability performance of the South African – European wine supply chain the performance of all three dimensions needs to be improved. This research has therefore been focusing on these three sustainability dimensions.

As Sustainable Development is an ambiguous subject it is likely that actors in the supply chain perceive Sustainable Development unequally. For that reason it is deemed necessary to address this subject, not only empirically but also from a chain actor perspective. Approaching Sustainable Development interpretatively and empirically offers us the opportunity to get better insight in possible differences towards achieving a more sustainable supply chain. In the introduction of this research I have stated two main assumptions that possibly affect the realisation of a more sustainable supply chain when not taken into account: a) Chain actors connected to the supply chain have unequal perceptions towards achieving a more sustainable supply chain and b) Perceptions of chain actors towards achieving a more sustainable supply chain do not coincide with objective-empirical concluded results.

Thus, to determine possible differences in perspectives towards achieving a more sustainable supply chain the following research question needs to be answered:

*What are the differences in perceptions of actors connected to the supply chain, of the relative importance of various sustainability aspects of the South African – European wine supply chain?*

To answer this question the research has been divided in two main analyses. The first main analysis determined the impacts on the sustainability performance of the supply chain empirically while the second analysis determined the perceptions of chain actors towards the sustainability performance of the supply chain. However, the differences in perception can only be determined if a comparable method is employed.

### 8.1 Measuring the sustainability performance of supply chains

Though determining the sustainability performance of supply chains is not an uncommon practice it is usually measured empirically neglecting to determine Sustainable Development normative, as an issue in which actors decide for themselves what is relevant for attaining Sustainable Development. Since chain actors are affecting the progress towards Sustainable Development these perceptions need to be identified.

Moreover, the objective-empirical analysis towards the sustainability performance of the supply chain merely determines the environmental dimension, because LCA related methodology for assessing the supply chain's social and (socio)-economic performance is still in its infant stage. And while these social methodologies are not operational yet, many researchers are involved in developing these methodologies. Since these scholars are specifically focusing on LCA related methodology that measures social and (socio)-economic impacts, this research will not take part in that development. Hence, the objective-empirical analysis only determined the environmental performance of the wine supply chain conducting a secondary LCA analysis.

It is the approach to measure perceptions towards the sustainability performance which does not have a prominent position in research on Sustainable Development. Since chain actors affect the performance of the supply chain, their perceptions towards Sustainable Development will affect the sustainability performance of the supply chain, and improvements made to this performance. Since

we stress the necessity of more sustainable (global) supply chains, I argue that this cannot be attained without considering how chain actors perceive this subject. Hence, it is imperative that chain actors' perception towards improving the sustainability performance of the supply chain receives more attention. A method analysing differences in perception to determine the sustainability performance of supply chains has not been identified and has therefore been designed. Thus, besides answering the abovementioned main research question, this research also aspires to determine if a method for analysing chain actor perceptions could be employed successfully.

The SPA is designed to measure perceptions of chain actors connected to the supply chain. However, perceptions are socially constructed and therefore differ per chain actor. In order to assure that chain actor perception is measured on similar sustainability aspects a fixed format is used, as opposed to open interviews. To ensure no sustainability aspects are neglected in the analysis a broad selection of sustainability aspects is included. Moreover, a fixed format, like the employed perceptionnaire, offering structured chain actor perspectives, allows individual chain actor perceptions to be aggregated into specific societal sphere perceptions.

However, in order to analyse a large number of chain actors and aggregate their perspectives into grouped results it is necessary to transform perceptions into quantifiably measurable results. Transforming individual perceptions into quantifiably measurable results might seem somewhat controversial, as the data becomes less sensitive and loses some of its detail. However, making perceptions objectively measurable assures that perceptions can be compared to each other without obtaining a lot of incomparable data which is more likely to be obtained with open questions.

Employing the SPA demonstrates that making results measurable, is making the method more effective and efficient when applying it to large (chain) actor groups residing in different societal spheres. Even though the method was designed for the South African - European wine supply chain this method can be applied to other supply chains. Moreover, the SPA should be employable for other sustainability subjects with large stakeholder groups. However, it should be stressed that the SPA is a method best applied when analysing the perceptions of large stakeholder groups like those in the South African – European wine supply chain. When analysing the perceptions of small stakeholder groups it might be more effective to employ regular open interviews without aggregating the results into specific stakeholder groups or societal spheres.

## **8.2 Consensus or disagreement towards a more sustainable wine supply chain**

The sustainability performance of supply chains is as argued based on three dimensions. Moreover, when the sustainability performance of the supply chain is discussed three additional issues arise; what to improve, where to improve, and who is responsible for these improvements. The three sustainability dimensions as well as the three sustainability issues are considered in the SPA. Since consensus in general is perceived to be imperative in order to attain sustainable development it should be necessary to reach consensus on all three sustainability issues. However, the established hypothesis in section 1.4 state that perceptions between supply chain sides and societal spheres are not equal, hence, different perceptions leads to disagreement which result in unsustainable development or, less dramatically, an ineffective and inefficient progress towards a more sustainable supply chain. However, what the differences in perception towards improving the sustainability performance of the supply chain are, needs to be answered in threefold as the sustainability performance is measured on three sustainability issues. Additionally, one should determine if objective-empirical obtained results differ from the SPA results.

The SPA concludes that perceptions towards the relevance of main sustainability aspects of the supply chain are more equal between the supply- and demand side than perceptions of individual societal spheres. Especially the three sustainability dimensions are perceived similarly relevant for improving the sustainability performance of the wine supply chain. Individual societal spheres deviate somewhat more from perception towards the relevance of the main sustainability aspects. Differences in perceived relevance can be noticed between societal spheres for the main

environmental aspects as well as for the main social and socio-economic aspects. Mainly, societal spheres operating on the same side of the supply chain perceive main sustainability aspects unequally relevant. However, these differences do not automatically result in completely deviating perspectives towards the relevance of main sustainability aspects. While few larger differences can be observed for some of the main sustainability aspects, differences between societal spheres are in general not very extensive. When larger differences appear; the inequality in perceived relevance is frequently between Civil Society or the Scientific Community and their counterparts on the opposite side of the supply chain. Moreover, no relation can be found between the perceived relevance of detailed sustainability aspects and the perceived relevance of main sustainability aspects. Detailed sustainability aspects are perceived more relevant regardless of the perceived relevance of the main sustainability aspects. Hence, if resources necessary for improving the wine supply chain are infinite chain actors tend to perceive sustainability aspects in general more relevant. Consequently, when relevance is perceived as an infinite resource, chain actors do not consider making choices how to spend these resources.

The SPA concludes that societal spheres on both sides of the supply chain perceive sections on the supply side of the supply chain most relevant for improvements that increase the sustainability performance of the supply chain. However, as the SPA demonstrates, no evidence that societal spheres on the demand side structurally perceive sections on the demand side more relevant for improvement. Nor can it be proven that societal spheres on the supply side consistently perceive sections on the demand side more applicable for improvement. Differences between societal spheres on the supply- and the demand side are smaller than expected. Even if both sides of the supply chain recognize that most sustainability gains can be achieved on the supply side they also acknowledge that the demand side of the wine supply chain is not fully sustainable and opportunities for improving its sustainability performance still exist.

In general, is concluded that the supply side assigns most responsibility to a State/Market partnership or a State/Market/Civil Society partnership while the demand side considers the Market or a State/Market partnership most often responsible. State in general is never perceived as most responsible. Other partnerships, or in some cases State, are perceived more responsible, however they are not assigned most responsibility for improving the sustainability performance. This demonstrates that for most sustainability aspects, societal spheres on the supply side as well as on the demand side perceive a partnership between two or three societal spheres as most effective/reliable to improve the sustainability performance of the wine supply chain.

Differences between the objective-empirical concluded results from the second LCA analysis and the interpretative SPA results could only be determined for the environmental dimension. However, the differences between the empirically determined results from secondary LCA analysis and the results from the SPA are rather small. Both analyses conclude that sections on the supply side cause most environmental impact on all main environmental aspects. Moreover, Atmosphere and Energy & Resources are considered relevant for sections other than the sections on the supply side. However, societal spheres have the tendency to perceive some sections more relevant for improvements than concluded by the secondary LCA. The most apparent section is the Wine Cellar/Exporter, which is not considered having a substantial negative environmental impact by the secondary LCA analysis. Moreover, Nuisances is concluded to be relevant by neither the secondary LCA analysis nor the SPA.

### **8.3 Governance for improving the sustainability performance of the wine supply chain**

It is concluded that different perceptions toward the sustainability performance of the South African - European wine supply chain are evident between different societal spheres. Moreover the objectively concluded empirical results deviate from the chain actor perceptions. However, according to the established hypothesis in section 1.4, these differences are smaller than expected. Hence, it appears there is more agreement between supply- and demand side and between societal spheres

on achieving a more sustainable supply chain than generally assumed. Moreover, differences between objective-empirical concluded results and perceived relevance are smaller than initially assumed.

Even if perceptions of societal spheres in general not deviate substantially main sustainability aspects and supply chain sections are perceived differently and responsibility is in some instances assigned to different partnerships. Considering those results I state that the various societal spheres connected to the supply chain receive different or no information on the supply chain's sustainability performance or interpret this information wrongly. Hence, no absolute consensus is present between chain actors how to improve the sustainability performance of the supply chain, even though consensus is often declared necessary for attaining sustainable development. Additionally, these results imply that the supply chain is not transparent, since none of the indirect societal spheres are completely familiar with the performance of the processes in the supply chain, and Market actors do not fully comprehend what is perceived relevant by societal spheres on the opposite side or the same side of the supply chain to achieve sustainability. However, this transparency seems to be more turbid between different societal spheres operating on the same side of the supply chain than between societal spheres and their counterparts. Hence, it can be concluded that different perceptions towards sustainable development are more evident between different societal spheres operating on the same side of the supply chain than between societal spheres in the 'North' and their counterparts in the 'South'. Easier access to information on the performance of the wine supply chain and regular communication with other societal spheres connected to the wine supply chain increases the transparency of the wine supply chain, hence increases the efficiency and effectiveness of improving the sustainability performance of the wine supply chain

Moreover, the SPA concludes that the majority of societal spheres on both sides of the supply chain perceive that it is necessary to establish partnerships in order to enhance the sustainability performance of the South African – European wine supply chain. More consensus on improving the sustainability performance of the wine supply chain will result from such collaboration between different societal spheres while, at the same time, the supply chain will become more transparent. Though societal spheres differ on the fact if these partnerships should include Civil Society two forms of partnerships to establish can be considered.

- The first one focuses on different societal spheres operating at the same side of the supply chain. These partnerships create a more transparent wine supply chain which offers better insight in the performance of each actor in this supply chain. Moreover, it would prevent different societal spheres receiving dissimilar information. Though objective-empirical results and SPA results do not deviate substantially a choice can be made to involve the Scientific Community in these collaboration. Involving the Scientific Community in such a partnership will offer them the opportunity to obtain practical information while communicating empirically obtained results reducing the possibility that this knowledge gap will grow. Such a partnership could even be expanded to global partnerships since the South African – European wine supply chain is a global supply chain.
- A second collaboration could be established between societal spheres and their counterparts on the opposite of the supply chain. The Scientific Community and Civil Society in particular, deviate in perception from their counterparts. It seems necessary to establish more intensive distribution of information regarding the sustainability performance of the wine supply chain between them. A more intense collaboration would give both societal spheres better insight in the conditions the supply chain operates in on the opposite side of the supply chain. Such a partnership ideally involves more NGOs involved in similar subjects on both sides of the supply chain, or in case of the Scientific Community, multiple scholars, universities or research institutes involved in

subjects related to the sustainability performance of the wine supply chain. In case of Market and State, even if perceptions deviate less often, communications on the sustainability performance of the supply chain should continue, in order to improve the sustainability performance.

The establishment of partnerships in itself should not be a problem as it is concluded that the majority of chain actors perceive this as imperative for achieving a more sustainable supply chain. However, even if differences are in general smaller than initially expected, few larger deviations in perceived relevance and responsibility do transpire. Is it possible to solve these largely deviating perceptions towards achieving a sustainable supply chain when discussed in a partnership? Partnerships for Sustainable Development issues have been established for a long time, with 'positive' and 'negative' outcomes towards sustainability (examples; 'the energy efficient housing construction' and 'the Solaris project' respectively (Glasbergen, 2007)). However, it is questionable if these partnerships will reach consensus on those sustainability issues where societal spheres' perceptions substantially deviate from each other. Moreover, is this consensus always required? Consensus does not have to be the main goal of such a partnership. A global partnership with State/Market or State/Market/Civil Society could contribute to better insights in the perceptions of other societal spheres towards a more sustainable supply chain and decrease the risk of implementing the often called 'Eurocentric' solutions. This would entail that societal spheres from both sides are not only willing to collaborate but are also willing to collaborate in a transparent setting and take responsibility for improvements to be made.

## 9 Reflection: SPA methodology

In social science perceptions have been measured to determine the actor's perception towards situations or events that can possibly form a risk. However, actor perceptions had not been measured to determine the sustainability performance of a supply chain. Hence, it has been necessary to design a methodology to determine perceptions towards the sustainability performance. Although, employing this method on the South African – European wine supply chain has given interesting results it should be stressed that this analysis was also a trial to determine if such a method could successfully be established. While developing and executing this method several problems regarding context and complexity arose. Nonetheless, chain actor perceptions can be determined and conclusions have been made, however, it is important to be critical in assessing this method. Since this is the first step in designing a new method for measuring actor perceptions towards Sustainable Development and sustainable supply chains, reflection on the employed method is necessary. Thus, improvements to increase the effectiveness of this method need to be seriously considered for use in future studies. Reflection and subsequent improvements are divided in two categories:

- Methodological
- Execution

### *Reflection on the SPA Methodology*

Several remarks can be made on the methodological aspect of the SPA, though most can be solved by making the SPA less complex, hence obtaining less data. It begs the question whether the reliability of the method will be positively or negatively affected when complexity is reduced. Nonetheless, the SPA, as it was employed, provided more information than could be processed in the available time and pages. Therefore, one needs to make a decision beforehand how many hours are available for the SPA and the level of detail one considers sufficient for the SPA.

When an in-depth analysis is required and there is sufficient time available the SPA in its current design *could* be employed. However, it is for the executer to decide what the 'additional' data contributes to the end result. Additional data in this respect is the obtained data which is not used for the final analysis. In the employed SPA the some data was excluded (personal data, additional Likert scale choices) from the analysis or used modestly (relevance detailed sustainability aspects). If a more 'quick scan' approach is employed it can be decided to exclude some more data from the SPA.

Personal data can give more insight in chain actors' perception. As it is assumed that different societal spheres have different perceptions it could also be the case that within these societal spheres perceptions depend on individual personal characteristics. Characteristics such as education, age and sex, for instance, can affect an individual's perception. However, to establish feasible results the number of respondents per societal sphere needs to be larger. Hence, it was decided to exclude this from the final analysis.

Relevance has been measured in two different ways, the relative relevance and the relevance measured according a Likert scale. The reason for measuring relevance in two ways is to determine if chain actors would perceive all detailed sustainability aspects relevant if they were not required to allocate resources, in this case 100 points. Even if it was concluded that there is hardly any relation between the perceived relative relevance of a sustainability aspect and the perceived relevance of the detailed sustainability aspects on a Likert scale, it remains questionable how relevant the obtained data was.

Additional choices on the Likert scale, such as, 'Instated', 'Not Applicable (N/A)' or 'No Opinion' have been used differently as anticipated and have only been used to exclude sustainability aspects from further analysis. Detailed sustainability aspects perceived 'N/A' or answered with 'No Opinion' have been perceived as irrelevant. The option 'Instated' has been perceived as not relevant

if established legislation was considered properly instated and nothing needed to be changed. If legislation was considered not properly instated a rate of relevance was given as well as the relevant chain sections and responsibility.

Moreover, if a detailed sustainability aspect was perceived in any way relevant the respondent had to answer for which section it was relevant and who was responsible. However, a simple choice between 'relevant' and 'not relevant' would have been sufficient. The additional data offered by these extra choices was not necessary to answer the main research questions or sub-questions and only built-in in case respondents opted for that answer. However, by giving these options the perceptionnaire became unnecessarily more complex.

An additional complexity in the SPA methodology is the supposed confusion between 'chain section relevance' and 'responsibility'. While 'chain section relevance' was asked to determine which of the seven chain sections was perceived most relevant for improving the sustainability performance 'responsibility' was asked to determine who is responsible to implement these improvements. However, perceptions towards 'chain section relevance' often seemed confused with 'responsibility'. For some detailed sustainability aspects chain actors perceived chain sections relevant that are unlikely to be relevant for that detailed sustainability aspect. Though, additional explanations by respondents did explain their reasoning behind that response, this could still be used to answer both questions. Hence a sharper division between determining the relevance of the supply chain section and the responsibility for improving the sustainability performance of the supply chain is needed to prevent such confusion possibly contaminating data. Excluding one question is also a possibility if one does not require the perception towards 'section' or 'responsibility'. Still it should be clearly explained which perception is required in order to prevent obtaining a perception on the wrong issue.

#### *Reflection on the SPA Execution*

The SPA intended to determine the perceptions of all societal spheres plus the Scientific Community on both sides of the supply chain instead of determining the difference in perception between the supply- and demand side. Consequently, the amount of societal spheres, each with their own perceptions, made the SPA much more complex and time consuming than expected.

Before one starts to execute the SPA one should know how many chain actors are available. As for the South African – European wine supply chain the pool of chain actors is rather small. A sufficient amount of chain actors can be identified for Market, however, for other societal spheres the pool of chain actors turned out to be much smaller. The main reason for this could be that wine, especially on the demand side, is not a very important economic commodity, or at least not that important that someone specifically addresses the sustainability issue in the South African – European wine supply chain. Moreover, there are, except for Market, almost no actors within societal spheres that focus specifically on (South African) wine. Chain actors from other societal spheres are therefore not specialised in the subject and do not regard themselves as the suitable party to have a perception on the sustainability performance of the South African wine supply chain. This of course reduces the pool of potential respondents further and makes it more time consuming to find participants and set up interviews.

