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Big Data to Enable Global Disruption of the Grapevine-powered Industries

D2.1 - Use Cases & Technical Requirements Specification

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EXECUTIVE SUMMARY

The deliverable D2.1, "Use Cases & Technical Requirements Specification", aims to give the outline, specify and present in detail the use cases that will be examined and undertaken during the project lifetime. It is a report documenting the use cases and the different scenarios and hypotheses that derive from them, which are directly linked and related to the BigDataGrapes pilots. More specifically, this deliverable provides the methodology that was followed by the project partners in order to define and categorize the use cases, the interpretation of the use cases with respect to their technical and infrastructural requirements, since each use case elicits to specific software requirements in terms of functionality, expected performance and required equipment.

The document is structured as follows. Chapter 1 serves as an introduction to the deliverable whereas Chapter 2 provides an overview of the use cases with details on the methodology which was followed in order to define them, their categorization and analysis as well as their importance on the domain. Each use case is separated in four sections: the scenario behind the use case, the real-life data problem to be addressed, the approach that is currently used to address the data problem, the scenario hypothesis, which practically presents a new approach to the data problem at hand thanks to the BigDataProject, the related data and their description, the technical requirements of the use case and the related pilot(s) that relate directly to the use case. Finally, Chapter 3 contains the conclusions regarding the use cases.

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1 INTRODUCTION

BigDataGrapes aims to explore realistic, applicable Big Data challenges in grapevine-powered industries, and as a result the early involvement of the relevant stakeholders in order to elaborate on the envisaged use cases has been defined as critical. The data problems of the targeted grapevine-powered industries require cross-sector technical solutions for the entire lifecycle of the Big Data Value Chain. While for some of the data problems entailed in the use cases there are established technologies and processes to be adopted, others require novel methodologies to ensure that the real-world demands posed by the industries are met. To this end, BigDataGrapes will produce a complete, integrated Big Data solution that responds to the different core challenges by adapting and extending existing standards and tools or, where necessary, advancing the state-of-the-art with outcomes of basic research in the relevant fields.

The driver for the project's developments is the Data Challenges faced by these industries, which have already been collected, refined and analysed in the context of WP2, Grapevine-powered Industry Big Data Challenges (and will continue to do so) by solidifying the BigDataGrapes use cases, record and systematically analyse data assets, identify the pragmatic Big Data needs that need to be covered, and, ultimately, produce the architecture of the BigDataGrapes solution. WP2 in general aims to:

a. Produce a concrete specification of the use cases where data challenges are of major significance for the relevant stakeholders;
b. Elicit the technical requirements for serving these use cases, taking into account functional, operative and performance demands.

More specifically, the objectives of T2.1 "Use Cases and Requirements" are (i) the mapping of the various data problems that exist within the domain, (ii) the elicitation of the technical requirements in order to address the data problem, and (iii) the definition of the hypotheses that need to be examined in order to pave the way for experimental testing. The work of this task and its outcome, deliverable D2.1, is the main driver for the entire project since they directly linked to other activities covering a large spectrum of the project, namely activities related to WP8 and the BigDataGrapes pilots as well as to the technical WPs, which will make use of the data defined and used within the use cases and their instantiations, namely the BigDataGrapes pilots.

2 USE CASES

2.1 METHODOLOGY

The partners defined, identified and documented use cases mirroring the data challenges they face and their expectations and foreseen benefits from the application of the project's technological assets, in terms of operational, revenue and expansion gains. These are both technical and research problems that all partners would like to tackle, and they constitute the key point and are requested in the context of WP2. These requirements are expected to be based on both the partners experience as well as input from end-users.

The first step was to identify and map the different data problems that exist within the different domains. If the problem is important for the domain, then it is worth to further explore it as a use case. The second step was to examine whether there are data for a specific Use Case. In case of insufficient or no data at all, the intermediate step was to examine there would be enough time and equipment to generate the data in question. The third step was to examine if the use case is feasible and if there is the necessary experimentation space in order to carry out the related pilot(s) to verify and evaluate the use case.

