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

D8.1 - Piloting Plan

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EXECUTIVE SUMMARY

The deliverable D8.1, "Piloting Plan", aims to give a general scope of the activities that will be undertaken during the project lifetime under the pilots, a report documenting the plan for the development and execution of the pilots and the methodology and materials for the pilot trials. The objective of this deliverable is to provide, in the first part, generic guidelines to all the pilots that will constitute instantiations of the use cases that have already been identified in WP2. Updated versions of this deliverable, including refined piloting plans, are due to M15 and M24 of the project lifetime.

Deliverable D8.1, "Piloting Plan", is based on the individual plans of the following pilots: Table and Wine Grapes Pilot (AUA), Wine Making Pilot (INRA), Farm Management Pilot (ABACO & Geocledian), and Natural Cosmetics Pilot (Symbeeosis). This document reports tailored guidelines and concludes with a detailed overview of the planning for each of the four pilots. Information was directly provided by the pilot leaders to ensure the specificity of the guidelines and the smooth progress of the operations.

The document is structured as follows. Chapter 1 serves as an introduction to the deliverable whereas Chapter 2 provides an overview of the four piloting plans containing important information regarding them, in order to describe the importance of these pilot trials and the methodology and materials that will be used. Each of these pilot plans is separated in four sections: the introduction and its specific goals, the technical guidelines and methodology to be used, the measurements to be performed and the envisaged outcomes. The introduction describes the importance of the pilot trials proposed and contains information to clearly identify why the pilot is being conducted and what the pilot is intended to accomplish, along with any assumptions being made. In the technical guidelines section, the site description where the pilot trials will take place, the equipment and methods used, along with a detailed description of all resources necessary to fully conduct the pilot, and the expected timeline are included. Finally, the envisaged outcomes part constitutes a description of how the collected data and datasets will be used to operate in favour of the BigDataGrapes project. Chapter 3 illustrates the connection of the pilots to the use cases identified in WP2 and Chapter 4 contains the conclusions regarding the pilot planning.

It's worth mentioning that the 1st version of this deliverable was submitted in M6 (June 2018) and outlined the piloting plans to be followed throughout the course of the project. This deliverable is to be periodically updated to take account of additional methodologies, measurements and data adopted during the project lifetime. This is the 2nd version of the deliverable D8.1.

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1 INTRODUCTION

Data-driven approaches have the potential to improve decision making in different industries and settings, which sometimes requires that the involved researchers and practitioners act as a 'data scientist', lighting up the meaningful relationships and patterns in the available data. However, in the case of complex systems, the variability and heterogeneity of data assets that can be combined and produce meaningful insights, might not be manageable by personnel specialized in other than data analysis domains. Thus, it is evident that, a rich, large-scale and diverse data pool is needed for carrying out the foreseen research and industry-centred activities, nevertheless, the incorporation and/or production of an extended data pool that combines different data types potentially bears extremely high costs on personnel and equipment.

From Day 1 and throughout the lifecycle of the project, BigDataGrapes will continuously collect and monitor sensor data derived from all test sites owned or accessible by consortium members, bringing an expansive and diverse collection of datasets. These streams of data and datasets will serve as the basis for carrying out research and technical work and will be used as the testbed for enabling the implemented technical components to efficiently handle the volume and intricacies of these data, clearly acquired from realistic in-field conditions. The corporate and public organisations that are producing and harvesting these data assets will contribute them to a data marketplace demonstrator that will serve as the project's experimentation environment, an environment where the testing and adjustment of the proposed technical solutions can be carried out in a realistic setting. As the project progresses, the data pool will be continuously enriched in volume and range, in accordance with the needs and requirements of the covered use cases.