A small pool of chain actors does in itself not form a problem since the SPA is conducted to conclude the perception of societal spheres towards the sustainability performance of the South African – European wine supply chain. If all chain actors within a societal sphere are involved in the SPA, even if this is a small number, the perception of that societal sphere can be determined. However, large differences in perceptions are more likely to give a skewed result when the number of chain actors in a specific societal sphere is low, as the perception of a societal sphere is the average of all chain actors' perceptions. If perceptions deviate substantially from each other, meaning one half perceives a sustainability aspect very relevant while the other half perceives that same sustainability aspect not

relevant, the average will be somewhere in the middle. However, it is questionable if this is the perspective of the societal sphere towards that sustainability aspect. When a large number of chain actors from a societal sphere are involved it is less likely that such an apparent division in perceptions will appear. Moreover, when a large number of chain actors is involved the *standard deviation* could be determined to conclude if a large variation of perceptions is present within the different societal spheres. Since the conducted SPA involved a small number of chain actors for most of the societal spheres large deviations in perceptions did occur for some sustainability aspects, however, these differences have not been taken in account nor was there any form of correction implemented.

The results from the email based survey and the survey conducted at wine tasting session have been disappointing. It is therefore prudent that the perceptionnaires used in the surveys are simplified and made less time consuming. The email based questionnaire took on average 25 minutes to complete. Because some of the perceptionnaires returned uncompleted it is very likely that these respondents and potential respondents considered the survey too time consuming. It was, however, in my opinion not possible to include these chain actors with a more simplified / less time consuming perceptionnaire without losing any reliability in the obtained data. Moreover, the survey during the wine taste sessions was badly planned. Several contacted organisers of wine taste sessions were not interested in participating. The two organisers that were interested stated their concern if the subject wasn't too complex for consumers and if consumers were actually interested in participating. For both concerns they have been right in view of the low return of completed perceptionnaires. However, an email based survey for chain actors directly involved still seems like the best method to enlarge your number of respondents. Regarding the consumer, one should carefully consider if they have the background knowledge about the subject to form a reliable opinion, hence, have useful input in the SPA. If not, it might be better to exclude the Consumer even if the consumer's perspective has an effect on the sustainability performance of any supply chains. If it is decided that the consumer has a valuable contribution to make then another approach to obtain their perception is strongly recommended.

Comparison of perceived relevance has been done between different societal spheres on the supply side and between different societal spheres on the demand side. Moreover, similar societal spheres are compared with their counterparts on the other side of the supply chain. However, the analysis on responsibility demonstrates that a cooperative approach is most frequently perceived successful for improving the sustainability performance of the South African – European wine supply chain. An analysis between societal spheres on the same side and a comparison between societal spheres and their counterparts on the opposite side of the supply chain has been conducted. However, a cross analysis of societal spheres with other societal spheres on the opposite side of the supply chain might be beneficial to examine if more differences in perception can be distinguished that confirm similar perspectives towards the relevance of sustainability aspects. Moreover, a comparison between markets from different nations would have been useful to determine if different EU markets perceive relevance differently. However, for obtaining feasible results the number of EU respondents, other than Dutch, was simply too low.

If this research will significantly contribute to increasing the sustainability performance of the South African - European Wine supply chain, that will be decided by others. However, the results of this research are not statistically significant due to the low number of respondents. For a statistical significance an amount of at least 30 respondents for each societal sphere is necessary, or at least 15 for alternative tests. Except for Market the pool to subtract respondents involved in the South African – European wine supply chain or to sustainable supply chains in general is simply too low. It proved to be especially difficult to find State actors who were involved in sustainable (wine) supply chains. Concessions have been made for these chain actors and chosen was to involve people working on social or agricultural issues. However, approached government officials on the demand side were hesitant to be involved as they thought other parties were better suited to comment on

this issue. Organisations within South African Civil Society have been found. However, of those involved only FTSA was included, WIETA and BWI could not find time to schedule an interview during my stay in South Africa.

Even though afore mentioned obstructions have had an effect on the reliability of the results and made the analysis more complex than necessary the SPA is, in my opinion, a method that can bring about useful results. Understanding the difference perceptions towards improving the sustainability performance of the wine supply chain sustainable development will increase the realisation of a more sustainable supply chain. However, before the SPA can be effectively employed the method needs to be further developed instead of blatantly applied.

**Appendix I: Consulted literature for sustainability aspects**

- Amnesty International (2004) UN Human Rights Norms for Business. London
- BSCI (2007) BSCI Systems; Rules and Functioning. Brussels, FTA
- DJSI (2009) Dow Jones Sustainability World Indexes Guide, version 10.2. NP
- Gauthier, C. (2005) Measuring Corporate Social and Environmental Performance, *Journal of business ethics*, 59: 199-206
- GlobalGap (2007) General Regulations Integrated Farm Assurance, version 3.0-2Sept\_07. Cologne
- GPN (2003) Principles for Global Corporate Responsibility; Bench Marks for Measuring Business Performance. Pretoria
- Guineé, J.B. (2002) handbook on life cycle assessment; operational guide to the ISO Standards. New York, Boston, Dordrecht, London, Moscow: Kluwer Academic Publishers.
- GRI (2006) Sustainability Reporting Guidelines, version 3.0. NP
- Hilderink, H.B.M. (2004) Towards Human and Social Sustainability Indicators: A multidimensional approach No. 550012002. Bilthoven: RIVM
- ILO (2003) Tripartite Declaration of Principles concerning multinational enterprises and social policy. Geneva
- ILO (2008) International Labour Standards by Subject. Geneva
- Krajnc, D & P. Glavic (2003) Indicators of sustainable production. *Clean Techn Environ Policy*, 5: 279-288
- Labuschagne, C. and A.C. Brent (2005) Environmental and Social Impact Considerations for Sustainable Project Life Cycle Management in the Process Industry. *Corporate Social Sustainability and Environmental Management* 12, 38-54
- OECD (2002) The OECD Guidelines for Multinational Enterprises (revision 2002). Paris
- SAI (2008) Social Accountability 8000. New York
- SEDEX (2009) Sedex Members Ethical Trade Audit (SMETA) Best Practice Guidance. NP
- The Global Principals workgroup (2003) Principles for Global Corporate Responsibility: Benchmarks for Measuring Business Performance
- UN (2008) The Millennium Development Goals Report. New York
- UN Global Compact (2007) Annual Review 2007: Leaders Summit. New York
- UNSD (2001) Indicators of Sustainable Development: Guidelines and Methodologies. New York
- UNSD (2007) Indicators of Sustainable Development: Guidelines and Methodologies. New York
- Veleva and Ellenbecker (2000) A proposal for measuring business sustainability: addressing shortcomings in existing frameworks, GMI 31
- WBCSD (2004) Strategic Challenges for Companies: Accountability-codes. Conches-Geneva

## Appendix II: Detailed Sustainability Aspects

Sustainability Aspects	
Environmental Aspects	Socio-economic Aspects
<p><b>Land Use</b></p> <p>A1. Decreasing natural areas as result of farmland expansion</p> <p>A2. The farmland's (declining) productive capabilities as a result of vineyard processes</p> <p>A3. The acidification of farmland caused by grape growing processes</p> <p>A4. The soil compaction of farmland caused by the use of heavy machinery</p> <p>A5. Other forms of soil degradation like erosion, dryland salinity, etc. caused by vineyard processes</p> <p><b>Atmosphere</b></p> <p>A6. The discharge of harmful emissions by supply chain processes causing climate change (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, etc.)</p> <p>A7. Ozone depleting substances emitted by processes in the supply chain (CFC, HCFC, Halon, etc.)</p> <p>A8. The emission of harmful substances by processes in the supply chain reducing air quality (SMOG, Carbon, VOC, particles, ashes)</p> <p>A9. The production of excessive heat in supply chain processes that is not necessary for the process but discharged in the atmosphere</p> <p><b>Water</b></p> <p>A10. The use of water in supply chain processes contributing to water shortages</p> <p>A11. The use of cooling water in supply chain processes</p> <p>A12. The use of cleaning water in supply chain processes</p> <p>A13. Wastewater treatment for water used in the supply chain processes</p> <p>A14. The disposal of wastewater</p> <p>A15. The eutrophication of water caused by substances, like nutrients and fertilizers, used in supply chain processes</p> <p>A16. Droughts resulting in an increased chance of fire hazards</p> <p><b>Biodiversity</b></p> <p>A17. The use of herbicides, pesticides and fungicides to control pests and diseases in supply chain processes</p> <p>A18. The use of fertilizers and growth regulators in supply chain processes</p> <p>A19. The use of hazardous materials in the supply chain processes (i.e. disinfectants, cleaning agents)</p> <p>A20. Processes in the supply chain producing toxins harmful to human and animal life</p> <p>A21. The use of GMOs in the supply chain processes</p> <p>A22. Processes in the supply chain negatively affecting wild life</p> <p>A23. The invasion of alien species (plants) caused by supply chain shipments</p> <p>A24. The production and disposal of solid waste in supply chain processes</p> <p>A25. Damage to the ecosystem and habitats caused by processes in the supply chain</p> <p><b>Energy &amp; Resources</b></p> <p>A26. The amount of abiotic (non-living) materials used in the wine supply chain processes (i.e. packaging)</p> <p>A27. The amount of biotic (living) materials used in the wine supply chain processes (i.e. seeds, wine plants)</p> <p>A28. The use of (more) recycled materials in the supply chain processes</p> <p>A29. The use of (more) renewable materials in the supply chain processes</p> <p>A30. The reduction of energy intensive processes in the supply chain</p> <p>A31. The implementation of new, less energy intensive technologies</p> <p>A32. Increased employer/employee awareness towards energy use to reduce the energy use in the wine supply chain</p> <p>A33. The use of renewable energy in wine supply chain processes to reduce negative impacts caused by conventional energy</p> <p><b>Nuisances</b></p> <p>A34. The excessive noise produced by processes in the supply chain</p> <p>A35. The excessive smell produced by processes in the supply chain</p> <p>A36. Landscape pollution as a result of storage and production buildings and other facilities used in the supply chain</p>	<p><b>Social Aspects</b></p> <p><b>Employment</b></p> <p>A37. The labour hours for employees in the supply chain</p> <p>A38. The amount of allowed overtime for employees in the supply chain</p> <p>A39. The workload for employees in the supply chain</p> <p>A40. Increasing job security for employees in the supply chain</p> <p>A41. Increasing job security for seasonal workers in the supply chain</p> <p>A42. Employee satisfaction with their occupation</p> <p>A43. Empowerment opportunities for employees</p> <p>A44. Equal access to labour in the supply chain</p> <p>A45. Equal labour conditions for employees in the supply chain</p> <p>A46. The prohibition of forced labour</p> <p>A47. Allowed maternity leave</p> <p>A48. Monitoring by labour inspection to ensure labour is performed according to the basic conditions of employment</p> <p><b>Health &amp; Safety</b></p> <p>A49. Health and safety in the workplace</p> <p>A50. Health and safety in the community</p> <p>A51. Time of absence when ill or due to illness of a family member</p> <p>A52. Healthcare (facilities) within the community wherein the supply chain operates</p> <p><b>Training &amp; Education</b></p> <p>A53. Health and Safety training for employees</p> <p>A54. On job training for employee skill development</p> <p>A55. The opportunity for employees to develop through education and training outside the work place</p> <p>A56. Opportunities for employees regarding job promotions within the supply chain</p> <p>A57. Increasing the level of <i>adult</i> education in the community in which the supply chain operates</p> <p>A58. Increasing the level of <i>child</i> education in the community in which the supply chain operates</p> <p><b>Social Capital: Coherence and Trust</b></p> <p>A59. Collective bargaining</p> <p>A60. The freedom of association</p> <p>A61. Cooperation of Market with Government and Society to improve the sustainability performance of the supply chain and its processes</p> <p>A62. Information sharing among supply chain actors</p> <p>A63. Information sharing with the public</p> <p>A64. The involvement of employees in chain improvement processes</p> <p>A65. Open communication with, and transparency towards, chain actors</p> <p>A66. Promoting and communicating ethical, environmental and financial integrity throughout the chain</p> <p>A67. Ensuring ethical, environmental and financial integrity within the chain</p> <p><b>Physical Capital</b></p> <p>A68. Availability of housing for employees in the supply chain</p> <p>A69. Availability of mobility infrastructure to increase accessibility to the community employees live in</p> <p>A70. Availability of mobility infrastructure to increase accessibility for the supply chain</p> <p>A71. Access to tools and equipment to increase the efficiency of supply chain processes</p> <p>A72. Access to tools and equipment to improve working conditions in the supply chain</p> <p><b>Consumer Interest</b></p> <p>A73. Consumer safety of products</p> <p>A74. Customer complaints regarding the product or the production process</p> <p>A75. Providing the consumer with environmental and social sustainability information on the product and its processes</p> <p><b>Wages</b></p> <p>A76. The wage level of employees in the supply chain</p> <p>A77. The compensation employees receive for overtime</p> <p>A78. The written particulars of employment and remunerations</p> <p>A79. The regular payment of wages</p> <p><b>Social Safety Net</b></p> <p>A80. Unemployment benefits</p> <p>A81. Paid maternity leave for women working in the supply chain</p> <p>A82. Old-Age pensions for people who have worked in the supply chain</p> <p>A83. Disability benefits for employees injured in the supply chain</p> <p>A84. Illness / temporary disability benefits for employees injured in the supply chain</p> <p>A85. Social grants/welfare for employees in the supply chain unable to meet the needs of their family</p> <p><b>Community Prosperity</b></p> <p>A86. Number of employees from the community the supply chain operates in</p> <p>A87. Involving local and community business in supply chain processes</p> <p>A88. Monetary investments for community development</p> <p>A89. Monetary investments for environmental development</p> <p><b>Trade &amp; Finance</b></p> <p>A90. The allocation of value generated by companies in the supply chain</p> <p>A91. The allocation of financial risks for market actors in supply chain</p> <p>A92. The integration of externalized costs, like environmental damage, in product price</p> <p>A93. Absence of protective trade barriers in international trade</p> <p>A94. Absence of competition disrupting subsidies</p> <p>A95. Partner investments to develop company and community performance</p> <p>A96. External financing from outside the supply chain to develop company and community performance</p>

### Appendix III: Perceptionnaire

The following questions are meant to determine your perception of the sustainability performance of the South African – European wine supply chain and which aspects are important in order to improve the sustainability performance of this supply chain. I would like to ask you which aspects in this questionnaire you think are most relevant and should receive attention in order to improve the sustainability performance of the South African – European wine supply chain. I would also like you to point out which section(s) of the supply chain these aspects are relevant for and who you think is responsible for improving them.

However, the questionnaire was designed by including aspects deemed important in several environmental and social schemes (ISO14040, GRI, SA8000, GlobalGap, IPW, ILO, UNDSO, etc). It is possible that aspects mentioned in this questionnaire are, according to you, not applicable (N/A) for, or are already instated (I) in the wine supply chain. If there are aspects on which you do not have an opinion leave it blank.

Relevance					
N/A	I	a	b	c	d
Not applicable for the SA-EU wine supply chain	Aspect already instated in the SA-EU wine supply chain	Not relevant to improve the sustainability performance of the supply chain	Slightly relevant to improve the sustainability performance of the supply chain	Relevant to improve the sustainability performance of the supply chain	Very relevant to improve the sustainability performance of the supply chain

Supply chain Sections						
Supply side			Logistics	Demand side		
<b>1</b> Vineyard	<b>2</b> Winery	<b>3</b> Wine Cellars/Exporter	<b>4</b> Shipping	<b>5</b> Importer/Retailer	<b>6</b> Consumer	<b>7</b> Disposal
Process: Growing grapes	Process: Processing and Packaging	Process: Storing	Process: Transporting	Process: Sales and Storing	Process: Consumption	Process: Disposal of remaining product

Responsibility		
G	M	S
Government: national and local	Market: Economic actors and Branch organisations	Society: Unions, NGOs, Churches, Civil Society Groups

<b>Name</b>	
<b>Organisation</b>	
<b>Function</b>	
<b>Age</b>	
<b>Education</b>	
<b>IPW compliance*</b>	
<b>Compliance with other environmental or social schemes*</b>	

\*for wine farmers only

<b>Sustainable Development</b>	
<b>1</b>	<b>What do you perceive as Sustainable Development?</b>

### Environmental Aspects

<b>Land Use</b>						
<b>2</b>	<b>Do you think the growing of grapes/ the wine supply chain has an environmental impact on farmland and/or surrounding land?</b>	<b>Yes/No</b>				
2a	If so: How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a1	- <i>Decreasing natural areas as result of farmland expansion</i>	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
a2	- <i>The farmland's (declining) productive capabilities as a result of vineyard processes</i>	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
a3	- <i>The acidification of farmland caused by grape growing processes</i>	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
a4	- <i>The soil compaction of farmland caused by the use of heavy machinery</i>	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
a5	- <i>Other forms of soil degradation like erosion, dryland salinity, etc. caused by vineyard processes</i>	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
2b	Can you think of any other sustainability aspects relevant for the wine supply chain concerning 'Land Use' that should receive extra attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

Atmosphere						
3	Do you think that the processes in the wine supply chain have an environmental impact on the atmosphere?	Yes/No				
3a	If so: How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a6	- The discharge of harmful emissions by supply chain processes causing climate change (CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, etc.)	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a7	- Ozone depleting substances emitted by processes in the supply chain (CFC, HCFC, Halon, etc.)	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a8	- The emission of harmful substances by processes in the supply chain reducing air quality (SMOG, Carbon, VOC, particles, ashes)	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a9	- The production of excessive heat in supply chain processes that is not necessary for the process but discharged in the atmosphere	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
3b	Can you think of any other sustainability aspects relevant for the wine supply chain concerning the 'Atmosphere' that should receive extra attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