2.2 USE CASES CATEGORIZATION

Four overarching (4) use cases and ten (10) relevant scenarios, in which the use cases are further divided, have been identified so far under WP2, "T2.1-Use Cases & Technical Requirements" (Table 1). Instantiations of these use cases are the pilots that have been defined in D8.1.

2.2.1 Use Case A - Earth Observation Data Anomaly Detection and Classification.

The purpose of this use case is to develop models that differentiate between Earth Observation data issues and anomalies. This is for triggering warnings to farmers and insurances concerning farm management practices or damage events. This use case is a cross-pilot use case since it is going to be addressed, tested and evaluated by all pilots.

2.2.2 Use Case B - Yield & Quality Prediction

The purpose of this use case is to leverage historical earth observation data combined with additional relevant information from the field to make educated guesses about yield and wine quality, based also on the expertise and know-how of the vine growers.

2.2.3 Use Case C - Farm Management

This use case would take care of optimizing the farm practices and of management. This would mean modelling climate, sunlight exposure, soil quality, slope and topography to predict the vine specific needs considering how different cultivation and vineyard management techniques affect grape quality and quantity.

2.2.4 Use Case D - Risk Assessment

The purpose of this use case would be to minimize the waste in the production as we all as to ensure the minimal impact on the environment deriving from the cultivation techniques and farm management practices

Table 1: Use Cases and Scenarios

Use Cases (Generic)	Use Case Scenarios
A. Data Anomaly Detection & Classification	A. Earth Observation Data Anomaly Detection & Classification
B. Prediction	B1. Yield Prediction B2. Predicting Biological Efficacy B3. Crop Quality Prediction • for Optimizing Post Harvest Treatments of Table Grapes (B3-1) • for Optimizing Winemaking (B3-2)
C. Farm Management	C1. Optimization of Farm Practices in the Vineyard C2. Management Zones Delineation for Vineyards
D. Risk Assessment	D1. Grape and Wine Quality Risk Assessment (safety) D2. Environmental Impact D3. Long-term Risk Assessment (Insurance Scenario)

2.3 USE CASES ANALYSIS

Each use case is separated in four sections: the scenario behind the use case, the real-life data problem to be addressed, the approach that is currently used to address the data problem, the scenario hypothesis, which practically presents a new approach to the data problem at hand thanks to the BigDataGrapes Project, the related data and their description, the technical requirements of the use case and the related pilot(s) related directly to the use case described in deliverable D8.1.

Depending on the experimentation feasibility with respect to the required availability of data, use cases have been further divided to two sets. The first one refers to use cases that will be piloted during the first project period. The second one refers to use cases that need preparatory actions to support the required data spectrum and will be planned for the second round of BigDataGrapes pilots.

2.3.1 Selected use cases for the first project period

The use case entitled (A) Data Anomaly Detection & Classification has one relevant scenario named "Earth Observation Data Anomaly Detection & Classification" (Table 2).

