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ENVIRONMENTAL SUSTAINABILITY INDICATORS
IMPLEMENTED IN A DECISION SUPPORT SYSTEM FOR
VITICULTURAL SECTOR

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ABSTRACT

Environmental sustainability principles applied to agricultural and specifically to viticultural sector are presented.

A rigorous and complete approach is built with the final purpose to assess the sustainability level of agricultural productions. The work focuses on grape growing process and undergoes a detailed analysis of the environmental performance associated to all the phases of the grape lifecycle.

The approach takes into account different impacts in a comprehensive modelling of the processes and estimates impacts categories regarding human health, air, soil, biodiversity conservation, energetic consumptions and water use. The methodology comprehends both indicators that evaluate the emissions and resources use with a Life Cycle Assessment approach, and typically agronomic indicators. In fact, besides using indicators like carbon, water and ecological footprint or acidification and eutrophication, the research work includes also agronomic indicator such as carbon sequestration, soil coverage, erosion risk, water use efficiency, fuel consumptions, etc. as well as biodiversity issues and the assessment of toxicological and eco-toxicological risk caused by chemical products use in the field.

The study is carried out following the guidelines from international standards and from documented literature sources for the assessment of the environmental performance and elaborating original methodologies for the input data collection, the quantification of the impacts, and the interpretation of the results.

The main goals of the work are the: (i) analysis of the literature background on environmental indicators implementation in agricultural and viticultural sector; (ii) development of innovative methodology to assess environmental impact of grape production process; and (iii) testing of the methodology in practical cases.

Four parts and a conclusion chapter form the structure of the thesis.

Part I - The introduction concerns the general framework of the thesis and is divided in different sections concerning: i) the implementation of sustainability aspects into agricultural sector through the construction of a set of indicators; ii) environmental sustainability indicators issues; iii) researches and methodologies to analyse the environmental sustainability of an agricultural productions; iv) the interest in sustainable wine consumption and production and initiatives of vitivinicultural sustainability assessments in Italy and at international level; and v) the DSS, specific tools that help implementing sustainability principles into agricultural sector.

Part II - The second part of the thesis explains the main objectives of the Doctoral work programme and the methodology used to build the environmental sustainability indicators for the viticultural sector.

Part III - The third chapter examines the indicators, starting with the definition of the macro-areas (Human Health, Air, Soil, Biodiversity, Energy and Water) going through the description of the sub-indicators calculation methodology and characteristics and finishing with the definition of the applied scores.

Part IV - After having defined indicators and sub-indicators, weights were attributed and the methodology was tested. Therefore, the fourth part shows the results of the indicators test in practical cases within the European FP7-KBBE project "*InnoVine*" on innovation in viticulture. In particular, the indicators were tested with two InnoVine partners, one located in Italy and the other in Spain. In the first section of this part the InnoVine project is described with a specific focus on the work package 4, in which the tests were performed. A second section explains data collection process and the indicators implementation in the practical cases. Finally the results about environmental indicators calculation are presented and discussed.

The final chapter of the thesis summarizes the results obtained and draws the conclusions, confirming:
i) the methodology validity in quantifying the impacts of different grape production practices on the environment and ii) the methodology implementation in the DSS vite.net® through a calculator.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	ERROR! BOOKMARK NOT DEFINED.
ABSTRACT	III
TABLE OF CONTENTS	V
LIST OF FIGURES	IX
LIST OF TABLES	XI
ACRONYMS AND SYMBOLS USED THROUGHOUT THE THESIS	XIII
PART I:INTRODUCTION	1
<i>1.1 From sustainable development to sustainable agriculture</i>	<i>3</i>
<i>1.1.1 European Union policy background</i>	<i>3</i>
<i>1.1.2 Sustainability principles applied to agricultural and viticultural sector</i>	<i>5</i>
<i>1.2 Environmental sustainability assessment of agricultural systems</i>	<i>9</i>
<i>1.2.1 Environmental indicators</i>	<i>9</i>
<i>1.2.2 Calculation scale of environmental indicators</i>	<i>12</i>
<i>1.3 Agri-environmental sustainability assessment at European level</i>	<i>14</i>
<i>1.4 Main sustainability assessments implemented into viticulture and wine sector</i>	<i>20</i>
<i>1.4.1 Consumer's interest in sustainable wine</i>	<i>20</i>
<i>1.4.2 Italian initiatives of wine sustainability</i>	<i>20</i>
<i>1.4.3 International initiatives of wine sustainability</i>	<i>23</i>
<i>1.5 Decision Support Systems for sustainable agriculture integrating production environmental impact</i>	<i>27</i>
<i>1.5.1 Vite.net®: a decision support system for the viticultural sector</i>	<i>28</i>

PART II: OBJECTIVES AND METHODOLOGY	33
2.1 Objectives	35
2.2 Methodology.....	37
2.2.1 Sustainability indicators work team	37
2.2.2 Methodology of the research	38
PART III: RESULTS OF INDICATORS FOR ENVIRONMENTAL SUSTAINABILITY	41
3.1 Human Health Indicator.....	53
3.1.1 Context.....	53
3.1.2 Human health indicator structure	58
3.2 Air Indicator.....	61
3.2.1 Context.....	61
3.1.2 Air indicator structure.....	67
3.3 Soil Indicator	73
3.3.1 Context.....	73
3.1.2 Soil indicator structure	80
3.4 Biodiversity indicator	93
3.4.1 Context.....	93
3.4.2 Biodiversity indicator structure	98
3.5 Energy Indicator	101
3.5.1 Context.....	101
3.5.2 Energy indicator structure	104
3.6 Water Indicator.....	111
3.6.1 Context.....	111

3.6.2 <i>Water indicator structure</i>	117
PART IV: TEST OF INDICATORS IN PRACTICAL CASES	133
4.1 <i>InnoVine project</i>	135
4.2 <i>Environmental indicators test in practical cases</i>	140
CONCLUSIONS	157
BIBLIOGRAPHY	159