Water						
4	Do you think processes in the wine supply chain have a negative effect on the quality and quantity of water?	Yes/No				
4a	If so: How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a10	- The use of water in supply chain processes contributing to water shortages	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a11	- The use of cooling water in supply chain processes	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a12	- The use of cleaning water in supply chain processes	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a13	- Wastewater treatment for water used in the supply chain processes	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a14	- The disposal of wastewater	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a15	- The eutrophication of water caused by substances, like nutrients and fertilizers, used in supply chain processes	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a16	- Droughts resulting in an increased chance of fire hazards	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
4b	Can you think of any other sustainability aspect relevant for the wine supply chain concerning 'Water quality or quantity' that should receive extra attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

Biodiversity						
5	Do you think that processes in the wine supply chain can have a negative effect on biodiversity?	Yes/No				
5a	If so: How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a17	- The use of herbicides, pesticides and fungicides to control pests and diseases in supply chain processes	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a18	- The use of fertilizers and growth regulators in supply chain processes	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a19	- The use of hazardous materials in the supply chain processes (i.e. disinfectants, cleaning agents)	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a20	- Processes in the supply chain producing toxins harmful to human and animal life	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a21	- The use of GMOs in the supply chain processes	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a22	- Processes in the supply chain negatively affecting wild life	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a23	- The invasion of alien species (plants) caused by supply chain shipments	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a24	- The production and disposal of solid waste in supply chain processes	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a25	- Damage to the ecosystem and habitats caused by processes in the supply chain	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
5b	Can you think of any other sustainability aspects relevant for the wine supply chain concerning 'Biodiversity' that should receive extra attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

Energy & Resources						
6	Do you think that reducing the amount of energy (fuel, electricity) and resources used in the supply chain will benefit the sustainability performance of the wine supply chain?	Yes/No				
6a	If so: How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a26	- The amount of abiotic (non-living) materials used in the wine supply chain processes (i.e. packaging)	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a27	- The amount of biotic (living) materials used in the wine supply chain processes (i.e. seeds, wine plants)	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a28	- The use of (more) recycled materials in the supply chain processes	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a29	- The use of (more) renewable materials in the supply chain processes	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a30	- The reduction of energy intensive processes in the supply chain	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a31	- The implementation of new, less energy intensive technologies	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a32	- Increased employer/employee awareness towards energy use to reduce the energy use in the wine supply chain	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a33	- The use of renewable energy in wine supply chain processes to reduce negative impacts caused by conventional energy	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
6b	Can you think of any other sustainability aspects relevant for the wine supply chain concerning 'Energy & Resources' that should receive extra attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

Nuisances						
7	Do you think supply chain processes produce harmful excessive nuisance?	Yes/No				
7a	If so: How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a34	- <i>The excessive noise produced by processes in the supply chain</i>	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
a35	- <i>The excessive smell produced by processes in the supply chain</i>	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
a36	- <i>The landscape pollution as a result of storage and production buildings and other facilities used in the supply chain</i>	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
7b	Can you think of any other sustainability aspects relevant for the wine supply chain concerning 'Excessive Nuisances' that should receive more attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

8	If you could divide 100 points over each of these 6 main aspects, giving the most points to the main aspect you think is most important in order to improve the sustainability performance of the supply chain, how would you divide them?	
	<i>Land Use</i>	
	<i>Atmosphere</i>	
	<i>Water</i>	
	<i>Biodiversity</i>	
	<i>Energy &amp; Resources</i>	
	<i>Nuisances</i>	

### Social Aspects

Employment						
9	Do you think the following 'Employment' aspects are sufficiently addressed by law and do all sections of the wine supply chain comply with these aspects?	Yes/No				
9a	If not: How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a37	- The labour hours for employees in the supply chain	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a38	- The amount of allowed overtime for employees in the supply chain	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a39	- The workload for employees in the supply chain	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a40	- Increasing job security for employees in the supply chain	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a41	- Increasing job security for seasonal workers in the supply chain	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a42	- Employee satisfaction with their occupation	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a43	- Empowerment opportunities for employees	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a44	- Equal access to labour in the supply chain	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a45	- Equal labour conditions for employees in the supply chain	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a46	- The prohibition of forced labour	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a47	- Allowed maternity leave	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a48	- Monitoring by labour inspection to ensure labour is performed according to the basic conditions of employment	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
9b	Can you think of any other sustainability aspects relevant for the wine supply chain concerning 'Coherence and Trust' that should receive extra attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

Health and Safety						
10	Do you think that improving the 'Health and Safety' of the community and workforce will benefit the sustainability performance of the wine supply chain?	Yes/No				
10a	If so: How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a49	- Health and safety in the workplace	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a50	- Health and safety in the community	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a51	- Time of absence when ill or due to illness of a family member	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a52	- Healthcare (facilities) within the community wherein the supply chain operates	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
10b	Can you think of any other sustainability aspects relevant for the wine supply chain concerning 'Health & Safety' that should receive extra attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

Training and Education						
11	Do you think 'training and education' of employees and the community the supply chain operates in will bring about benefits to the sustainability performance of the wine supply chain.	Yes/No				
11a	If so: How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a53	- Health and Safety training for employees	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a54	- On job training for employee skill development	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a55	- The opportunity for employees to develop through education and training outside the work place	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a56	- Opportunities for employees regarding job promotions within the supply chain	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a57	- Increasing the level of <i>adult</i> education in the community in which the supply chain operates	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a58	- Increasing the level of <i>child</i> education in the community in which the supply chain operates	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
11b	Can you think of any other sustainability aspects relevant for the wine supply chain concerning 'Training and Education' that should receive extra attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

Social Capital: Coherence and Trust						
12	Do you think 'Coherence and Trust' between supply chain actors will increase the sustainability performance of the wine supply chain?	Yes/No				
12a	If so: How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a59	- Collective bargaining	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a60	- The freedom of association	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a61	- Cooperation of Market with Government and Society to improve the sustainability performance of the supply chain and its processes	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a62	- Information sharing among supply chain actors	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a63	- Information sharing with the public	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a64	- The involvement of employees in chain improvement processes	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a65	- Open communication with, and transparency towards, chain actors	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a66	- Promoting and communicating ethical, environmental and financial integrity throughout the chain	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a67	- Ensuring ethical, environmental and financial integrity within the chain	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
12b	Can you think of any other sustainability aspects relevant for the wine supply chain concerning 'Coherence and Trust' that should receive extra attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

Physical capital						
13	Do you think that proper access to, and availability of physical capital (infrastructure, housing, tools/equipment) for actors in the supply chain (employees and employers) will increase the sustainability performance of the supply chain?	Yes/No				
13a	If so: How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a68	- Availability of housing for employees in the supply chain	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
a69	- Availability of mobility infrastructure to increase accessibility to the community employees live in	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
a70	- Availability of mobility infrastructure to increase accessibility for the supply chain	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
a71	- Access to tools and equipment to increase the efficiency of supply chain processes	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
a72	- Access to tools and equipment to improve working conditions in the supply chain	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
13b	Can you think of any other sustainability aspect relevant for the wine supply chain concerning 'Physical Capital' that should receive extra attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

Consumer Interest						
14	Do you think that 'Consumer Interest' towards the safety of the product and processes in the wine supply chain does have an effect on the sustainability performance of the supply chain?	Yes/No				
14a	If so: How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a73	- Consumer safety of products	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
a74	- Customer complaints regarding the product or the production process	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
a75	- Providing the consumer with environmental and social sustainability information on the product and its processes	n/a	I	a-b-c-d	1-2-3-4-5-6-7	G / M / S
14b	Can you think of any other sustainability aspects relevant for the wine supply chain concerning 'Product Satisfaction' that should receive extra attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

15	If you could divide 100 points over each of these 6 main aspects, giving the most points to the main aspect you think is most important in order to improve the sustainability performance of the supply chain, how would you divide them?	
	Employment	
	Health and Safety	
	Training and Education	
	Social Capital: Coherence and Trust	
	Physical Capital	
	Consumer Interest	

### Socio-Economic Aspects

Wages						
16	Do you think there are possible improvements to be made concerning 'Wages' within the supply chain that will improve the sustainability performance of the supply chain?	Yes/No				
16a	If so: How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a76	- <i>The wage level of employees in the supply chain</i>	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a77	- <i>The compensation employees receive for overtime</i>	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a78	- <i>The written particulars of employment and remunerations</i>	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a79	- <i>The regular payment of wages</i>	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
16b	Can you think of any other sustainability aspects relevant for the wine supply chain concerning 'Wages' that should receive extra attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

Social safety net						
17	Do you think that the established social safety net for the disadvantaged does meet the needs of those receiving such a benefit? (Unemployment benefits, paid maternity leave, etc.)	Yes/No				
17a	<b>If not:</b> How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a80	- <i>Unemployment benefits</i>	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a81	- <i>Paid maternity leave for women working in the supply chain</i>	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a82	- <i>Old-Age pensions for people who have worked in the supply chain</i>	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a83	- <i>Disability benefits for employees injured in the supply chain</i>	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a84	- <i>Illness / temporary disability benefits for employees injured in the supply chain</i>	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a85	- <i>Social grants/welfare for employees in the supply chain unable to meet the needs of their family</i>	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
17b	Can you think of any other sustainability aspects relevant for the wine supply chain concerning the 'Social safety net' that should receive extra attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

Community Prosperity						
18	Do you think that the 'Community' the supply chain operates in has an effect on the sustainability performance of the supply chain	Yes/No				
18a	If so: How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a86	- <i>Number of employees from the community the supply chain operates in</i>	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a87	- <i>Involving local and community business in supply chain processes</i>	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a88	- <i>Monetary investments for community development</i>	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a89	- <i>Monetary investments for environmental development</i>	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
18b	Can you think of any other sustainability aspects relevant for the wine supply chain concerning the 'Community Prosperity' that should receive extra attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

Trade & Finances						
19	Do you think 'Trade & Finances' are properly arranged within the supply chain?	Yes/No				
19a	If not: How <i>relevant</i> are the following aspects in order to improve the sustainability performance of the wine supply chain; For which <i>section(s)</i> is this relevant, and; Who is <i>responsible</i> for improving these aspects?	Relevance			Section of supply chain	Responsibility
a90	- The allocation of value generated by companies in the supply chain	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a91	- The allocation of financial risks for market actors in supply chain	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a92	- The integration of externalized costs, like environmental damage, in product price	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a93	- Absence of protective trade barriers in international trade	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a94	- Absence of competition disrupting subsidies	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a95	- Partner investments to develop company and community performance	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
a96	- External financing from outside the supply chain to develop company and community performance	n/a		a-b-c-d	1-2-3-4-5-6-7	G / M / S
19b	Can you think of any other sustainability aspects relevant for the wine supply chain concerning 'Trade and Finances' that should receive extra attention?					
		a-b-c-d			1-2-3-4-5-6-7	G / M / S
		a-b-c-d			1-2-3-4-5-6-7	G / M / S

20	If you could divide 100 points over each of these 4 main aspects, giving the most points to the main aspect you think is most important in order to improve the sustainability performance of the supply chain, how would you divide them?	
	Wages	
	Social safety net	
	Community prosperity	
	Trade & Finances	

21	If you could divide 100 point over the 3 sustainability dimensions giving the most points to the dimension you believe is most important in order to improve the sustainability performance of the wine supply chain, how would you divide them?	
	Environmental dimension	
	Social dimension	
	Socio-economic dimension	

Thank you for your participation!

Do you have any further remarks or questions?

## Appendix IV: Consumer Perceptionnaire (in Dutch)

### De verduurzaming van de Zuid Afrikaanse – Europese wijnketen

Geachte deelnemer,

De vraag naar groene en meer duurzame producten neemt toe. De overheid stimuleert bedrijven om meer duurzaam te produceren en in te kopen. Daarnaast wil de markt graag inspelen op de vraag naar duurzame producten. Ook in de wijnketen is het besef gekomen dat het product en de processen in de wijnketen verduurzaamd moeten worden. Het is nu de vraag hoe deze verduurzaming het best gerealiseerd kan worden en op welke aspecten de wijnketen zich moet richten om een meer duurzaam product te realiseren. Niet alleen de markt, ook de overheid wil graag weten wat de consument als belangrijk ervaart in een duurzaam product. U als consument heeft een grote invloed op de wijn die wordt geïmporteerd. Daarom zou ik met onderstaande vragen graag bepalen wat u als belangrijk ervaart voor het verduurzamen van de Zuid Afrikaanse – Europese Wijnketen. Een overzicht van de secties en de processen in de wijnketen is weergegeven in figuur 1.

<b>1</b>	<b><i>In hoeverre heeft u een beeld van de gevolgen voor het milieu die zijn veroorzaakt door processen (productie, transport, consumptie, etc) in de Zuid Afrikaanse – Europese wijnketen</i></b>				
	1) onvoldoende	2) matig	3) voldoende	4) goed	5) uitstekend
<b>2</b>	<b><i>In hoeverre heeft u een beeld van de sociale omstandigheden (arbeid, educatie, etc.) in de Zuid Afrikaanse – Europese wijnketen</i></b>				
	1) onvoldoende	2) matig	3) voldoende	4) goed	5) uitstekend
<b>3</b>	<b><i>In hoeverre heeft u een beeld van de sociaal-economische omstandigheden (lonen, welvaart etc.) in de Zuid Afrikaanse – Europese wijnketen</i></b>				
	1) onvoldoende	2) matig	3) voldoende	4) goed	5) uitstekend

Kunt u, door 100 punten te verdelen, aangeven welke van de drie hieronder genoemde stellingen u het meest belangrijk vindt. Vindt u ze allen even belangrijk geef dan iedere stelling 33 punten.

<b>4</b>	<b><i>In hoeverre vindt u het belangrijk dat;</i></b>	<b>Relatief belang</b>
	De negatieve gevolgen voor het <b>milieu</b> die zijn veroorzaakt door processen in de wijnketen, <u>verminderd</u> worden	
	De <b>sociale</b> omstandigheden voor mensen die werken in de wijnketen <u>verbeterd</u> worden	
	De <b>sociaal-economische</b> omstandigheden voor mensen en bedrijven in de wijnketen <u>verbeterd</u> worden	
	<b>totaal</b>	<b>100</b>

De vragen op de andere kant van deze questionnaire gaan dieper in op, de milieuaspecten, de sociale aspecten en de sociaal-economische aspecten die van belang kunnen zijn voor de verbetering van de duurzaamheid van de wijnketen. Graag zou ik van u het relatieve belang van deze aspecten willen weten. Wanneer u hier een mening over heeft, wil ik u vragen om 100 punten te verdelen over de op de achterkant genoemde aspecten. Mocht u de aspecten te gedetailleerd vinden en denkt u geen verdere bijdrage te kunnen leveren, dan wil ik u hartelijke bedanken voor het beantwoorden van de hier boven gestelde vragen.

<b>Aanbodzijde (Zuid Afrika)</b>	<b>Transport</b>	<b>Vraagzijde (Europa)</b>
<b>Wijngaard:</b> het telen van druiven <b>Wijnmakerij:</b> het produceren en verpakken van wijn <b>Wijnkelder/exporteur:</b> de opslag van wijn	<b>Transport:</b> het vervoeren van wijn	<b>Importeur/ Retailer:</b> de verkoop en opslag van wijn <b>Consument:</b> de consumptie van wijn <b>Afval:</b> de afvoer en verwerking van het overblijvende product

Figuur 1: Secties en processen in de Zuid Afrikaanse – Europese wijnketen

<b>Milieu</b>		
<b>5</b>	<b>Welke van de volgende milieuaspecten vindt u het meest relevant om aan te pakken om de duurzaamheid van de wijnketen te vergroten?</b>	<b>Relatief belang</b>
A	- Het effect van druiventeelt op de <b>landbouwgrond die</b> mogelijk resulteert in verminderde productiecapaciteit van de grond, samendrukking van de grond, verzuring van de grond, of erosie	
B	- Het effect op de <b>atmosfeer die is</b> veroorzaakt door bijvoorbeeld de uitstoot van CO <sub>2</sub> en N <sub>2</sub> O tijdens het maken van wijn, het transport van wijn of andere processen in de wijnketen	
C	- Het effect op de <b>waterkwaliteit en –kwantiteit</b> door bijvoorbeeld irrigatie van druiven, het gebruik van spoelwater in de wijnmakerij of het lozen van afvalwater	
D	- Het effect op de <b>biodiversiteit</b> en de <b>natuur</b> die is veroorzaakt door bijvoorbeeld het gebruik van pesticiden, meststoffen, en Genetisch Gemanipuleerde Organismen (GMOs)	
E	- Het gebruik van <b>brandstoffen, elektriciteit &amp; grondstoffen</b> verminderen tijdens de productie van wijn, het transport van wijn, en andere processen, door bijvoorbeeld, zuiniger om te gaan met energie, meer gerecyclede en hernieuwbare materialen te gebruiken of door meer duurzame energie zoals wind en zonne-energie te gebruiken	
F	- <b>Lawaai, stank en landschapsvervuiling</b> die is veroorzaakt door bijvoorbeeld de wijnmakerij, het fermentatie proces of het afvalverwerkingsproces	
<b>totaal</b>		<b>100</b>

<b>Sociaal</b>		
<b>6</b>	<b>Welke van de volgende sociale aspecten vindt u het meest relevant om aan te pakken om de duurzaamheid van de wijnketen te vergroten?</b>	<b>Relatief belang</b>
G	- Het verbeteren van <b>arbeidsomstandigheden</b> in de wijnketen zoals, verminderen arbeidsuren, verlagen werkdruk, vergroten arbeidszekerheid, of gelijke toegang tot arbeid	
H	- Het verbeteren van de <b>veiligheid</b> op de werkvloer en het creëren van gezondere arbeidsomstandigheden voor werknemers	
I	- Het verbeteren van de <b>training &amp; educatie</b> voor werknemers zodat zij bijvoorbeeld zich kunnen ontwikkelen, promotie kunnen maken of veiliger leren werken	
J	- <b>Samenwerking &amp; vertrouwen</b> , zoals het delen van informatie met andere bedrijven in de wijnketen, transparantie in bedrijfsvoering vergroten, het toestaan van vakbonden	
K	- Het verbeteren van <b>huisvesting, infrastructuur, machines en gereedschappen</b> voor werknemers en bedrijven in de wijnketen	
L	- Het <b>consumenten belang</b> meer in acht nemen, zodat producten veilig zijn, klachten van consumenten gehoord worden en de consument geïnformeerd wordt over het product	
<b>totaal</b>		<b>100</b>

<b>Sociaal-economisch</b>		
<b>7</b>	<b>Welke van de volgende sociaal-economische aspecten vindt u het meest relevant om aan te pakken om de duurzaamheid van de wijnketen te vergroten?</b>	<b>Relatief belang</b>
M	Het verbeteren van de <b>lonen</b> voor werknemers in de wijnketen door bijvoorbeeld het geven van hogere lonen, geregelde betaling van lonen, of beter loonadministratie	
N	Het verbeteren van het <b>sociaal vangnet</b> zodat werknemers bijvoorbeeld betaald zwangerschapsverlof, pensioen, of een vergoeding tijdens ziekte krijgen	
O	Het verhogen van de <b>welvaart</b> voor de gemeenschap door werknemers en bedrijven uit de gemeenschap in te huren	
P	Verbetering van handel & financiën binnen de wijnketen zoals een eerlijkere verdeling van winst, opheffen van handelsbarrières en subsidies, en integratie van externe kosten, zoals schade aan het milieu, in de productprijs	
<b>totaal</b>		<b>100</b>

Hartelijk dank voor het invullen van deze questionnaire.