Table 2: Earth Observation Data Anomaly Detection and Classification Scenario

Use Cases	(A) Data Anomaly Detection and Classification	
Scenario	Earth Observation Data Anomaly Detection and Classification	
Real-life Problem	Inadequate management practices such as over or under cropping, irrigating, spraying, inadequate pruning and poor canopy management is an issue in viticulture. Each plant has its own specific needs.	
Current Approach	Currently, cropping, irrigation levels, fertilization, spraying and pruning can only be adjusted at the vineyard block level and do not account for individual vine requirements.	
Scenario Hypothesis	An intimate understanding of vineyard site and growing conditions is required including climate, sunlight exposure, soil quality, slope and topography. A system that predicts vine specific needs can be developed, using satellite imagery geo-spatial data (weather, climate, soil conditions) and other sensor data integrated with satellite and sent alerts to initiate the needed management procedures to each vine in order to produce the highest quality grapes.	
Related Data/Description	North American Cartographic Information Society (NACIS)	Natural Earth Public Domain Maps
	Land-based Weather Data	National Centers for Environmental Information (NCEI)
	Weather Data	solar radiation, air temperature, humidity, wind speed, rainfall at an hourly or a daily time step
	Grape berry and plant microclimate monitoring	Temperature, wind, radiation, humidity i.e. at 12-min time step
	French soil database	clay, silt, sand, pH, organic matter content
	IoT stationary data	Soil moisture data, meteorological parameters, leaf wetness data
	Canopy sensing	Canopy sensing data
	Laser scanner	Laser scanner data
	Drone imagery	Drone images
	Farm Data	Records of crop growth stages and agricultural operations yield and quality, soil analysis
	Eca sensing	Georeferenced soil electrical conductivity data
	Sentinel-2	Sentinel-2A/B MSI visible & NIR bands
	Landsat-8	LS-8 OLI visible & NIR bands
	TripleSat	TripleSat VHR optical bands
Technical Requirements	- Develop a data pre-processing component able to classify between EO data issues and anomalies. This component will rely on machine learning/deep learning libraries in order to perform the classification task. - Develop a data pre-processing component able to automatically send warning message to the specialist actors in response to certain events such that data anomaly detection.	
Related Pilot(s)	Farm Management Pilot- ABACO, Wine Making Pilot- INRA, Table and Wine Grapes Pilot- AUA	

The use case under the generic name (B) Prediction has three (3) relevant scenarios named B1- Yield Prediction, B2- Predicting Biological Efficacy, B3- Crop Quality Prediction. More specifically, the third scenario is divided into two subcategories B3.1 Crop Quality Prediction for Optimizing Post Harvest Treatments of Table Grapes and B3.2 Crop Quality Prediction for Optimizing Winemaking (Tables 3,4,5,6).

Table 3: Quality/Yield management/prediction Scenario

Use Cases	(B) Prediction	
Scenario	B1- Quality/Yield management/ prediction	
Real-life Problem	Is it possible to predict quality or yield? To determine which data sources (and data qualities) are relevant to predict quality or yield? e.g. Weather, Soil, Elevation & Exposition, Variety/Genomics, Anomalies (e.g. pests/diseases), Management practices etc. What are the limiting factors?	
Current Approach	The standard approach is the knowledge, expertise and know-how that characterize vine growers, who can provide a rough estimation of the grape quality and yield of the year.	
Scenario Hypothesis	Using historical earth observation data combined with additional relevant information it should be possible to make an educated guess about wine yield or quality.	
Related Data/Description	Sentinel-2	Sentinel-2A/B MSI visible & NIR bands
	Landsat-8	LS-8 OLI visible & NIR bands
	TripleSat	TripleSat VHR optical bands
	Additional data sets	to be defined; e.g. Weather, Soil, Elevation, Exposition, Variety, Anomalies (e.g. pests/diseases), Management practices, historical yield/quality, etc.
	North American Cartographic Information Society (NACIS)	Natural Earth Public Domain Maps
	Land-based Weather Data	National Centers for Environmental Information (NCEI)
	Catalogue of vine varieties registered in France	
	viticulture experimental data	Monitoring agricultural operations (pruning, vine-shoot tying, ploughing, fertilising, pest control activities, crop diseases, water status and yield)
	Grape berry quality analysis (non-destructive analysis from experimental field)	anthocyanin accumulation in grape berry
	Plants phenotype variables (automatic measurement under controlled or semi-controlled climatic scenarios)	Monitoring of leaf elongation rate and transpiration, 3D images of leaves, biovolume, leaf number and individual organ size, growth rates, development rates, transpiration water use efficiency or radiation use efficiency, photosynthesis, stomatal conductance, infra-red temperature, chlorophyll fluorescence

Technical Requirements	Develop a data analytics component able to support management decisions concerning the yield and quality of grape production (under different quality criteria).
Related Pilot(s)	Table and Wine Grapes Pilot- AUA, Wine Making Pilot- INRA