Moving from testing in laboratory conditions to testing in real-world settings, BigDataGrapes will design and execute application pilots, pertaining to the defined Use Cases, under WP8, "Grapevine-powered Industry Application Pilots". The work package will be responsible for the planning and preparation of the pilots, the definition of the experimental and evaluation protocols to be followed, the execution of the pilots and ultimately, the collection and evaluation of the pilot results and their assessment over indicators defined by the end users. In this context, this document provides the plan for developing and executing the pilots during the BigDataGrapes project lifetime, outlines how they should be designed and deployed, what methodology will be adopted and what materials will be used for the pilot trials.

The aforementioned detailed piloting and evaluation plan will be produced and followed during pilot execution. The BigDataGrapes Piloting partners will run a set of human-centred assessment activities, organised in the following phases:

Formative phase, leading up to the "Use Case Definition & Assessment Planning" (M9): Industry-centred requirements and the concrete use cases where the BigDataGrapes solution will be applied and tested against these requirements will be defined through WP2 and WP8. During this phase, suitable data and processes for fulfilling the requirements of the specific use cases will be identified and relevant piloting activities will be defined.

Intermediate phase, leading up to "Functional Assessment Sessions" (M18): The first round of controlled pilot trials, will implement a first version of the pilots, using the first versions of newly developed BigDataGrapes components. These will be restricted piloting trials in terms of scale and complexity. The objectives of these trials are (a) to provide data for the assessment of early BigDataGrapes components and (b) to refine the pilots themselves into their subsequent iterations.

Summative phase, leading up to "Operational Assessment" (M36): The final phase entails the validation of the BigDataGrapes components in real-life conditions and with realistic complexity. The components will be used throughout the timespan, with developments in the technologies incorporated opaquely in the operational platform. A summary of the operation of the system and the respective pilot observations will be delivered, followed by a final Evaluation report where the performance of the system will be assessed against the established evaluation criteria and the appropriate Key Performance Indicators.

2 INDIVIDUAL PILOTING PLANS

All four Pilot partners (Table and Wine Grapes Pilot- AUA, Wine Making Pilot- INRA, Farm Management Pilot- ABACO- Geocledian, Natural Cosmetics Pilot- Symbeeosis) provided important information regarding their pilots, in order to describe the importance of their pilot trials and the methodology and materials to be used.

Each of these pilot plans is separated in four sections: the introduction and its specific goals, the technical guidelines and methodology to be used, the measurements to be performed and the envisaged outcomes. The introduction describes the importance of the pilot trials proposed and contains information to clearly identify why the pilot is being conducted and what the pilot is intended to accomplish, along with any assumptions being made. In the technical guidelines section, the site description where the pilot trials will take place, the equipment and methods used, along with a detailed description of all resources necessary to fully conduct the pilot, and the expected timeline are included. Piloting plans were mainly developed based on methods and instruments found in the scientific literature. Finally, the envisaged outcomes part is a description of how the collected data and datasets will be used to operate in favour of the BigDataGrapes project.

2.1 TABLE AND WINE GRAPES PILOT (AUA)

2.1.1 Specific Goals, Technological Guidance, Measurements and Envisaged Outcomes

AUA's Pilot Plan	Table and Wine Grapes Pilot
Introduction & Specific Goals	Deriving meaningful knowledge from many relevant, yet heterogeneous data sources is very important and will act as the basis for future decision-making processes. Throughout the lifecycle of the project, AUA will continuously collect and monitor sensor, farming and phenological data derived from all test sites located in Greece. Soil properties, climate conditions and cultivation techniques constitute significant variables, which affect the quality of the final product. In particular, soil data (soil texture, soil electrical conductivity etc.) and weather data (average temperature, humidity etc.) affect both crop quality data (sugar content, anthocyanins content, phenolic compounds concentrations etc.) and crop quantity data (crop yield, berry weight and size etc.). Some of the goals to be achieved through this sensor and farming data collection, is to denote associations and correlations between precision agriculture information and phenological data and grape and wine chemical analysis. Location-specific data will be used as auxiliary sources and will lead to the supply of vegetation indexes corrected for vineyard cultivation practices, more accurately determined vegetation stages and input to plant performance and grape quality indicators among others. Finally, the ultimate goal is to correlate the aforementioned data with earth observation data to examine the effectiveness of applying machine learning techniques and eventually train the relevant machine learning components.
Technical Guidelines/ Methodology	*Site Description* Three test sites have been chosen for data collection for BigDataGrapes in Greece. These are situated in the regional unit of Corinthia, in the north-eastern part of Peloponnese. The following have been selected: for winemaking Palivou Estate and Kontogiannis Estate and for table grapes Fasoulis Estate.