Bertil Abbing  
Copernicus Instituut  
Universiteit Utrecht

**Appendix V: Excluded perceptions concerning Applicability and Responsibility**

Main Environmental Aspects		Societal Sphere							
		Supply side				Demand side			
		State	Market	Civil Society	Scientific Community	State	Market	Civil Society	Scientific Community
Land Use	Instated	0.0%	14.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	N/A	10.0%	1.3%	0.0%	0.0%	0.0%	2.7%	6.7%	0.0%
	No opinion	0.0%	1.3%	20.0%	10.0%	20.0%	2.7%	13.3%	0.0%
Atmosphere	Instated	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	N/A	12.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	No opinion	12.5%	1.7%	0.0%	12.5%	0.0%	0.0%	41.7%	0.0%
Water	Instated	0.0%	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	N/A	0.0%	0.0%	0.0%	0.0%	0.0%	2.9%	0.0%	0.0%
	No opinion	7.1%	1.9%	0.0%	7.1%	0.0%	1.0%	47.6%	0.0%
Biodiversity	Instated	0.0%	3.0%	0.0%	0.0%	0.0%	3.0%	0.0%	0.0%
	N/A	0.0%	2.2%	0.0%	0.0%	11.1%	3.7%	3.7%	0.0%
	No opinion	0.0%	0.7%	0.0%	16.7%	0.0%	0.7%	22.2%	0.0%
Energy & Resources	Instated	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	N/A	6.3%	0.0%	0.0%	0.0%	3.3%	0.0%	4.2%	0.0%
	No opinion	0.0%	0.8%	25.0%	6.3%	0.0%	0.0%	12.5%	0.0%
Nuisances	Instated	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%	0.0%
	N/A	0.0%	0.0%	0.0%	0.0%	0.0%	4.4%	66.7%	0.0%
	No opinion	0.0%	0.0%	0.0%	16.7%	0.0%	4.4%	0.0%	0.0%

Main Social Aspects		Societal Sphere							
		Supply side				Demand side			
		State	Market	Civil Society	Scientific Community	State	Market	Civil Society	Scientific Community
Employment	Instated	0.0%	6.0%	0.0%	0.0%	0.0%	1.7%	0.0%	0.0%
	N/A	0.0%	0.6%	0.0%	0.0%	0.0%	1.1%	0.0%	0.0%
	No opinion	0.0%	0.6%	0.0%	0.0%	0.0%	1.1%	27.8%	0.0%
Health & Safety	Instated	0.0%	1.8%	0.0%	0.0%	0.0%	1.7%	0.0%	0.0%
	N/A	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%	0.0%	0.0%
	No opinion	0.0%	1.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Training & Education	Instated	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	N/A	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.0%	0.0%
	No opinion	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Social Capital	Instated	0.0%	1.6%	0.0%	0.0%	0.0%	1.5%	0.0%	0.0%
	N/A	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%	0.0%
	No opinion	0.0%	0.8%	0.0%	0.0%	0.0%	2.2%	0.0%	0.0%
Physical Capital	Instated	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	N/A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	No opinion	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Consumer Interest	Instated	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%	11.1%	0.0%
	N/A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	No opinion	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Main Socio-economic Aspects		Societal Sphere							
		Supply side				Demand side			
		State	Market	Civil Society	Scientific Community	State	Market	Civil Society	Scientific Community
Employment	Instated	0.0%	10.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	N/A	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%	0.0%	0.0%
	No opinion	0.0%	1.8%	0.0%	0.0%	0.0%	7.1%	0.0%	0.0%
Health & Safety	Instated	8.3%	8.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	N/A	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.6%	0.0%
	No opinion	0.0%	0.0%	0.0%	50.0%	0.0%	7.1%	16.7%	0.0%
Training & Education	Instated	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	N/A	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%	0.0%	0.0%
	No opinion	0.0%	0.0%	0.0%	0.0%	0.0%	7.1%	0.0%	0.0%
Social Capital	Instated	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.0%
	N/A	0.0%	0.0%	0.0%	0.0%	0.0%	5.1%	0.0%	0.0%
	No opinion	50.0%	4.1%	0.0%	50.0%	0.0%	0.0%	5.6%	0.0%

**Appendix VI: Perceived relevance detailed sustainability aspects**

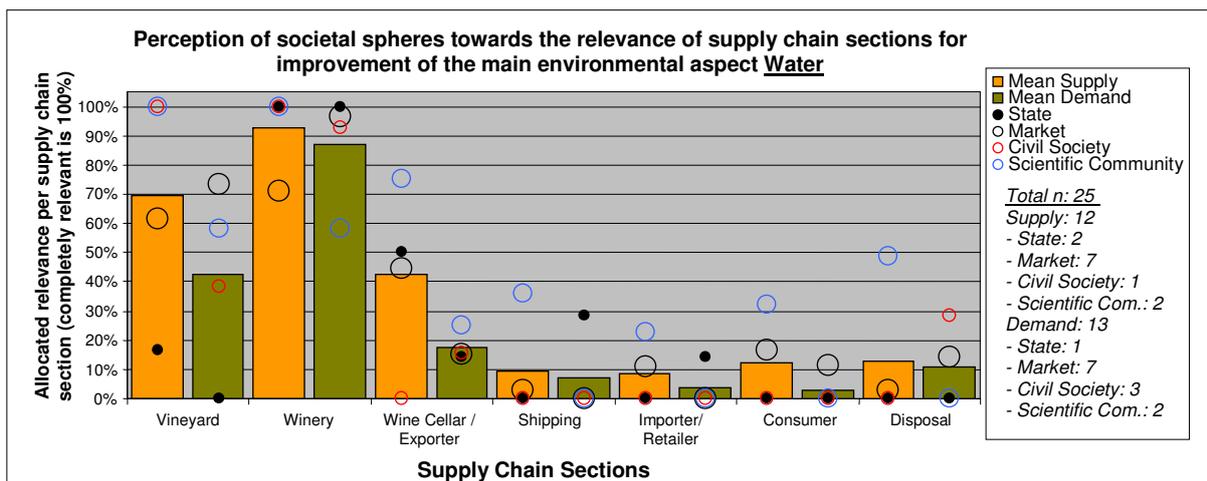
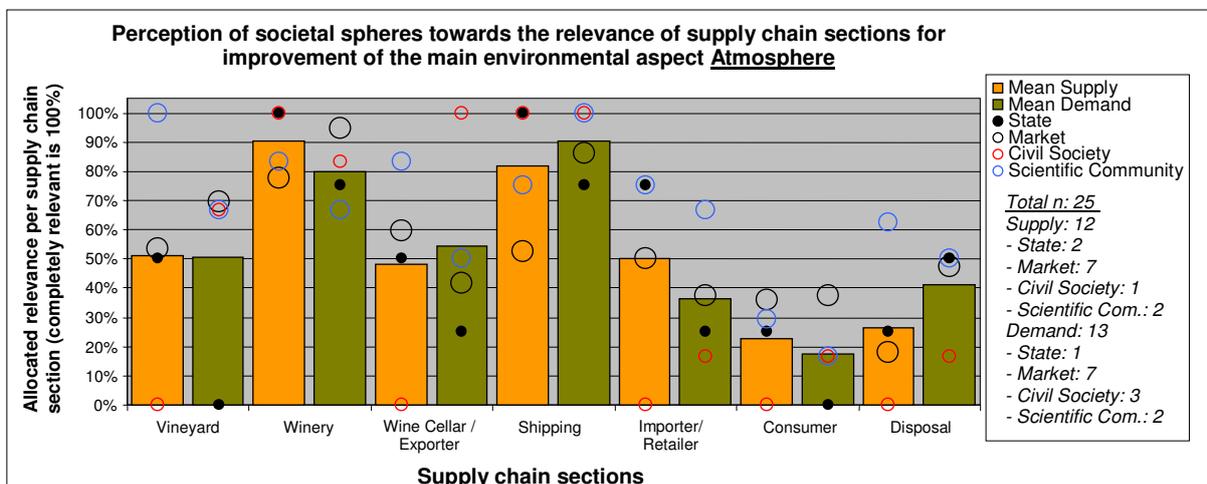
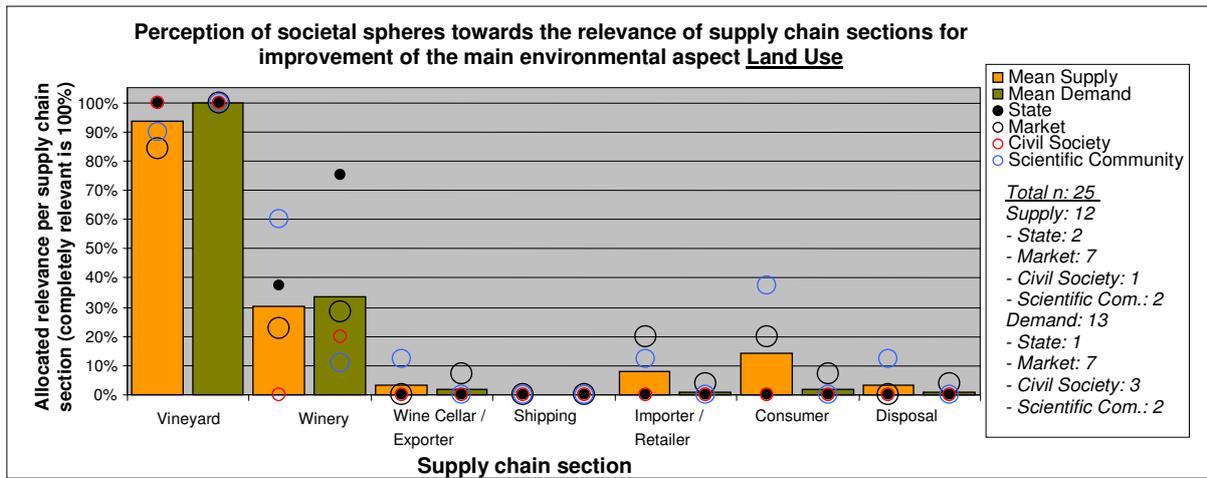
Detailed Sustainability Aspects	Perceived relevance detailed environmental aspects							
	Supply Side				Demand Side			
	State	Market	CS	ScC	State	Market	CS	ScC
<b>Land Use</b>								
a1	2.00	3.25	4.00	3.50	3.00	2.33	2.33	2.50
a2	2.50	2.50	--	3.50	3.00	2.36	2.33	3.00
a3	1.50	2.69	4.00	2.00	3.00	2.92	3.00	2.50
a4	2.00	2.75	4.00	3.50	--	2.36	2.00	2.00
a5	2.50	3.00	4.00	3.50	3.00	3.00	2.33	2.50
<b>Atmosphere</b>								
a6	3.50	3.40	4.00	4.00	3.00	2.60	2.33	3.00
a7	4.00	3.07	4.00	4.00	3.00	2.53	2.00	2.50
a8	3.50	3.27	4.00	4.00	3.00	2.80	2.00	3.00
a9	4.00	2.38	4.00	4.00	3.00	2.13	1.00	1.50
<b>Water</b>								
a10	3.50	3.33	3.00	3.50	3.00	2.93	3.00	2.50
a11	3.00	3.15	2.00	3.00	3.00	2.50	1.00	2.00
a12	3.00	3.00	3.00	3.50	2.00	2.73	2.00	2.00
a13	2.50	3.57	3.00	4.00	4.00	2.73	2.50	2.00
a14	2.50	3.57	3.00	4.00	4.00	2.93	2.50	2.00
a15	3.00	3.29	4.00	4.00	4.00	3.00	--	3.00
a16	4.00	2.93	4.00	4.00	2.00	2.92	3.50	2.00
<b>Biodiversity</b>								
a17	3.00	3.57	4.00	2.50	4.00	3.36	3.33	3.00
a18	3.00	3.47	3.00	3.50	4.00	3.29	2.67	2.50
a19	3.00	3.29	3.00	2.50	3.00	3.14	2.33	2.50
a20	3.00	3.07	3.00	2.50	4.00	2.77	3.00	2.50
a21	2.50	2.83	3.00	1.00	--	2.62	1.00	1.50
a22	2.00	3.00	4.00	2.50	3.00	2.57	2.00	2.00
a23	2.50	2.71	3.00	1.00	2.00	2.23	2.00	1.50
a24	2.50	3.13	4.00	1.00	4.00	2.93	2.00	3.00
a25	3.00	3.00	4.00	3.50	4.00	2.87	3.00	2.50
<b>Energy &amp; Resources</b>								
a26	3.00	3.40	--	3.50	3.00	3.13	2.00	2.50
a27	3.00	2.67	--	4.00	1.00	2.53	1.00	1.50
a28	3.00	3.60	4.00	3.50	4.00	3.33	2.00	3.00
a29	3.00	3.60	4.00	4.00	4.00	3.13	2.00	3.00
a30	3.00	3.53	2.00	4.00	1.00	3.29	2.00	3.00
a31	4.00	3.50	2.00	4.00	4.00	3.14	2.33	3.00
a32	2.50	3.60	4.00	4.00	4.00	3.29	2.33	2.50
a33	3.00	3.47	3.00	4.00	3.00	3.36	2.33	2.50
<b>Nuisances</b>								
a34	1.00	1.87	1.00	2.50	2.00	1.46	1.00	1.00
a35	2.00	2.00	1.00	3.50	2.00	1.69	1.00	1.00
a36	2.00	2.73	3.00	4.00	2.00	2.14	1.00	1.00

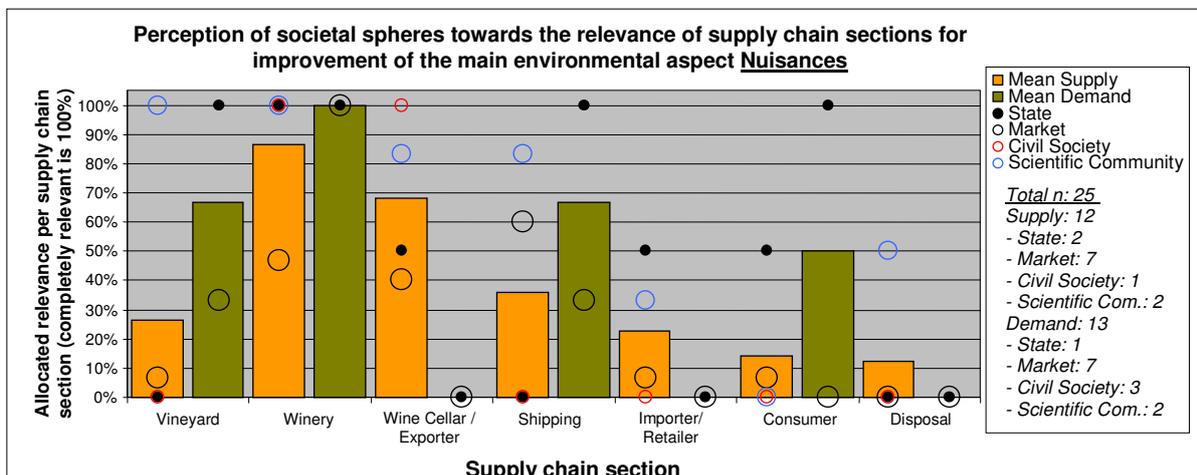
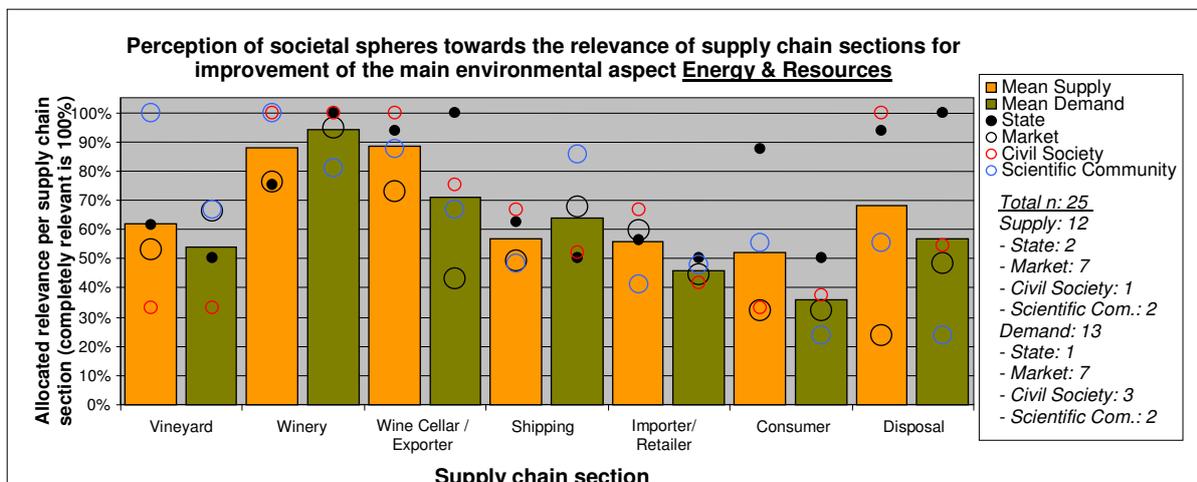
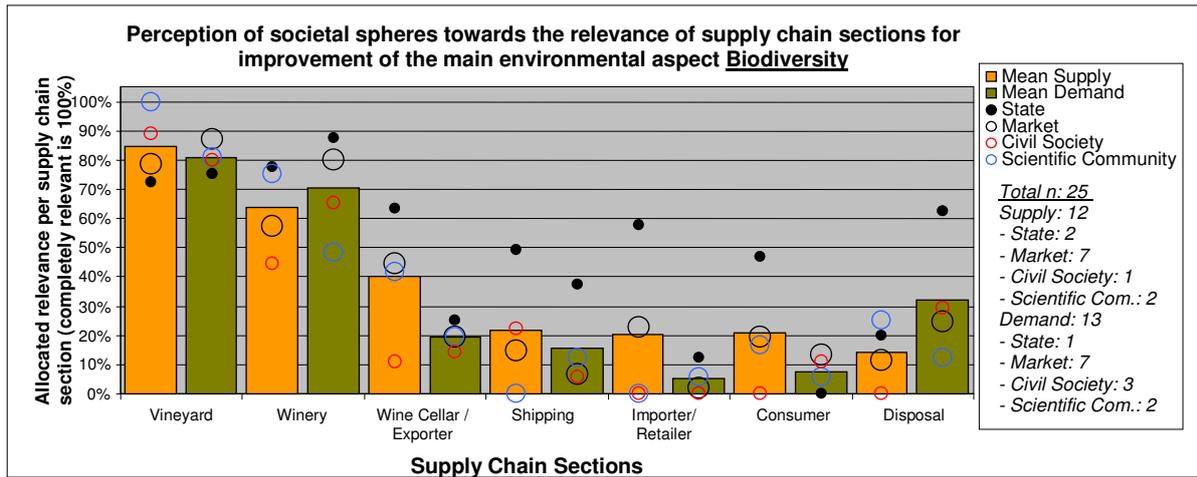
**1 = not relevant / 2 = Slightly relevant / 3 = relevant / 4 = very relevant**