Table 4: Predicting Biological Efficacy Scenario

<table>
<tr><th>Use Cases</th><th colspan="2">(B) Prediction</th></tr>
<tr><td>Scenario</td><td colspan="2">B2- Predicting Biological Efficacy</td></tr>
<tr><td>Real-life Problem</td><td colspan="2">There is a need to extract the most out of pharmaceutical plants for both economic and environmental reasons. A real challenge is to add high value to by-products. Wine making produces a lot of by-products that may have a significant biological value if there are adequate data concerning farm management. These data can lead to decisions concerning the processing of by-products in order to produce high added value active ingredients for cosmetics and food supplements. The pilot can face the challenge: "how data from the field can be linked to the biological efficacy of final products - with an application on wine making by-products"</td></tr>
<tr><td>Current Approach</td><td colspan="2">Standard approach involves processing of by-products (e.g. grape seed) according to the availability of the material.</td></tr>
<tr><td>Scenario Hypothesis</td><td colspan="2">The scenario presumes that precision farming and control of parameters linked to the quality of wine (soil characteristics, GIS data etc.) may provide by-products of superior quality. The goal of the pilot is to prove the correlation between data from other scenarios to the quality of extracts from vine materials developed (grape seed oil, vine leaf extracts etc.)</td></tr>
<tr><td rowspan="13">elated Data/Description</td><td>IoT stationary data</td><td>Soil moisture data, meteorological parameters, leaf wetness data</td></tr>
<tr><td>Canopy sensing</td><td>Canopy sensing data</td></tr>
<tr><td>Laser scanner</td><td>Laser scanner data</td></tr>
<tr><td>Drone imagery</td><td>Drone images</td></tr>
<tr><td>Crop Calendar</td><td>Records of crop growth stages and agricultural operations</td></tr>
<tr><td>Eca sensing</td><td>Georeferenced soil electrical conductivity data</td></tr>
<tr><td>North American Cartographic Information Society (NACIS)</td><td>Natural Earth Public Domain Maps</td></tr>
<tr><td>Land-based Weather Data</td><td>National Centers for Environmental Information (NCEI)</td></tr>
<tr><td>Vine Leaf Variety 1 – Extraction Method 1</td><td>Data on biological efficacy</td></tr>
<tr><td>Vine Leaf Variety 1 – Extraction Method 2</td><td>Data on biological efficacy</td></tr>
<tr><td>Vine Leaf Variety 2 – Extraction Method 1</td><td>Data on biological efficacy</td></tr>
<tr><td>Vine Leaf Variety 2 – Extraction Method 2</td><td>Data on biological efficacy</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Technical Requirements</td><td colspan="2">Develop a data analytics component able to support decision making</td></tr>
<tr><td>Related Pilot(s)</td><td colspan="2">Natural Cosmetics Pilot- APIGEA, Table and Wine Grapes Pilot- AUA, Wine Making Pilot-INRA</td></tr>
</table>

Table 5: Crop Quality Prediction for Optimizing Post Harvest Treatments of Table Grapes Scenario