Palivou Estate: is located in Nemea, planted with *Vitis vinifera* L. cv. 'Agiorgitiko' and 'Merlot' for winemaking. The row orientation is northeast-southwest, and the training/trellis system is VSP (vertical shoot positioned)- cane pruning, double Guyot.

Figure 1: Palivou Estate test site (Google Earth Pro)

Kontogiannis Estate: in Ancient Corinth having the same VSP -double Guyot or double Royat- training/trellis system planted with 'Roditis', 'Savatiano', 'Mavroudi' and 'Soultanina' for winemaking. Its row orientation is north to south.

Figure 2: Kontogiannis Estate test site (Google Earth Pro)

Fasoulis Estate: situated in Nemea, cultivated with 22 different table grape varieties, where each line has a different variety. The orientation is southeast to northwest.

Figure 3: Fasoulis Estate test site (Google Earth Pro)

Equipment Used

<u>Precision Agriculture Lab</u>

- EM38-MK2 probe (Geonics LTD, Mississauga, ON, Canada) (Figure 4). Data collection is supported by the DAS70-AR Data Acquisition System (Archer Data logger). The EM38 measures apparent soil electrical conductivity (ECa) in millisiemens per metre (mS/m) in the root zone at 0.5 and 1.0 m depth and the in-phase ratio of the secondary to primary magnetic field in parts per thousand (ppt) (Kitchen et al., 2005; Anastasiou at al., 2017; Balafoutis et al., 2017). One measurement per season will take place.

Figure4: EM38-MK2 (left) and Archer Data logger (right)

- HiPer V RTK GPS (Topcon Positioning Systems Inc., Livermore, CA, United States) (Figure 5). Records topographical data, such as field boundary points, and elevation data (Kitchen et al., 2005; Pedersen &

Lind, 2017). The final output can be a KML, KMZ file. This measurement will be performed once throughout the course of the project, at the beginning of the table and wine grapes pilot, prior to all other measurements.

Figure 5: Topcon HiPer V RTK GPS

- Crop Circle ACS-470 (Holland Scientific Inc., Lincoln, NE, United States) (Figure 6). This remote sensing tool is measuring the radioactive transfer and the biophysical characteristics of plant canopies. It is an active crop canopy sensor that provides basic reflectance information from plant canopies and soil as well as classic spectral vegetative index data (NDVI, NDRE etc.). Six measurements per season will be performed, to record in the most precise way the phenological growth of the grapevines. Vegetative indices measurements for NDVI will be done in two different canopy parts, by the side and at upper canopy of the vines, by fitting the equipment to a winegrowing tractor.

Figure 6: Crop Circle ACS-470

- Laser Scanner LMS100 (Sick AG, Waldkirch, Germany) (Figure 7). It is a light detection and ranging system (LiDAR) that scans the vine trees to estimate the so-called pixelated leaf wall area (PLWA) as well as to characterize vine canopy distribution and retrieve information regarding the vine shoots dimensions and weight (Tagarakis et al., 2018). The distance between the LMS100 laser measurement system and an object is calculated from the time-of-flight of the emitted pulse. This 2D LiDAR sensor can evaluate two reception signals per emitted measurement beam.

Figure 7. Laser Scanner LMS100 (left) and SpectroSense2+ (right)

- SpectroSense2+ GPS (Skye Instruments Ltd, Landrindod Wells, UK) (Figure 7). Used to estimate LAI (Leaf Area Index) and NDVI vegetation indices.
- Crop Circle RapidSCAN CS-45 (Holland Scientific Inc., Lincoln, NE, United States). Used to estimate vegetation indices such as NDVI and NDRE indices (Figure 8).