Detailed Sustainability Aspects	Perceived relevance detailed social aspects							
	Supply Side				Demand Side			
	State	Market	CS	ScC	State	Market	CS	ScC
<b>Employment</b>								
a37	2.00	2.77	3.00	3.50	2.00	2.60	3.00	2.00
a38	2.50	2.50	2.00	4.00	2.00	2.40	3.50	2.00
a39	2.50	2.62	4.00	3.00	2.00	2.53	3.50	2.00
a40	2.50	2.93	4.00	2.50	2.00	2.53	4.00	2.00
a41	3.00	3.00	3.00	2.50	4.00	2.57	3.67	2.00
a42	3.50	2.86	3.00	3.50	4.00	2.60	3.00	2.00
a43	3.50	3.31	4.00	2.50	3.00	2.85	3.00	2.00
a44	3.50	3.07	3.00	2.50	3.00	2.60	4.00	2.00
a45	3.50	3.07	3.00	2.50	3.00	2.86	4.00	2.00
a46	2.50	2.80	4.00	3.00	3.00	3.00	4.00	2.50
a47	2.50	2.64	4.00	2.50	3.00	2.86	4.00	2.50
a48	3.00	3.08	4.00	2.50	3.00	2.80	3.50	2.00
<b>Training &amp; Education</b>								
a49	3.00	3.29	4.00	4.00	3.00	3.14	3.00	2.00
a50	3.50	3.21	4.00	4.00	3.00	2.80	2.67	2.00
a51	2.00	2.83	4.00	3.50	3.00	2.79	2.33	2.00
a52	3.00	3.07	3.00	3.50	3.00	2.93	2.33	2.00
<b>Health &amp; Safety</b>								
a53	2.50	3.21	3.00	3.50	3.00	3.00	3.33	2.00
a54	2.50	3.50	4.00	4.00	3.00	3.20	3.67	2.00
a55	3.00	3.21	4.00	3.50	3.00	3.20	3.33	2.00
a56	3.00	3.29	4.00	3.00	3.00	2.93	3.00	2.00
a57	3.00	3.36	3.00	3.50	2.00	3.07	3.33	2.00
a58	3.50	3.50	4.00	4.00	2.00	3.07	3.67	2.00
<b>Social Capital: Coherence &amp; Trust</b>								
a59	2.00	2.77	3.00	2.50	3.00	2.69	3.67	2.50
a60	1.50	3.08	3.00	2.50	3.00	2.69	3.67	3.50
a61	2.00	3.00	4.00	2.50	4.00	3.21	3.67	2.50
a62	2.00	3.29	3.00	2.50	4.00	2.87	3.33	3.00
a63	2.00	3.23	3.00	2.50	3.00	2.87	2.67	3.00
a64	2.50	3.43	4.00	2.50	3.00	3.33	3.33	3.00
a65	2.50	3.14	3.00	2.50	4.00	3.07	3.33	3.00
a66	2.50	3.36	3.00	2.50	4.00	2.93	3.33	3.00
a67	2.50	3.50	4.00	2.50	4.00	3.23	3.67	3.00
a68	3.50	2.71	3.00	4.00	2.00	2.80	2.33	2.50
<b>Physical Capital</b>								
a69	3.00	3.07	3.00	4.00	2.00	2.73	2.33	2.50
a70	3.00	2.79	3.00	3.00	4.00	2.47	2.00	1.50
a71	3.50	3.00	3.00	3.50	4.00	2.60	2.00	2.50
a72	3.50	2.93	4.00	4.00	4.00	2.53	2.00	2.50
<b>Consumer Interest</b>								
a73	4.00	3.64	4.00	4.00	4.00	3.14	2.50	2.50
a74	4.00	3.64	2.00	4.00	4.00	2.87	2.00	2.00
a75	4.00	3.43	4.00	4.00	4.00	3.40	3.33	3.00
1 = not relevant / 2 = Slightly relevant / 3 = relevant / 4 = very relevant								

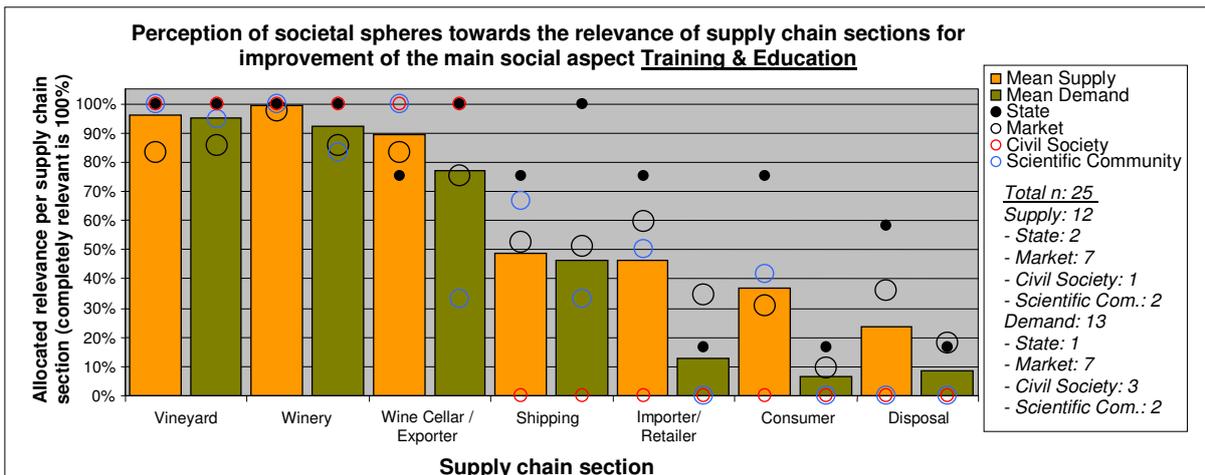
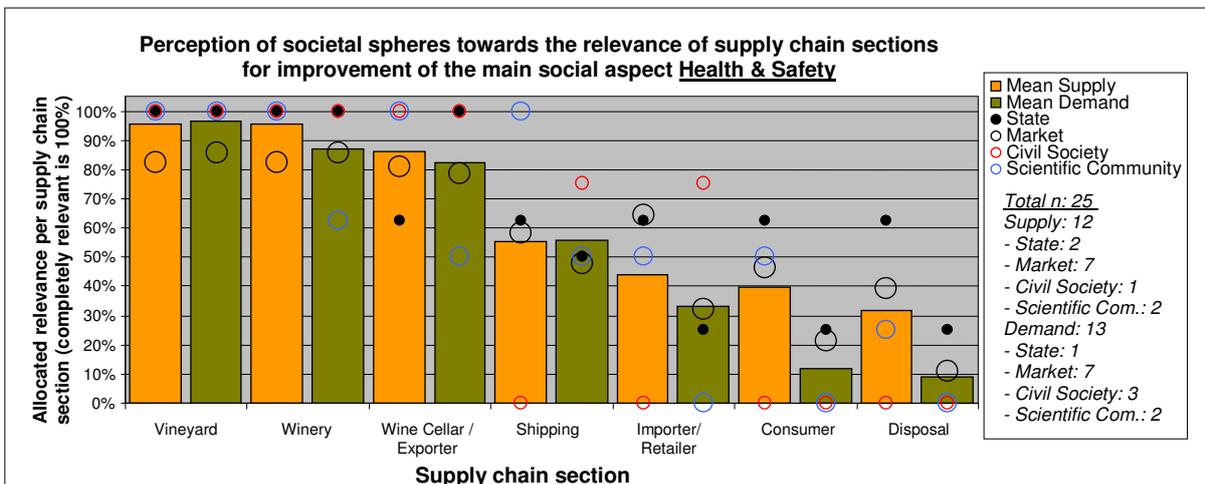
Detailed Sustainability Aspects	Perceived relevance detailed socio-economic aspects							
	Supply Side				Demand Side			
	State	Market	CS	ScC	State	Market	CS	ScC
<b>Wages</b>								
a76	1.50	3.15	4.00	4.00	4.00	3.15	3.33	2.50
a77	1.50	2.92	3.00	4.00	4.00	2.62	3.00	2.50
a78	1.50	2.92	4.00	3.50	4.00	2.92	3.00	3.00
a79	1.00	3.33	4.00	4.00	4.00	3.08	3.00	2.50
<b>Social Safety Net</b>								
a80	2.00	3.08	3.00	4.00	3.00	2.77	3.50	3.00
a81	2.00	3.17	4.00	4.00	3.00	2.69	3.00	2.50
a82	3.00	3.31	3.00	4.00	3.00	2.85	3.00	3.00
a83	3.50	3.46	4.00	4.00	3.00	2.92	3.00	3.00
a84	3.50	3.46	4.00	4.00	3.00	2.92	2.67	3.00
a85	1.50	3.00	4.00	4.00	3.00	2.77	3.00	3.00
<b>Community Prosperity</b>								
a86	2.50	2.86	1.00	3.50	3.00	2.17	2.67	2.50
a87	3.50	2.86	2.00	3.50	4.00	2.31	2.67	3.00
a88	3.50	3.00	3.00	3.50	4.00	2.46	2.33	2.50
a89	3.00	2.93	3.00	3.50	3.00	2.85	2.33	3.00
<b>Trade &amp; Finances</b>								
a90	4.00	3.31	4.00	4.00	2.00	2.38	3.33	2.00
a91	2.00	3.23	4.00	3.00	2.00	2.46	3.00	2.00
a92	2.00	3.31	4.00	4.00	4.00	2.38	3.67	2.00
a93	4.00	3.43	4.00	1.00	4.00	2.69	3.00	2.00
a94	4.00	3.43	4.00	1.00	4.00	2.50	3.00	2.00
a95	4.00	3.46	3.00	4.00	3.00	2.38	2.33	1.50
a96	4.00	3.21	1.00	4.00	3.00	2.23	2.33	1.50
1 = not relevant / 2 = Slightly relevant / 3 = relevant / 4 = very relevant								

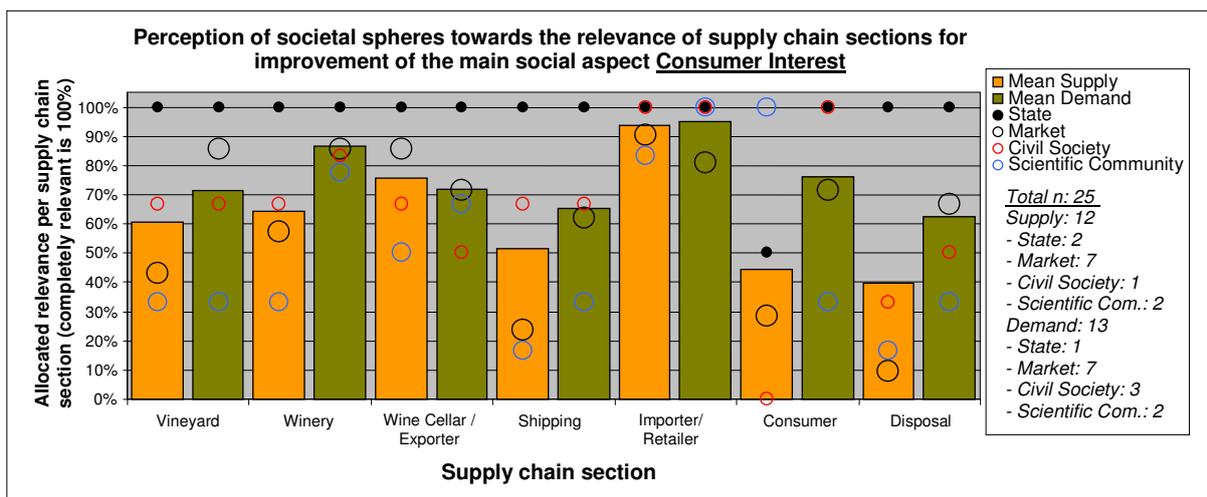
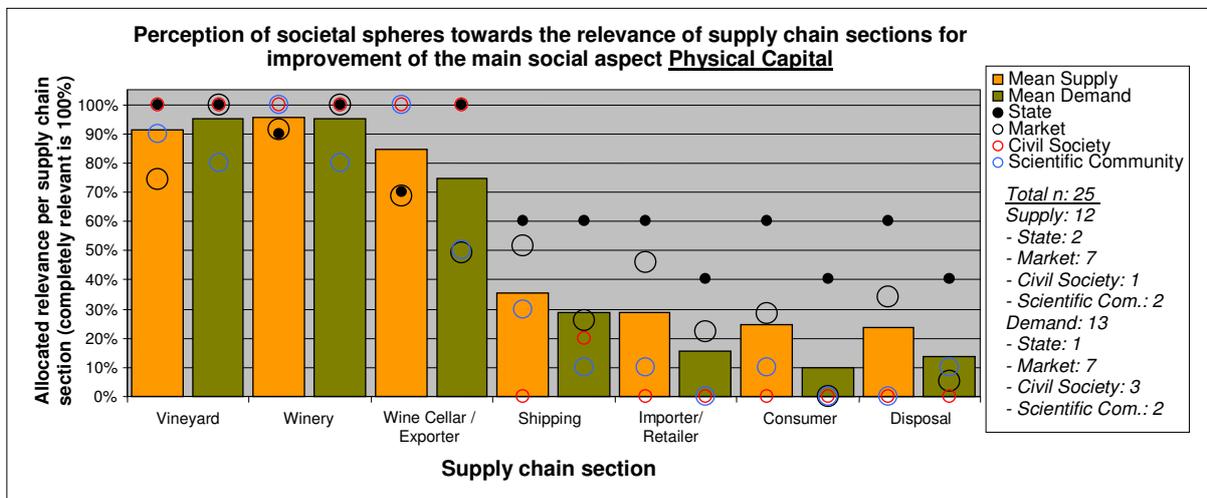
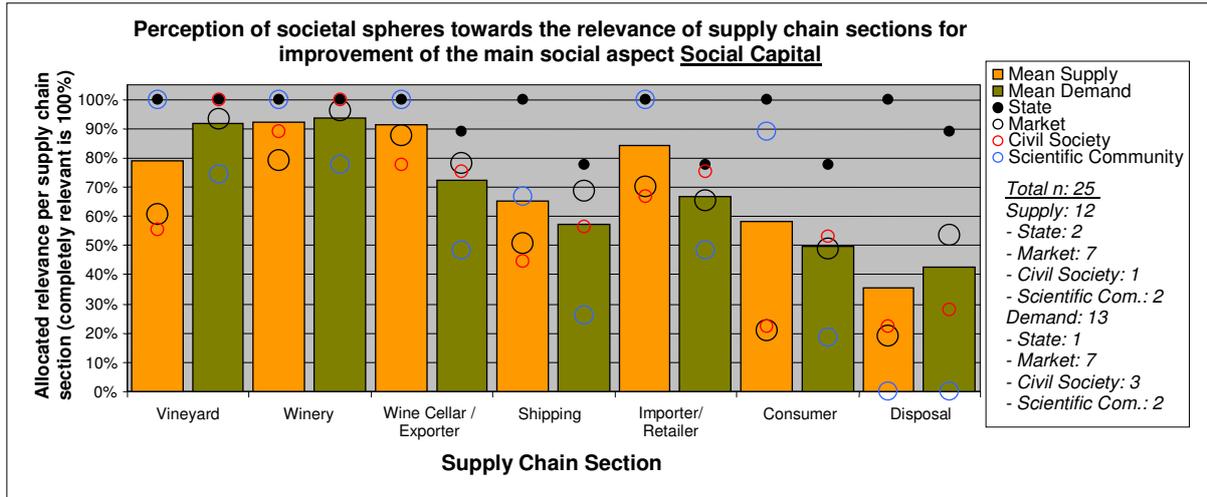
### Appendix VII: Supply chain section relevance – Main Environmental Aspects