Use Cases	(B) Prediction	
Scenario	B3.1- Crop Quality Prediction for Optimizing Post Harvest Treatments of Table Grapes	
Real-life Problem	Table grapes quality affects selling price, storability duration and post-harvest treatments. Moreover, studies indicate that consumers from different countries have different preferences on consuming agricultural products. Crop quality also determines the table grapes harvest. Therefore, the need for crop quality prediction is of great significance.	
Current Approach	Currently, there is limited use of crop quality prediction in the table grapes industry by using few parameters like sugar content and berry diameter. These parameters are usually used for determining only the time of harvest on the field using berry refractometers and calipers while these measurements are conducted only on specific plants and as a result there is no information on table grapes quality for the whole field.	
Scenario Hypothesis	Dimitris is a big table grower in the area of Nemea in Greece. He cultivates Soultanina variety which is a seedless variety. Dimitris sends his production to a big super market chain in UK through a table grapes grower association in which he is a member. Knowledge of crop quality helps the association to optimize harvest, storage and processing of table grapes. The table grapes growers' association wants a system which will help them to optimize table grapes harvest, to help them know the period that they can store their product and if the production covers the specific standards that are set by the super markets. They believe that a holistic approach that includes imagery from UAVs and satellites, weather data from in field weather stations and open source along with non-destructive measurements will fulfill their needs.	
Related Data/Description	IoT stationary data	Soil moisture data, meteorological parameters, leaf wetness data
	Canopy sensing	Canopy sensing data
	Laser scanner	Laser scanner data
	Drone imagery	Drone images
	Crop Calendar	Records of crop growth stages and agricultural operations
	Eca sensing	Georeferenced soil electrical conductivity data
	North American Cartographic Information Society (NACIS)	Natural Earth Public Domain Maps
	Land-based Weather Data	National Centers for Environmental Information (NCEI)
	Sentinel-2	Sentinel-2A/B MSI visible & NIR bands
	Landsat-8	LS-8 OLI visible & NIR bands
	TripleSat	TripleSat VHR optical bands
	SRTM DEM	Global 30m DEM
	HWSD soil data	Global Soil Map
Technical Requirements	Develop a data analytics component able to support crop quality prediction	
Related Pilot	Table and Wine Grapes Pilot- AUA	

Table 6: Crop Quality Prediction for Optimizing Winemaking Scenario

Use Cases	(B) Prediction	
Scenario	B3.2- Crop Quality Prediction for Optimizing Winemaking	
Real-life Problem	Winemaking needs knowledge on the grapes' quality at harvest. Different sugar content in wine grapes can produce wine with different characteristics. Moreover, some quality parameters like the concentration of nitrogen in wine grapes can affect the vinification process. As a result, winemakers have no idea on the quality of the wine grapes that they buy from the wine grape growers and adapt their vinification process accordingly while the last cannot achieve higher selling prices for their products due to better quality.	
Current Approach	Currently, there is limited use of crop quality prediction in wine grapes industry by using few parameters like sugar content and titratable acidity. These parameters are usually used for determining only the time of harvest on the field using berry refractometers or by collecting berry samples from few plants that take some time for providing the results. Thus, there is limited information on wine grape quality for the whole field.	
Scenario Hypothesis	Giannis has a big winery in North Greece while he cultivates 40 ha of wine grapes of different varieties. He also, collects grapes from local producers. Giannis wants to know the wine grape quality before harvest both from his vineyards and the vineyards of the producers that he collaborates with for optimizing the vinification in his winery. He believes that a holistic approach that includes imagery from UAVs and satellites, weather data from in field weather stations and open source weather along with in field non-destructive measurements will fulfill his needs and help him to provide better prices to the wine grape growers according to the produced crop yield quality.	
Related Data/ Description	North American Cartographic Information Society (NACIS)	Natural Earth Public Domain Maps
	Land-based Weather Data	National Centers for Environmental Information (NCEI)
	IoT stationary data	Soil moisture data, meteorological parameters, leaf wetness data
	Canopy sensing	Canopy sensing data
	Laser scanner	Laser scanner data
	Drone imagery	Drone images
	Crop Calendar	Records of crop groth stages and agricultural operations
	Eca sensing	Georeferenced soil electrical conductivity data
	Sentinel-2	Sentinel-2A/B MSI visible & NIR bands
	Landsat-8	LS-8 OLI visible & NIR bands
	TripleSat	TripleSat VHR optical bands
	SRTM DEM	Global 30m DEM
	winemaking off line data	Monitoring of winemaking operations from harvesting to bottling
	winemaking on line data	Alcohol, CO2, must weight and volume, yeast biomass, Musts and yeast characteristics
	offline data from biological analyses	cell number or concentration of extra-

		cellular metabolites and their metadata (expert opinions, operation descriptions, faults, etc.).
	characteristics of wine products during winemaking process	observational and analytical data of grape, initial must, must after alcoholic fermentation, and finished wine
	Sensory analysis	Expert panel of tasters assessed wine bitterness, astringency, phenol content, aroma and so on
	HWSD soil data	Global Soil Map
Technical Requirements	Develop a data analytics component able to support selling price decisions.	
Related Pilot	Wine Making Pilot- INRA, Table and Wine Grapes Pilot- AUA, Farm Management Pilot- ABACO	

The use case by the name (C) Farm Management, has two (2) scenarios C1- Optimization of Farm Practices in the Vineyard and C2- Management Zones Delineation for Vineyards (Table 7, 8).