Figure 8: Crop Circle RapidSCAN AC-45 handheld reflectance sensor

- Software such as Surfer 11 (Golden Software), ArcGIS (ESRI, Redlands, CA, USA), Global Mapper for the generation of thematic maps.

Equipment purchased:

- Two Vantage Pro 2 weather stations (Davis Instruments Corp., Hayward, CA, United States) (Figure 9) with rain sensor, to detect rainfall, anemometer to measure wind speed and direction, air temperature sensor, air humidity sensor, barometer to monitor atmospheric pressure. The basic equipment can be supplemented with sensors for UV and solar radiation. The automatic weather station will be installed inside the vineyard. Weather information will be recorded throughout the growing season.

Figure 9: Vantage Pro2 Weather Station (left) and Decagon EC-5 soil moisture sensor (right)

- Four Decagon EC-5 soil moisture sensors (METER Group, Inc., Pullman, WA, USA) (Figure 9) recording throughout the growing season the humidity and temperature of the soil.
- Two (2) Phantom 4 Pro drones (Dà-Jiāng Innovations, Shenzhen, Guangdong, China) equipped with a multispectral Parrot Sequoia+ camera (Parrot SA, Paris, France) and a Flir Vue Pro thermal camera (FLIR Systems Inc., Wilsonville, Oregon, United States) to collect aerial imagery data and generate Vegetation Indices and Irrigation/Water Activity maps respectively.

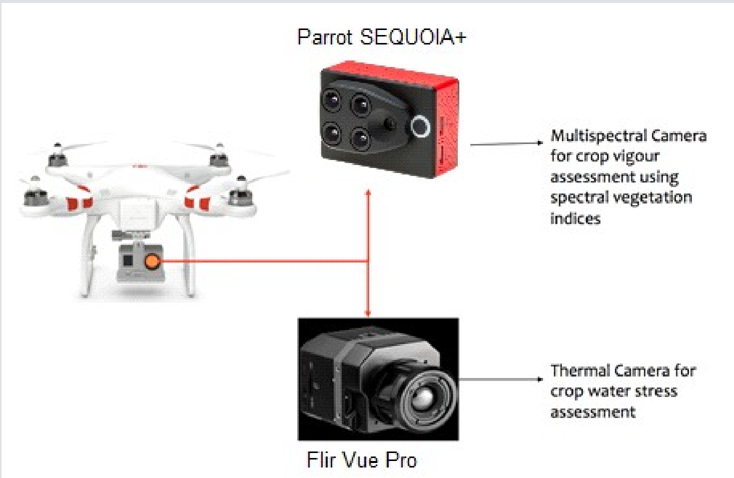


Figure 10: Phantom 4 Pro drone w/ multispectral and thermal cameras

<u>Laboratory of Viticulture</u>

- Soluble solids will be determined using an ATAGO N1-a refractometer with a 0-32 Brix measurement range at 0.28 Brix increments.
- Total titratable acidity will be measured by titration with a 0.1 N NaOH solution and will be expressed as tartaric acid.
- The quantitative and qualitative analysis of the substances, which exist in berries, must and wines such as, organic acids, sugars, phenolic compounds, amino acids, anthocyanins, volatile compounds, etc. will be performed using an HPLC Shimadzu Nexera comprising a gradient pump Shimadzu Nexera X2, a ProStar model 410 AutoSampler, and a ProStar