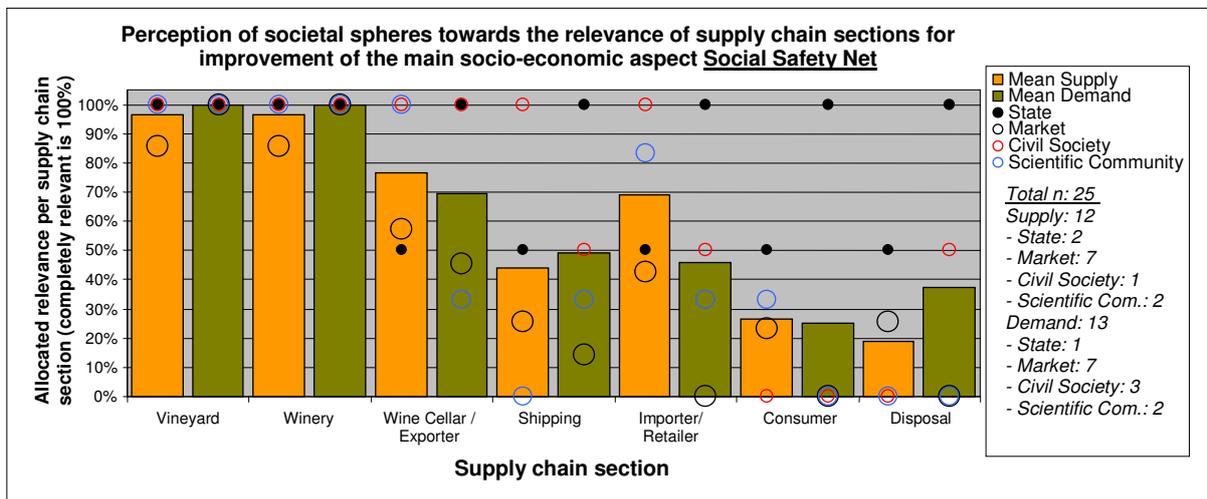
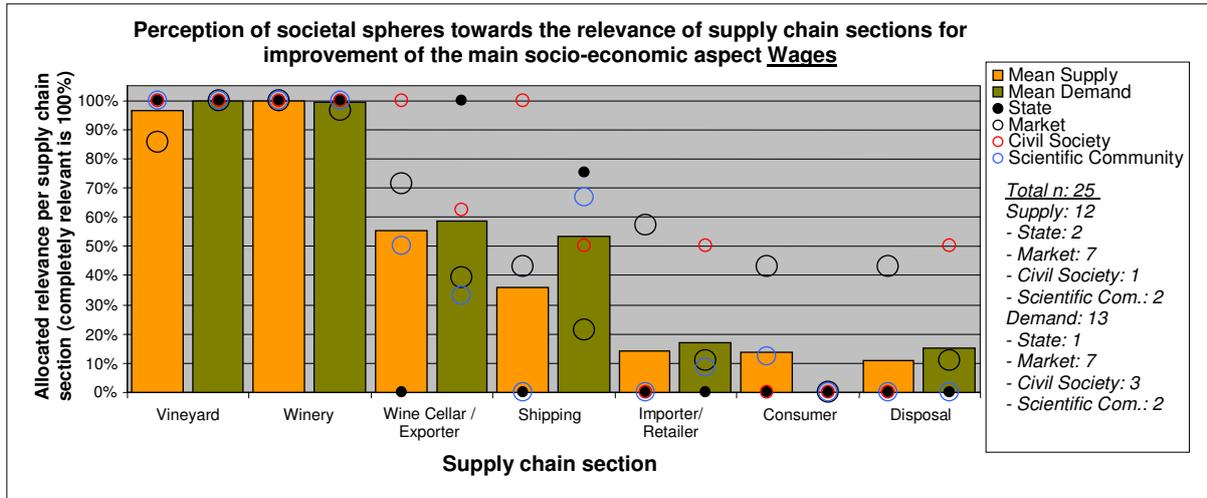


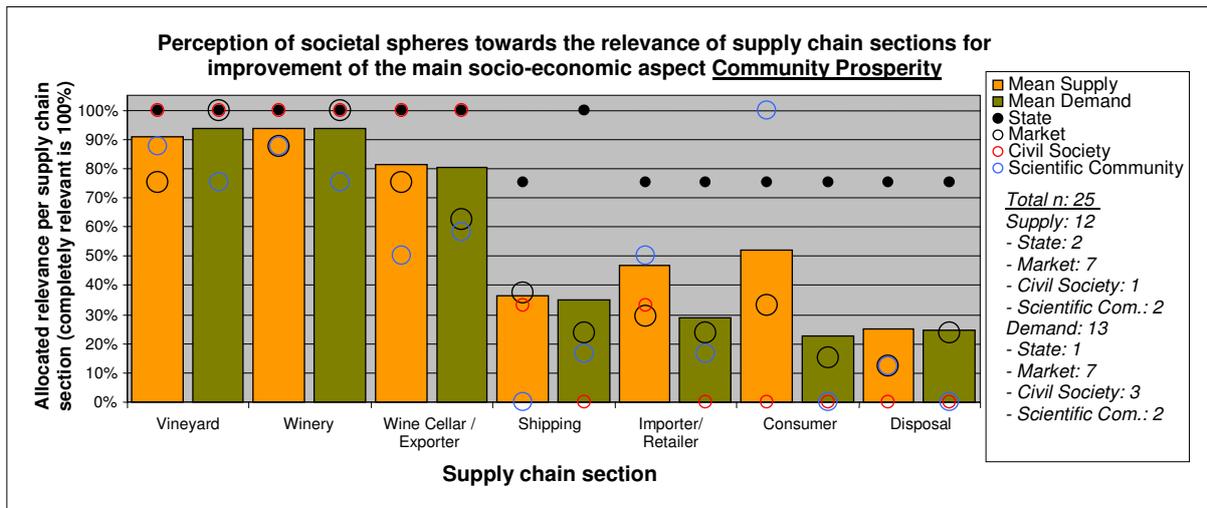
### Appendix VIII: Supply chain section relevance – Main Social Aspects



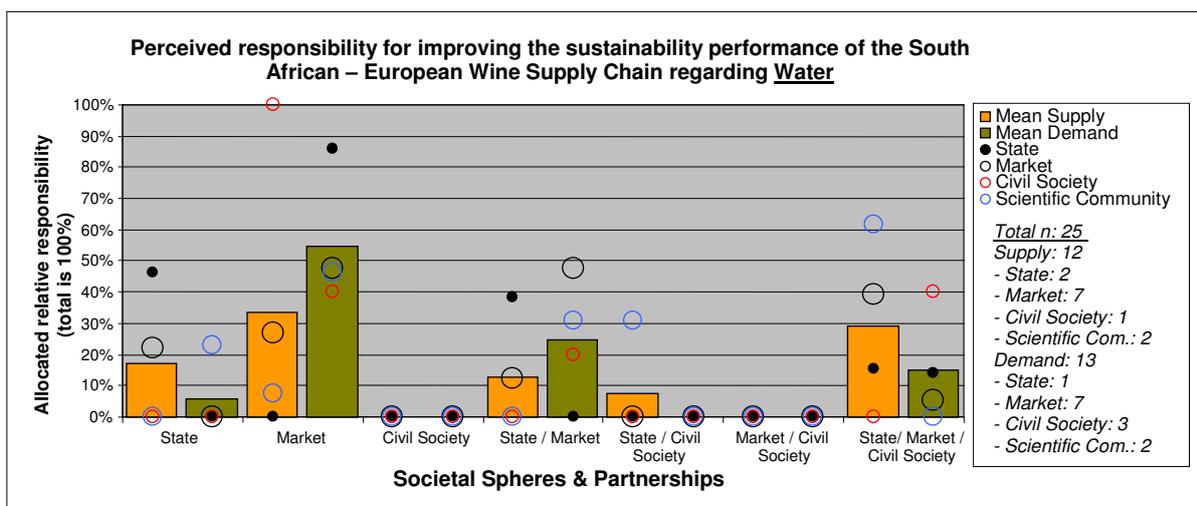
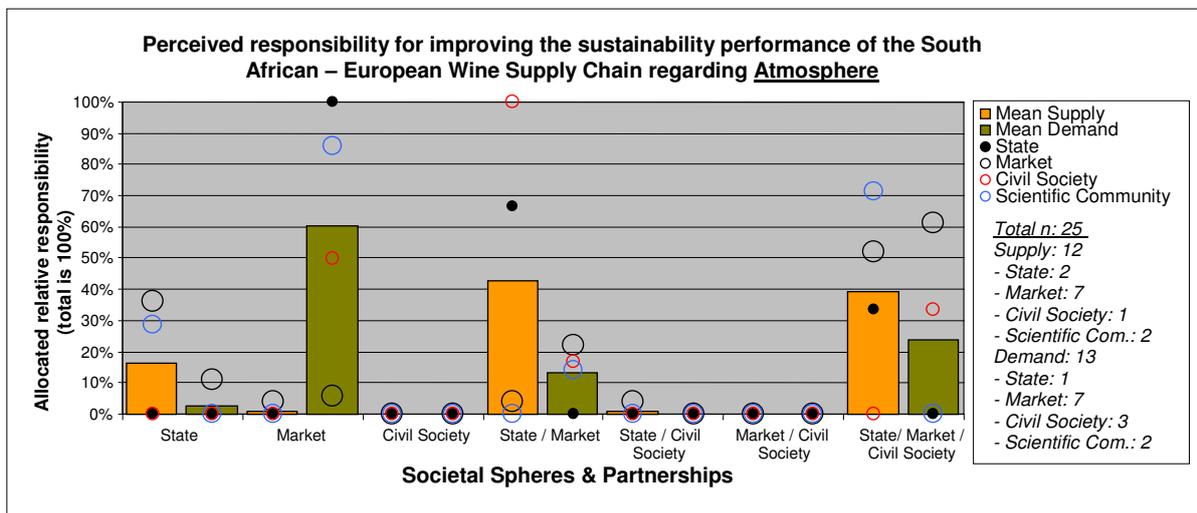
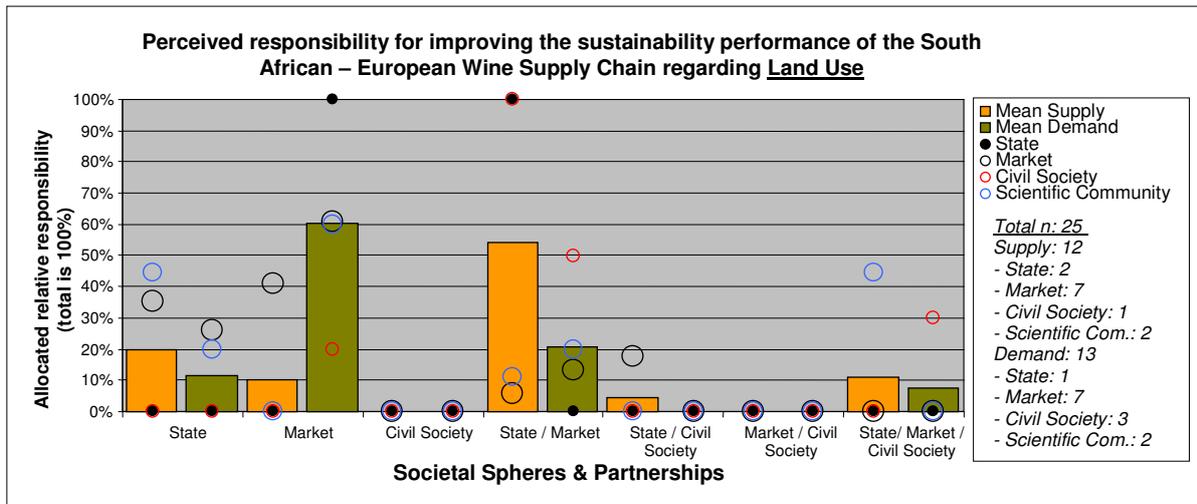


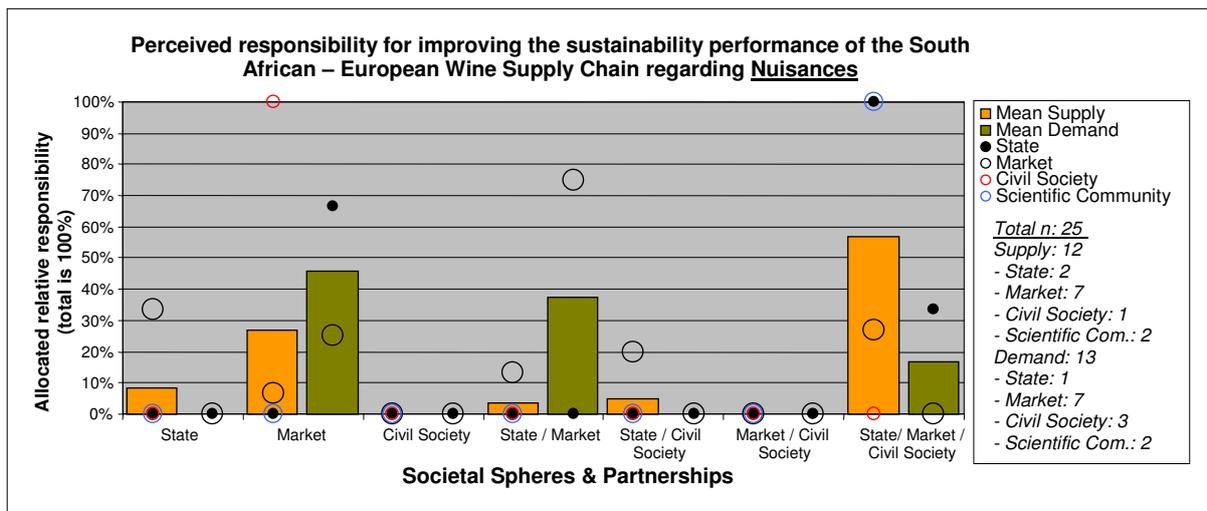
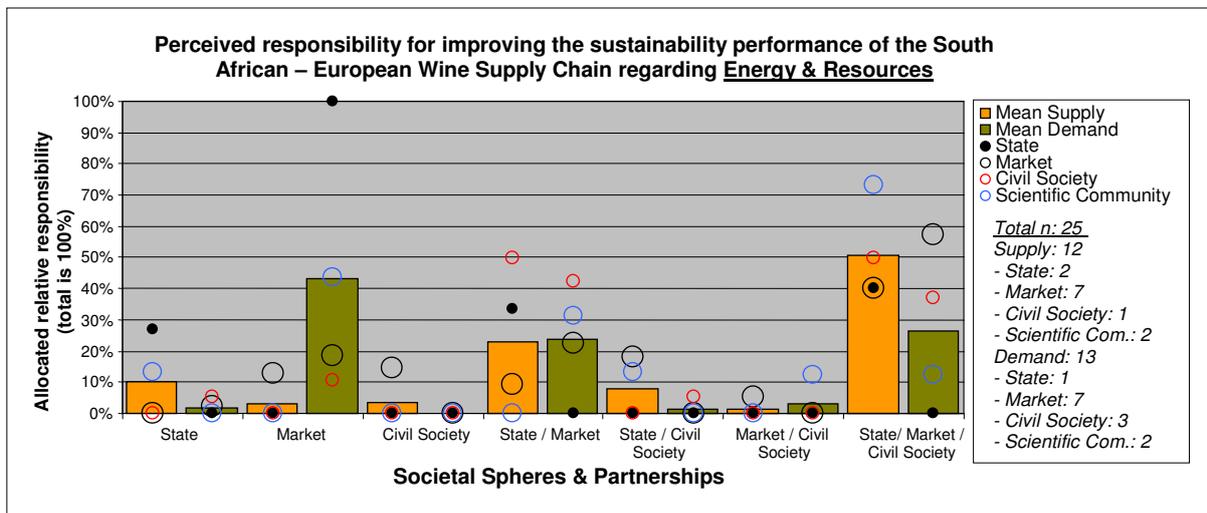
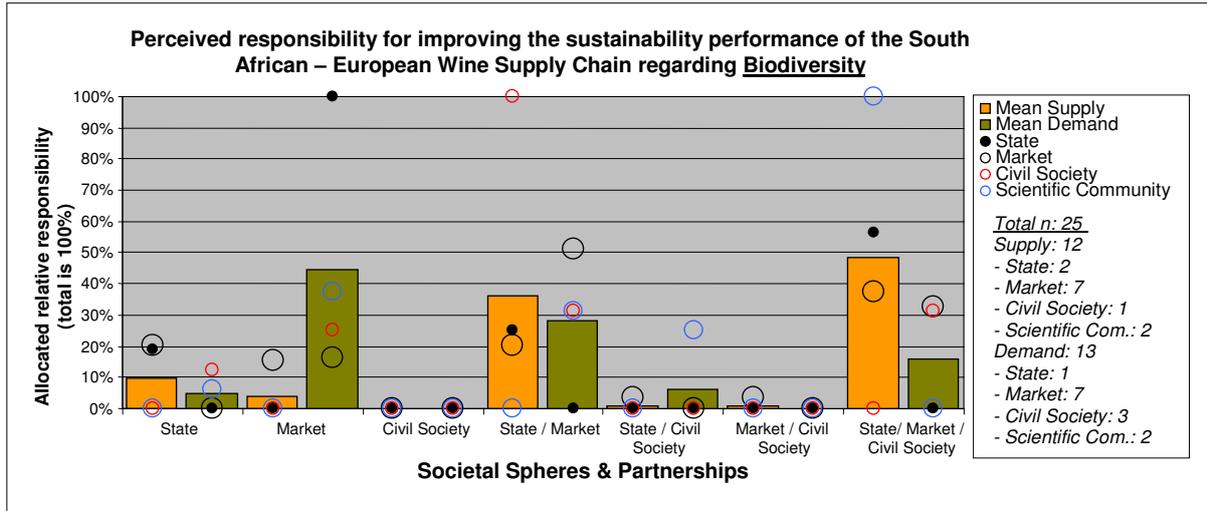
### Appendix IX: Supply chain section relevance – Main Socio-economic Aspects