Table 7: Optimization of Farm Practices in the Vineyard Scenario

Use Cases	(C) Farm Management	
Scenario	C1- Optimization of Farm Practices in the Vineyard	
Real-life Problem	Inadequate management practices such as over or under cropping, irrigating, spraying, inadequate pruning and poor canopy management is an issue in viticulture. Each plant has its own specific needs.	
Current Approach	Currently, cropping, irrigation levels, fertilization, spraying and pruning can only be adjusted at the vineyard block level and do not account for individual vine requirements.	
Scenario Hypothesis	An intimate understanding of vineyard site and growing conditions is required including climate, sunlight exposure, soil quality, slope and topography. A system that predicts vine specific needs can be developed, using satellite imagery geo-spatial data (weather, climate, soil conditions) and other sensor data integrated with satellite and sent alerts to initiate the needed management procedures to each vine in order to produce the highest quality grapes.	
Related Data/Description	North American Cartographic Information Society (NACIS)	Natural Earth Public Domain Maps
	Land-based Weather Data	National Centers for Environmental Information (NCEI)
	Weather Data	solar radiation, air temperature, humidity, wind speed, rainfall at an hourly or a daily time step
	Grape berry and plant microclimate monitoring	Temp, Wind, Radiation, Humidity… at 12 min time step
	French soil database	clay, silt, sand, pH, organic matter content
	IoT stationary data	Soil moisture data, meteorological parameters, leaf wetness data
	Canopy sensing	Canopy sensing data

	Laser scanner	Laser scanner data
	Drone imagery	Drone images
	Farm Data	Records of crop growth stages and agricultural operations, yield and quality, soil analysis
	Eca sensing	Georeferenced soil electrical conductivity data
	Sentinel-2	Sentinel-2A/B MSI visible & NIR bands
	Landsat-8	LS-8 OLI visible & NIR bands
	TripleSat	TripleSat VHR optical bands
Technical Requirements	Develop a data analytics component able to support management decisions regarding the quality of the wine production.	
Related Pilot(s)	Table and Wine Grapes Pilot- AUA, Farm Management Pilot- ABACO, Wine Making Pilot- INRA	

Table 8: Management Zones Delineation for Vineyards Scenario

Use Cases	(C) Farm Management	
Scenario	C2- Management Zones Delineation for Vineyards	
Real-life Problem	Soil is one of the main factors that affect crop yield and quality. This is due to the fact that affects crop growth given the different available water capacity and nutrient removal. Moreover, agricultural operations can affect crop vigor development by differentiating vine canopy which will also affect final crop yield and quality characteristics. All the aforementioned lead to high in field variation of crop yield and quality. These affect the post-harvest operations in the vine value chain due to problems that are caused by this variation.	
Current Approach	Delineation of management zones has provided many advantages to the wine grape growers by decreasing their input costs and increasing their production value due to selective harvesting. Delineation of management zones is done using satellite/drone imagery and/or soil measurements (soil type, nutrient concentration, terrain elevation). These data are used for delineating management zones for different operations such as fertilizer application, pruning, spraying, irrigation and selective harvesting in order to reduce the in-field variation or take benefit from it. However, the delineated management zones are affected by the agricultural operations that take part in the field and this doesn't lead always to optimized agricultural operations and consequently to profit loss from the side of the grower.	
Scenario Hypothesis	George has a vineyard cultivating Soultanina for table grapes production and wine making. However, he has high in field variation in his crop yield and quality due to the different soil types that are found in his vineyard. As a result, he doesn't have production of the same quality. He believes that a holistic approach that includes imagery from UAVs and satellites, weather data from in field weather stations and open source weather along with in field non-destructive measurements will fulfill his needs and help him to delineate better management zones and take full benefit of his crop production.	
Related Data/Description	North American Cartographic Information Society (NACIS)	Natural Earth Public Domain Maps
	Land-based Weather Data	National Centers for Environmental Information (NCEI)