	model 330 Photodiode Array Detector on a reversed-phase Waters C18 x select (250 mm x 4.6 mm, 5 mm) column. • Antioxidant activity (2,2-diphenyl-1-picrylhydrazyl, DPPH) will be evaluated by the free radical scavenging activity of DPPH using a modified colorimetric method, while the reduction of the DPPH radical will be determined by measuring the absorption at 517 nm in a UV/Vis spectrophotometer (Perkin Elmer, Lambda 25, Beaconsfield, Bucks, U.K.). The absorption of the antioxidant activity (Ferric Reducing Antioxidant Power, FRAP) will be measured at 593 nm. *Expected Timeline* Measurements related to the Table and Wine Grapes pilot will take place during the whole duration of the project (Figure 11). Emphasis will be given during the summer months, May through September, while grapevines grow and produce grapes. The boundaries of the vineyards will be geo-referenced using GPS technology at the very beginning of the project, as soon as the experimental fields are chosen. Time-stable zones will be formed using soil electrical conductivity (ECa) mapping, assisted by elevation mapping using the RTK-GPS. These data related to the boundaries, management zones and elevation will be used throughout the course of the project. Soil, weather and farming data will be continuously collected, starting on Day 1 of the project. Canopy characteristics and vegetation indices will be recorded with the use of Crop Circle, LiDAR laser scanner, SpectroSense2 and Crop Circle RapidSCAN sensors six times per season/summer starting at the beginning/middle of May, so that the phenological development of the grapevine, which is divided into 9 principal growth stages, will be followed in the best way. Similarly, drone imagery with thermal and multispectral cameras as well as Landsat-8 and Sentine-2 satellite data will be collected during the same periods with the measurements for the canopy characteristics, again six times per season/summer. These measurements will be repeated every year. Some of the qualitative and quantitative characters of the grapevines, such as pH, soluble solids, total titratable acidity, antioxidant capacity by DPPH, FRAP assay, and aminoacids, will be tested three times over a season. Finally, the rest of the qualitative and quantitative characters will be assessed at the end of each season, when harvesting. Similarly, yield mapping will also be estimated once per year.
Measurements	• *Remote sensing for spatial data, topographical and elevation mapping* • *Identification of grapevine varieties* • *Geo-referenced apparent soil electrical conductivity (ECa)* • *Canopy characteristics and vegetation indices using remote and proximal sensing* • *Qualitative and quantitative characters;* Grape and berry mechanical properties (weight, length, width, density etc.), berry deformation, berry detachment, density, grape volume, berries diameter, berries weight For wine and table grapes: soluble solids, pH, total titratable acidity, total phenols and anthocyanins, total flavonoid content, total flavanol, flavonol,

	flavone content, tannins, antioxidant capacity (trans-resveratrol, piceid, ε-viniferin) by DPPH, FRAP assay, aminoacids • *Full phenolic profile of grapevine varieties in correlation with the phenological stages to improve the quality of viticultural products* For table grapes: leaf analysis, foliar chlorophyll contents photosynthetic pigment content of the leaves, water potential correlated to the proline content • *Yield mapping* • *Soil, weather and farming data*
Envisaged Outcomes	The expansive and diverse collection of datasets for BigDataGrapes will serve as the basis for carrying out research and technical work. These data assets will contribute to a data marketplace demonstrator that will serve as the project's experimentation environment. The streams will be used as the testbed for enabling the implemented technical components to efficiently handle the volume and intricacies of these data (correct sensor measurements, fill in missing values, corrupted or inconsistent data, adjust outliers, etc.), clearly acquired from realistic in-field conditions. As the project progresses, the data pool will be continuously enriched in volume and range, in accordance with the needs and requirements of the covered use cases.

The proposed stage at which the Table and Wine Grapes pilot is going to conduct each testing throughout the course of the BigDataGrapes project, as well as its replications has been designated. Any pilot trial taking place within the Table and Wine Grapes pilot is accounted for in a timeline, illustrating all relevant testing in a chronological order per growing season and throughout the course of the project.