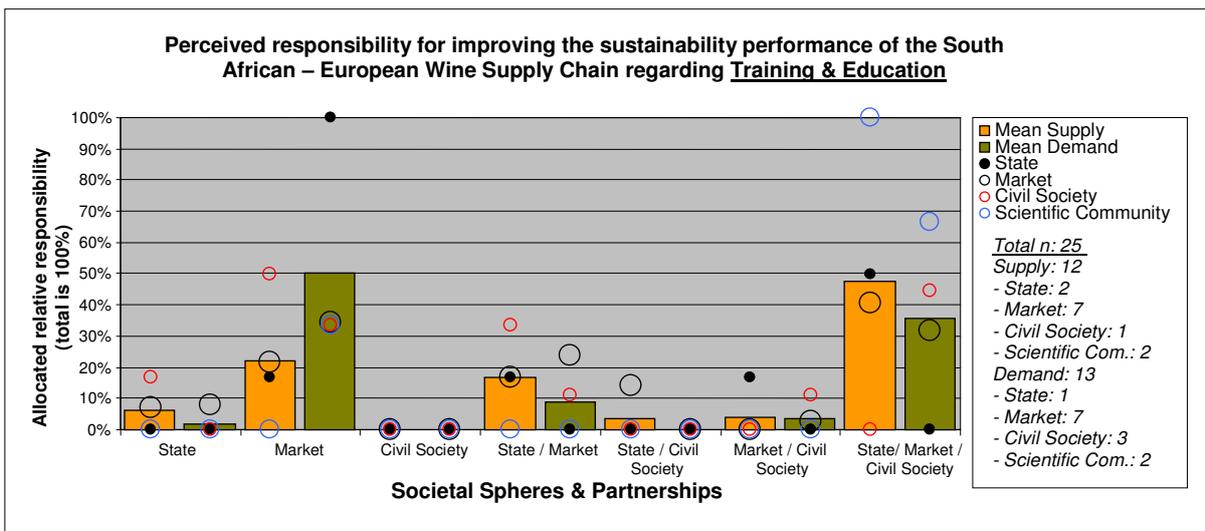
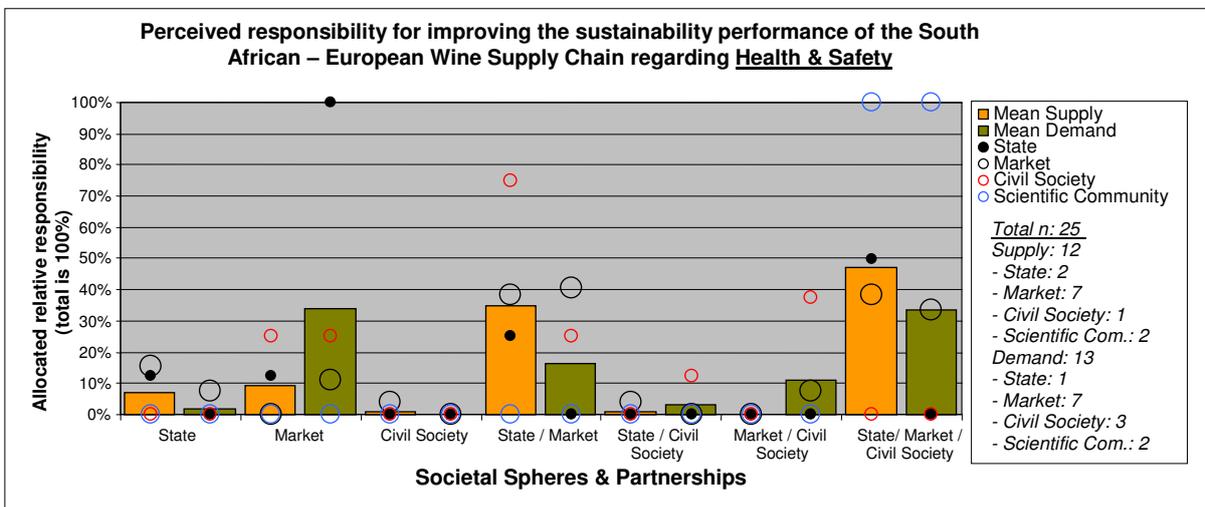
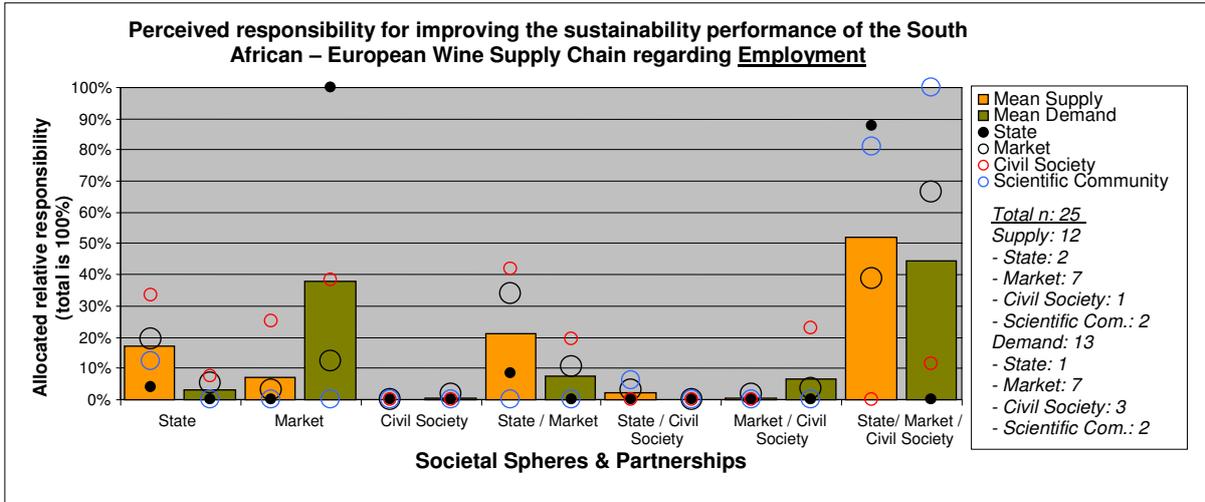


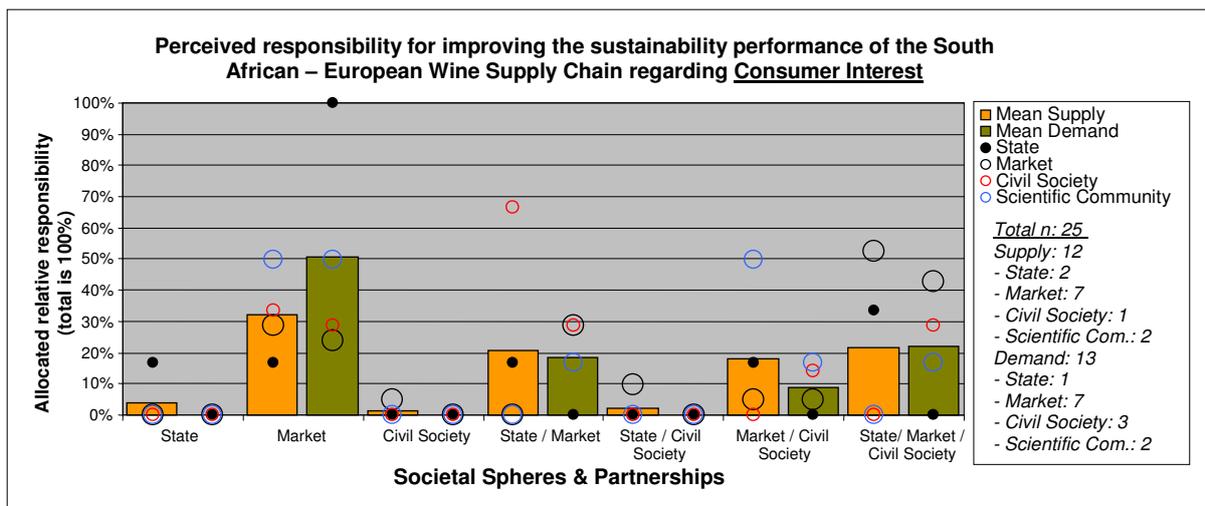
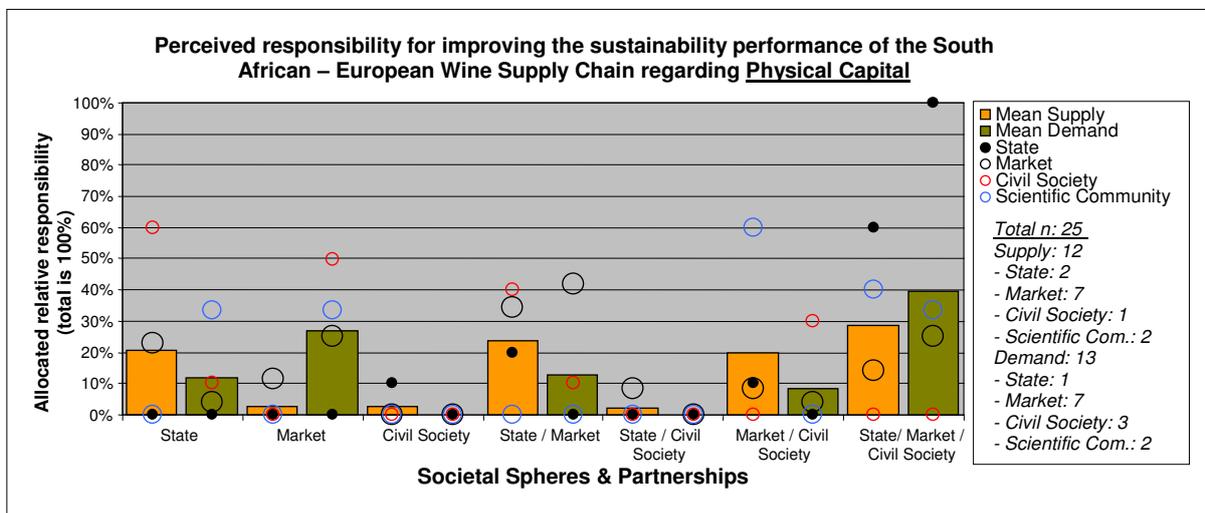
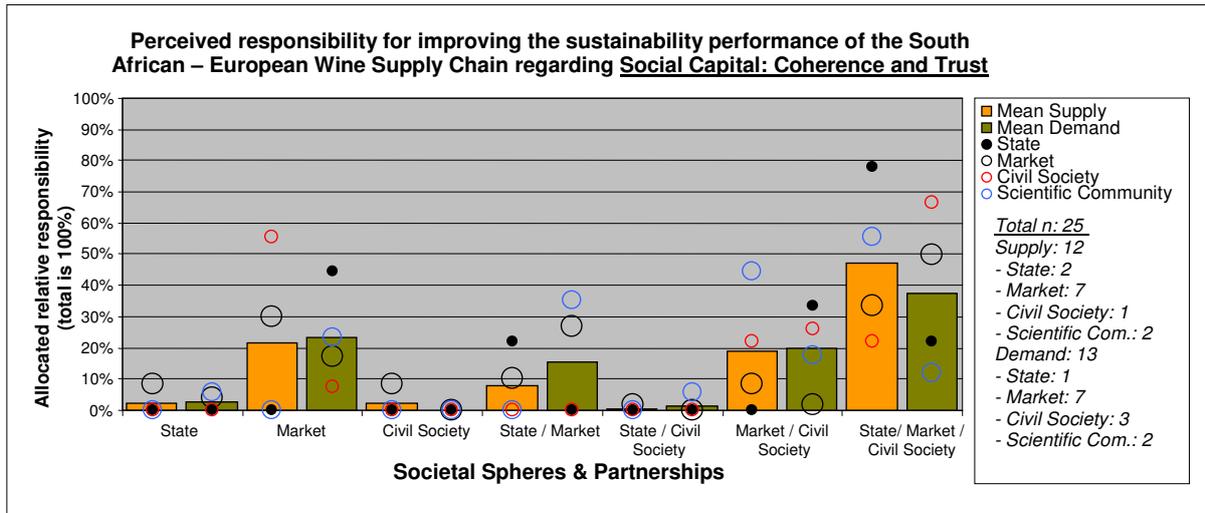
### Appendix X: Perceived responsibility improving environmental performance



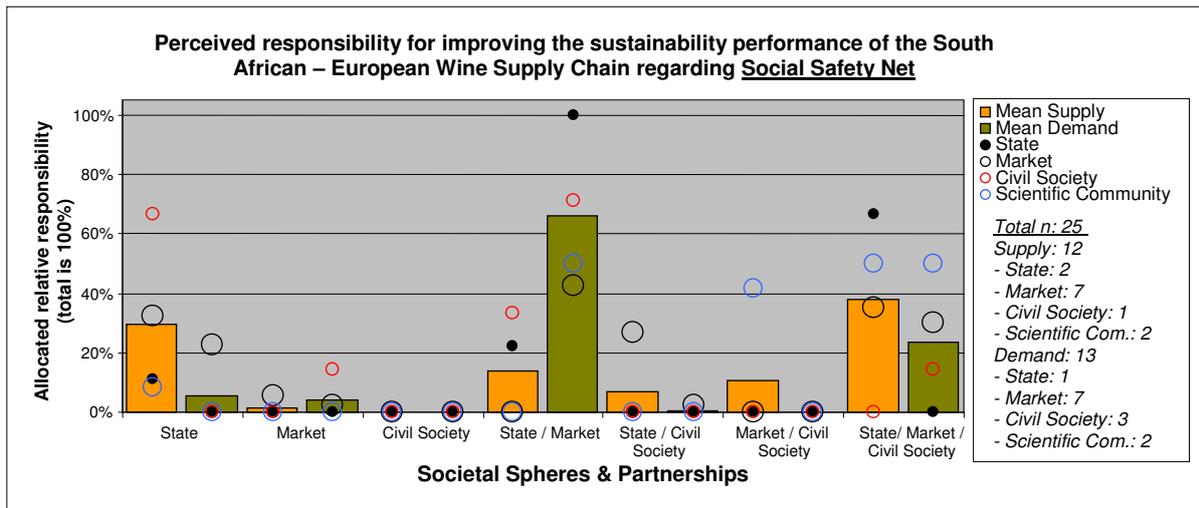
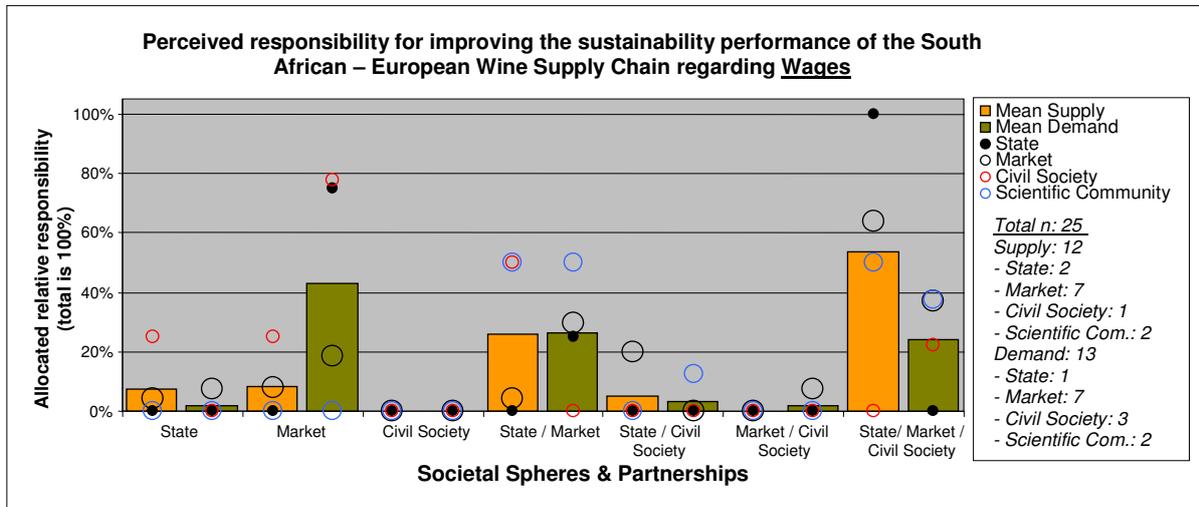


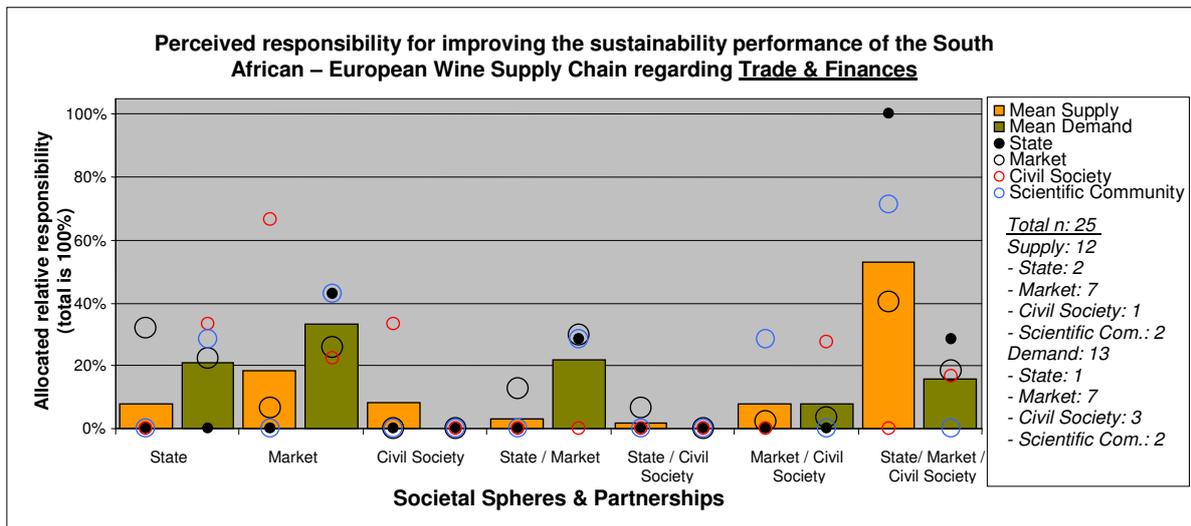
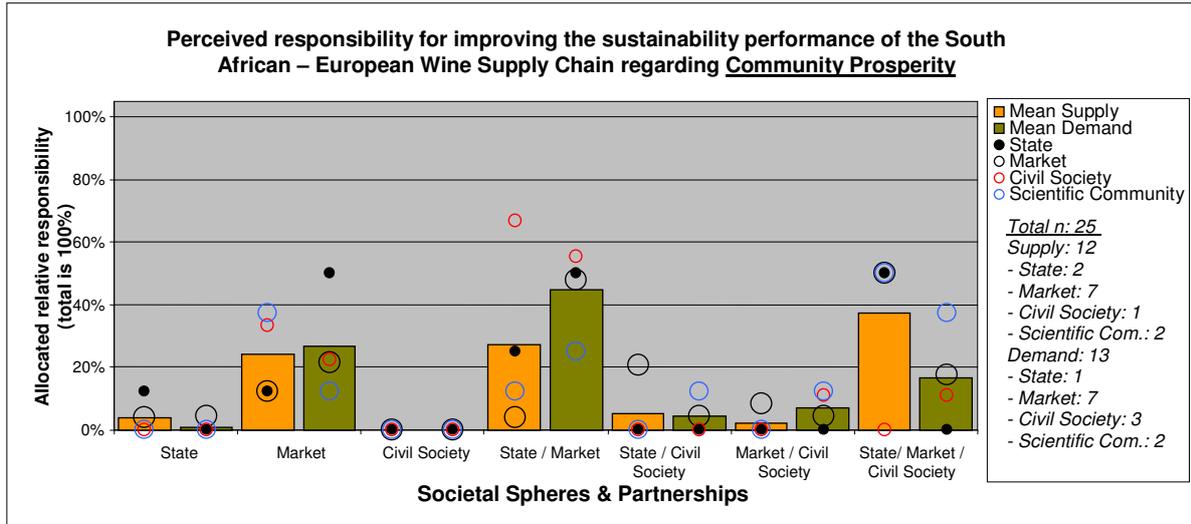
**Appendix XI: Perceived responsibility improving social performance**