	IoT stationary data	Soil moisture data, meteorological parameters, leaf wetness data
	Canopy sensing	Canopy sensing data
	Laser scanner	Laser scanner data
	Drone imagery	Drone images
	Farm Data	Records of crop growth stages and agricultural operations, yield and quality, soil analysis
	Eca sensing	Georeferenced soil electrical conductivity data
	Sentinel-2	Sentinel-2A/B MSI visible & NIR bands
	Landsat-8	LS-8 OLI visible & NIR bands
	TripleSat	TripleSat VHR optical bands
Technical Requirements	Develop a data analytics component able to support management decisions concerning the delineation of management zones.	
Related Pilot(s)	Table and Wine Grapes Pilot- AUA, Farm Management Pilot- ABACO, Wine Making Pilot- INRA	

2.3.2 Candidate use cases for the second project period

The use case by the name (D) Risk Assessment is divided into three (3) scenarios, D1- Grape and Wine Quality Risk Assessment (safety), D2- Environmental Impact and D3- Long-term Risk Assessment (Insurance Scenario) (Tables 9, 10, 11).

Table 9: Grape and Wine Quality Risk Assessment (safety) Scenario

Use Cases	(D) Risk Assessment
Scenario	D1- Grape and Wine Quality Risk Assessment (safety)
Real-life Problem	Grapes, that are classified as food, and their production methods shall be complied with acts, regulations, protocols and supporting behaviors relevant to the European grape and wine industry. Monitoring of pests and fungal diseases, agrochemical residue and contamination by any Matter Other than Grapes (MOG) and assessing of damage are crucial for the final product. While protocols exist, there is a need to develop industry endorsed protocols and adopt automated certifications that improve the safety and hygiene aspects of production, reduce the risks and exposures to hazards, thus increasing the overall product safety for human consumption.
Current Approach	Each grower/company document their own procedures and processing conditions. Such documentation can take any form and might commonly comprise a manual and it should be kept for a minimum period of time as required by the applicable EU legislation. They should be legible, accurate and easily understood. For example, use of spray diaries has been common practice for some years now to help protect table grapes and wine from the risk of residue exceeding maximum residue limits (MRL) for the destination market. Currently, it is the grower's responsibility to use only those agrochemical products registered for use in grapevines and within the recommended dose rate and to adhere to the recommended withholding periods.

Scenario Hypothesis	Producers should be able to deliver grapes within the acceptable MRL, with no agrochemical residue, safe for human consumption. This can happen by maintaining accurate spray diaries to monitor for residue and by enhancing the available vineyard assessment techniques such as random monitoring, visual examination and quantifying disease incidence and severity in grapes. An algorithm that will use the recorded information mentioned above, integrating weather data will be able to predict product quality, automatically assess compliance to crop production standards and produce certifications for good production practices.	
Related Data/Description	North American Cartographic Information Society (NACIS)	Natural Earth Public Domain Maps
	Land-based Weather Data	National Centers for Environmental Information (NCEI)
	IoT stationary data	Soil moisture data, meteorological parameters, leaf wetness data
	Canopy sensing	Canopy sensing data
	Drone imagery	Drone images
	Farm Data	Records of crop growth stages and agricultural operations yield and quality, soil analysis
	Toxicity on human skin cells	Results of grapevine extracts on human skin cell proliferation
Technical Requirements	Develop a data analytics component able to measure the quality of grapes and wines.	
Related Pilot(s)	Table and Wine Grapes Pilot- AUA, Wine Making Pilot- INRA	