### Appendix XII: Perceived responsibility improving socio-economic performance





## References

- Aranda, A., I. Zabalza & S. Scarpellini (2005) Economic and environmental analysis of the wine bottle production in Spain by means of LCA.
- Ardente, F., G. Beccali, M. Cellura et al. (2006) POEMS: A case study of an Italian wine-producing firm. *Environmental management* 38(3), pp.350-364.
- Banville, C., M. Landry, J. Martel et al. (1998) A stakeholder approach to MCDA. *Systems Research and Behavioral Science* 15(1), pp.15-32.
- Bauman, H and A. Tillman (2004) *The hitch hiker's guide to LCA: An orientation in life cycle assessment and application.*
- Bosker F. (2006) *De nieuwe wijnmakers: Speurtocht naar eerlijke wijnen uit nieuwe wereldlanden.* 's-Graveland: Fontaine Uitgevers.
- Bossel H. (1999) *Indicators for sustainable development: Theory, method, applications.* Winnipeg, Manitoba: International Institute for Sustainable Development.
- Boudreau-Sannier, V. (2008) *Sustainability inc.: Environmental self-regulation in the South African wine industry.* Unpublished manuscript.
- British Glass. (2008) *The recycling cycle.*
- Brown, J., ed. (1989) *Environmental threats (1st ed.).* London: Belhaven Press.
- BWI. (2009) Biodiversity & wine initiative [online] Retrieved 24 April 2009. Available on the world wide web: <<http://www.bwi.co.za/index.asp>>.
- Carney D. (1998) Rural livelihoods: What contribution can we make? paper presented at the DFID natural resources advisers conference, July 1998 London
- Cassam, Q. (2008) Knowledge, perception and analysis. *South African Journal of Philosophy* 27(3), pp.36-48.
- Clavijo Izquierdo M. J. et al. (2005) *Análisis del ciclo de vida del vino de crianza D.O.C. rioja.* Barcelona
- Cleary, J. (2009) Life cycle assessments of municipal solid waste management systems: A comparative analysis of selected peer-reviewed literature. *Environment international* 35(8), pp.1256-1266.
- Cypher, J. M. & J. L. Dietz (2009) *The process of economic development (third ed.).* London/New York: Routledge.

- Dahl, A. L. (1999) Living with environmental limits: Implications of baha'i principles for sustainable development [online] Retrieved 12 September 2009. Available on the world wide web: <<http://www.bcca.org/ief/ddahl99a.htm>>.
- Davidson N., F. Ouane, C. Phillpotts et al. (2009) Microeconomics of competitiveness: The South African wine cluster (University Research)
- Demhardt, I.J. (2003) Wine and tourism at the "Fairest cape" -- post-apartheid trends in the Western Cape Province and Stellenbosch (South Africa). *Journal of Travel & Tourism Marketing* 14(3), pp.113.
- Deutsche Umwelthilfe (2009) Hintergrund glas-mehrwegsysteme [online] 2009. Available on the world wide web: <<http://www.duh.de/1168.html>>.
- DFID (1999) Sustainable livelihoods guidance sheet DFID.
- Downing, S. (2005) The social construction of entrepreneurship: Narrative and dramatic processes in the coproduction of organizations and identities. *Entrepreneurship Theory and Practice* 29(2), pp.185-204.
- Dreyer, L., M. Hauschild & J. Schierbeck (2006) A framework for social life cycle impact assessment (10 pp). *The International Journal of Life Cycle Assessment* 11(2), pp.88-97.
- Elizabeth, L. M. (2009) Attitudes and responses to climate change: The intersection of worldviews and immediate concerns [Abstract] *IOP Conference Series: Earth and Environmental Science*, 6(57) 572001. from <http://stacks.iop.org/1755-1315/6/i=57/a=572001>
- EU (2008) IPP [online] Retrieved 01 April 2009. Available on the world wide web: <<http://ec.europa.eu/environment/ipp/integratedpp.htm>>.
- Fair Trade Original (2010) Over fair trade original: Introductie [online] Retrieved 24 January 2010. Available on the world wide web: <<http://www.fairtrade.nl/556/Introductie/>>.
- FairFood (2010) FairFood: About us [online] Retrieved 29 January 2010. Available on the world wide web: <<http://www.fairfood.org/about-us/>>.
- Ferdows, K. (1997) Making the most of foreign factories. *Harvard Business Review* 75, pp.73-88.
- FTSA (2010) Fair trade south africa [online] Retrieved 29 January 2010. Available on the world wide web: <<http://www.fairtrade.org.za/>>.
- Fung, A. (2003) Associations and democracy: Between theories, hopes, and realities. *Annual review of Sociology* 29(1), pp.515-539.

- Gauthier, C. (2005) Measuring corporate social and environmental performance: The extended life-cycle assessment. *Journal of Business Ethics* 59(1), pp.199-206.
- Gephart, R. (1999), Paradigms and research methods. *Research Methods Forum* 4
- Glasbak (2009) Glasbak algemeen [online] 2009. Available on the world wide web: <http://www.glasbak.nl/index.jsp?pageid=166>.
- Glasbergen, P. (2007) *Lecture sheets; the sustainability challenge A*. Unpublished manuscript.
- Gonzales A., A. Klimchuck & M. Martin (2006) Life cycle analysis of wine production process: Finding relevant process efficiency and comparison to eco-wine production
- Grimble R. (1998) Stakeholder methodologies in natural resource management. Chatham, UK: Natural Resource Institute.
- Grimble, R. & K. Wellard. (1997) Stakeholder methodologies in natural resource management: A review of principles, contexts, experiences and opportunities. *Agricultural Systems* 55(2), pp.173-193.
- Guinée, J.B., M. Gorrée, R. Heijungs et al., eds. (2002) Handbook on life cycle assessment: Operational guide to the ISO standards. New York, Boston, Dordrecht, London, Moscow: Kluwer Academic Publishers.
- Hall, J. (2001) Environmental supply-chain innovation. *Greener Management International* (35), pp.105.
- Hauschild, M.Z., L.C. Dreyer & A. Jørgensen (2008) Assessing social impacts in a life cycle perspective—Lessons learned. *CIRP Annals - Manufacturing Technology* 57(1), pp.21-24.
- Hilderink H. B. M. (2004). Towards human and social sustainability indicators: A multidimensional approach No. 550012002). Bilthoven: RIVM.
- Hunkeler, D. (2006) Societal LCA methodology and case study (12 pp). *The International Journal of Life Cycle Assessment* 11(6), pp.371-382.
- Hutchins, M.J. & J.W. Sutherland (2008) An exploration of measures of social sustainability and their application to supply chain decisions. *Journal of Cleaner Production* 16(15), pp.1688-1698.
- ISO (2000) ISO14042 No. ISO 14042:2000(E). Geneva, Switzerland: ISO copyright office.
- ISO (2006) ISO14040 No. ISO 14040:2006(E). Geneva, Switzerland: ISO copyright office.
- Jönson, G. (1996) LCA - a tool for measuring environmental performance. Surrey: Pira International.
- Jørgensen, A., A. Le Bocq, L. Nazarkina & M. Hauschild (2008) Methodologies for social life cycle assessment. *The International Journal of Life Cycle Assessment* 13(2), pp.96-103.

- Kickert, W.J.M., E. Klein & J.F.M. Koppenjan (1997) Introduction: A management perspective on policy networks. In W. J. M. Kickert, E. Klein & J. F. M. Koppenjan (Eds.), *Managing complex networks: Strategies for the public sector* pp. 1-13. London: Sage.
- Kloepffer, W. (2008) Life cycle sustainability assessment of products (with comments by helias A. udo de haes, p. 95). *The International Journal of Life Cycle Assessment* 13(2), pp.89-95.
- Kohler-Koch, B. & C. Quittkat (2009) What is civil society and who represents civil society in the EU?—Results of an online survey among civil society experts. *Policy and Society* 28(1), pp.11-22.
- Kruse, S., A. Flysjö, N. Kasperczyk et al. (2009) Socioeconomic indicators as a complement to life cycle assessment - an application to salmon production systems. *The International Journal of Life Cycle Assessment* 14(1), pp.8-18.
- Labuschagne, C. & A. Brent (2006) Social indicators for sustainable project and technology life cycle management in the process industry (13 pp + 4). *The International Journal of Life Cycle Assessment* 11(1), pp.3-15.
- Labuschagne, C., A.C. Brent & R.P.G. van Erck (2005) Assessing the sustainability performances of industries. *Journal of Cleaner Production*, 13(4), pp.373-385.
- Lafferty, W.M. & J. Meadowcroft (1996) Democracy and the environment: Prospects for greater congruence. In W. M. Lafferty, & J. Meadowcroft (Eds.), *Democracy and the environment: problems and prospects*, pp. 256-264, Edward Elgar.
- Leeuw, B. de (2006) Life cycle management in developing countries: State of the art and outlook. *The International Journal of Life Cycle Assessment* 11(0), pp.123-126.
- Lélé, S.M. (1991) Sustainable development: A critical review. *World Development* 19(6), pp.607-621.
- Levett, R. (1998) Sustainability indicators--integrating quality of life and environmental protection. *Journal of the Royal Statistical Society. Series A (Statistics in Society)* 161(3), pp.291-302.
- Mather, G. (2006) *Foundations of perception* (1st ed.). New York: Taylor & Francis Inc.
- Meadowcroft, J. (2000) Sustainable development: A new(ish) idea for a new century? *Political Studies* 48(2), pp.370-387.
- Mourad, A., L. Coltro, P. Oliveira et al. (2007) A simple methodology for elaborating the life cycle inventory of agricultural products. *The International Journal of Life Cycle Assessment* 12(6), pp.408-413.

- Müller, C., W.J.V. Vermeulen & P. Glasbergen (2009) Perceptions on the demand side and realities on the supply side: A study of the South African table grape export industry. *Sustainable Development* 17(5), pp.295-310.
- MVO Nederland (2010) Corporate social responsibility [online] Retrieved 24 January 2010. Available on the world wide web: <<http://www.mvonederland.nl/english/>>.
- Nasar, J.L. (2008) Assessing perceptions of environments for active living. *American Journal of Preventive Medicine* 34(4), pp.357-363.
- Norris, G.A. (2001) Integrating life cycle cost analysis and LCA. *Int J. LCA* 6, pp.118.
- Norris, G.A. (2006) Social impacts in product life cycles - towards life cycle attribute assessment. *The International Journal of Life Cycle Assessment* 11(0), pp.97-104.
- Notarnicola, B., G. Tassielli & G.M. Nicoletti (2003) Life cycle assessment (LCA) of wine production. In Mattsson, B. and U. Sonesson (Ed.) *Environmentally-friendly food processing* pp. 306-326. Cambridge: Woodhead publishing.
- Oxfam Novib (2010) Oxfam Novib: Wat wij doen [online] Retrieved 24 January 2010. Available on the world wide web: <<http://www.oxfamnovib.nl/id.html?ch=&id=3683>>.
- Parris, T.M. & R.W. Kates (2003) Characterizing and measuring sustainable development. *Annual Reviews of Environment and Resources* 28, pp.559.
- Pietrzyk, D.I. (2003) Democracy of civil society? *Politics* 23(1), pp.38-45.
- Pizzigallo, A.C.I., C. Granai & S. Borsa (2008) The joint use of LCA and energy evaluation for the analysis of two italian wine farms. *Journal of Environmental Management*, 86(2), pp.396-406.
- Point, E.V. (2008) Life cycle environmental impacts of wine production and consumption in Nova Scotia, Canada. Unpublished Master, Dalhousie University.
- Ports & Ships (2010) Port of Cape Town [online] Retrieved 4 februari 2010. Available on the world wide web: <<http://ports.co.za/cape-town.php>>.
- Productschap Wijn (2008) General (introduction flyer)
- Ras, P.J., W.J.V. Vermeulen & S.L. Saalmink (2007) Greening global product chains: Bridging barriers in the north-south cooperation. An exploratory study of possibilities for improvement in the product chains of table grape and wine connecting South Africa and the Netherlands. *Progress in Industrial Ecology - An International Journal* 4(6), pp.401-417.

- Ras, P.J. & W.J.V. Vermeulen (2009) Sustainable production and the performance of South African entrepreneurs in a global supply chain. The case of South African table grape producers. *Sustainable Development* 17(5), pp.325-340.
- Rowley, T.J. (1997) Moving beyond dyadic ties: A network theory of stakeholder influences. *The Academy of Management Review* 22(4), pp.887-910.
- Runhaar, H. (2008) *Lecture sheet; policy analysis - stakeholder analysis*. Unpublished manuscript.
- SAWIS (2009a) Macro-economic impact of the wine industry on the South African economy (also with reference to the impacts on the Western Cape) SAWIS.
- SAWIS (2009b) South African Wine Industry Statistics SAWIS.
- SAWIS (2010a) SA wine industry and systems [online] Retrieved 29 January 2010. Available on the world wide web: <<http://www.sawis.co.za/>>.
- SAWIS (2010b) Wine of origin production areas [online] Retrieved 3 Februari 2010. Available on the world wide web: <<http://www.sawis.co.za/cert/productionareas.php>>.
- SAWIT (2010) South African wine industry trust homepage [online]. Retrieved 5 februari 2010. Available on the world wide web: <<http://sawit.co.za/>>.
- Schaffer, S.P. & T.M. Schmidt (2006) Sustainable development and human performance technology. In J. A. Pershing (Ed.), *Handbook of human performance technology: Principles, practices, and potential* 3rd ed., pp. 1109-1121. San Fransisco: Pfeifer.
- Solidaridad (2008) Solidaridad: Missie en visie [online] Retrieved 29 January 2010. Available on the world wide web: <<http://www.solidaridad.nl/over-solidaridad/missie-visie>>.
- Tabbush C. (2005). Civil Society in United Nations conferences: A literature review No. Paper No. 17 UNRISD.
- UN (2008) The millenium development goals report. New York: UN.
- UNDSD (2007) Indicators of sustainable development: Guidelines and methodologies. New York: UN.
- UNEP (2007) Global environment outlook GEO4: Environment for development UNEP.
- UNEP (2008) Organic agriculture and food safety in Africa.
- Vermeulen, W. J. V. (2007) *Lecture sheet; interactive methods for sustainability*. Unpublished manuscript.
- Vermeulen, W.J.V. & P.J. Ras (2006) The challenge of greening global product chains: Meeting both ends. *Sustainable Development* 14(4), pp.245-256.

- WCED (1987) Our common future. Oxford: Oxford University Press.
- WEHAB (2002) WEHAB framework papers WSSD.
- Werner, F. & K. Richter (2007) Wooden building products in comparative LCA. The International Journal of Life Cycle Assessment 12(7), pp.470-479.
- WIETA (2006) Wine and agricultural industry ethical trade association [online] Retrieved 24 April, 2009.  
Available on the world wide web: <<http://www.wieta.org.za/>>.
- Williams, M. (2000) Interpretivism and generalization. Sociology 34(2), pp.209-224.
- WOSA. (2009a) Three centuries of cape wine [online] Retrieved 1 February 2010, Available on the world wide web: <[http://www.wosa.co.za/sa/history\\_3centuries.php](http://www.wosa.co.za/sa/history_3centuries.php)>.
- WOSA (2009b) Wines of South Africa [online] Available on the world wide web:  
<[http://www.wosa.co.za/sa/sustainable\\_ipw.php](http://www.wosa.co.za/sa/sustainable_ipw.php)>.
- Wrisberg, M.N., H.A. Udo de Haes, U. Triebswetter et al. (2002) Appendix A: Full description of tools. In M. N. Wrisberg, & H. A. Udo de Haes (Eds.), Analytical tools for environmental design and management in a systems perspective: The combined use of analytical tools. Dordrecht: Kluwer Academic Publishers.
- WUR (2010) Food & biobased research: Fresh, food & chains [online] Available on the world wide web:  
<[http://www.fbr.wur.nl/UK/research/specialisation/fresh\\_food\\_chains/](http://www.fbr.wur.nl/UK/research/specialisation/fresh_food_chains/)>.
- Zyl, D.J.van (1987). Vineyards and wine and history in South Africa. pp. 32