Table 10: Environmental Risk Assessment Scenario

Use Cases	(D) Risk Assessment
Scenario	D2- Environmental Risk Assessment
Real-life Problem	Growers shall manage their vineyard with due care to the environment. They should follow policies and procedures to minimize production of waste and the vineyard management activities shall be done so as to ensure minimal impact on the environment. What happens, though, in the case of pesticide drift from neighboring fields - herbicides, pesticides and fungicides floating away from their intended target and settling on nearby water or soil- and volatisation drift which occurs when chemicals settle, then rise up again as a vapor well after the initial spraying is done?
Current Approach	Best practice with regards to environmental management arising from vineyard and winery operations involves reducing their impact on the environment. This is achieved through a formal environmental management system, which is audited and certified to internationally recognized standards. The information of environmental aspects needs to be maintained and kept up to date.
Scenario Hypothesis	In order to meet environmental best practices, it is recommended to identify the significant aspects to be covered in environmental risk assessment associated with activities, products and services such as ongoing environmental recording, analysis, reporting and reviewing as well as identifying legal obligations and any other requirements or commitments. An algorithm that will use the recorded information mentioned above,

	integrating weather and land surface elevation data, concerning a specific field but also its neighboring fields, will be able to predict the environmental impact and produce automated certifications for good production practices.	
Related Data/Description	North American Cartographic Information Society (NACIS)	Natural Earth Public Domain Maps
	Land-based Weather Data	National Centers for Environmental Information (NCEI)
	IoT stationary data	Soil moisture data, meteorological parameters, leaf wetness data
	Canopy sensing	Canopy sensing data
	Laser scanner	Laser scanner data
	Drone imagery	Drone images
	Farm Data	Records of crop growth stages and agricultural operations yield and quality, soil analysis
	Eca sensing	Georeferenced soil electrical conductivity data
Technical Requirements	Develop a data analytics component able to measure the quality of grapes and wines.	
Related Pilot(s)	Table and Wine Grapes Pilot- AUA, Wine Making Pilot- INRA	

Table 11: Long-term Risk Assessment Scenario

Use Cases	(D) Risk Assessment	
Scenario	D3- Long-term Risk Assessment	
Real-life Problem	Insurances must do premium calculation based on long-term data records like weather data (drought, frost, hail, flooding), Damage event recordings, Text information about frequency of calamities. They must estimate the probability for damage events and Detect damage events (namely Anomaly)	
Current Approach	Mostly based on weather recordings	
Scenario Hypothesis	-	
Related Data/Description	Additional data sets	to be defined
	North American Cartographic Information Society (NACIS)	Natural Earth Public Domain Maps
	Land-based Weather Data	National Centers for Environmental Information (NCEI)
	IoT stationary data	Soil moisture data, meteorological parameters, leaf wetness data
	Canopy sensing	Canopy sensing data
	Laser scanner	Laser scanner data
	Drone imagery	Drone images
	Farm Data	Records of crop growth stages and agricultural operations yield and quality, soil analysis
	Eca sensing	Georeferenced soil electrical conductivity data
Technical Requirements	Develop a data analytics component able to estimate the probability of damage events and detect damage events.	
Related Pilot(s)	Table and Wine Grapes Pilot- AUA	

3 CONCLUSIONS

This deliverable, the "Use Cases & Technical Requirements Specification", belongs to WP2, which aims to identify and solidify the BigDataGrapes use cases, record and systematically analyse data assets, identify the pragmatic Big Data needs that have to be covered, and, ultimately, produce the architecture of the BigDataGrapes solution.

As identified through this report, all use cases describe different data challenges and data problems of the various aspects of the domain, which will be addressed and evaluated through the instantiations of the Use Cases, the BigDataGrapes pilots.

The project's Use Cases and Technical Requirements presented in this report is the basic driver to an efficient definition and evaluation of the use cases, their scenarios and hypotheses of the project and it is aligned with the project vision and objectives. Moreover, it is directly linked with other activities of the project, namely the BigDataGrapes pilots as well as the technical WPs.

An updated version of this deliverable, including refined Use Cases, is due on M18 of the project lifetime, which concludes the first period of the project.

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