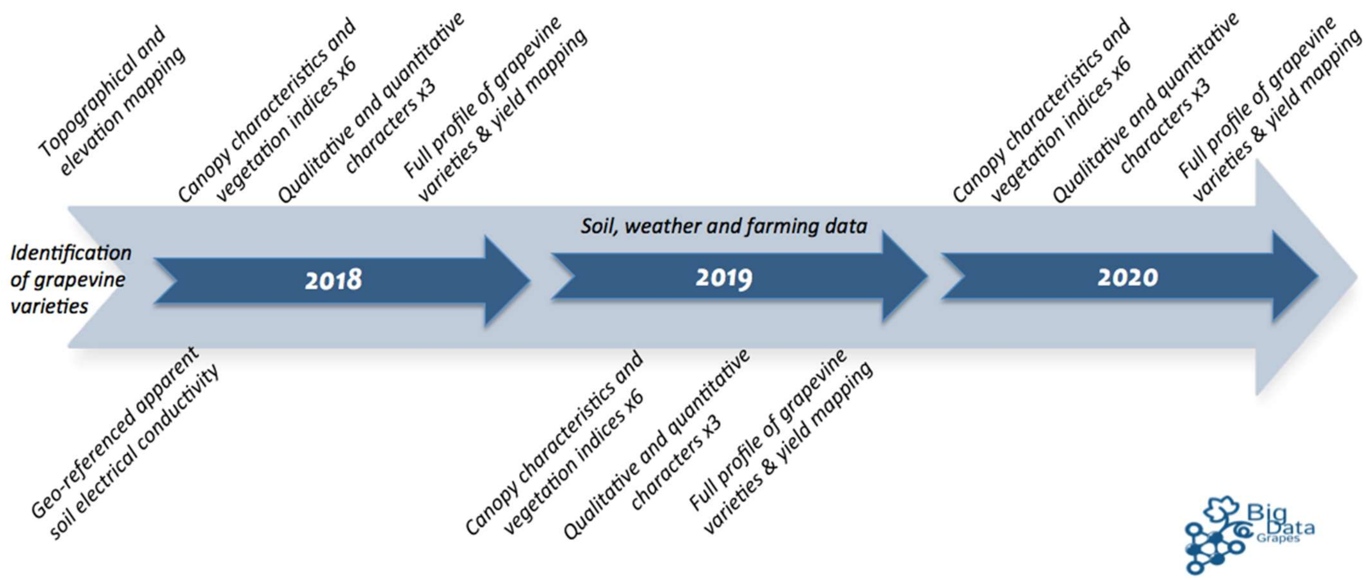


Figure 11: Timeline of table and wine grapes piloting plan

2.1.2 Assess Table and Wine Grapes Pilot Results

The table below provides an overview of the Data and the Datasets that will be gathered once the Table and Wine Grapes pilot will have run its course over a season/ year.

Table 1: Overview of Data and Datasets that will be gathered once the Table and Wine Grapes pilot will have run its course over a season/ year

Name	DataSet Description	Priority	Provenance	Data Type Format	Data size
Yield Mapping	Yield data	Essential	Laboratory equipment	csv, xls	MB
Grape and berry mechanical properties	Measurements	Essential	Laboratory equipment	csv, xls	MB
Classical analytical techniques (HPLC)	Phenolic composition data	Essential	Laboratory equipment	csv, xls	MB
Topographic da ta and elevation maps	Spatial data (boundaries and elevation data)	Essential	Remote sensing	csv, xls, xml	MB
Canopy sensing and vegetation indices	Canopy sensing data	Essential	Proximal sensors	csv, xls	MB
IoT stationary data	Soil moisture data, meteorological parameters	Essential	IoT data	csv, xls	MB
Drone imagery	Drone images	Essential	Multispectral and thermal cameras	GEOTIFF	GB
Crop Calendar	Records of crop groth stages and agricultiral operations	Essential	Log files	doc, xls	MB
Eca sensing	Geo-referenced soil electrical conductivity data	Essential	Proximal sensors	csv, xls	MB
Laser scanner	Laser scanner data	Essential	Proximal sensors	csv, xls	MB

2.2 WINE MAKING PILOT (INRA)

2.2.1 Specific Goals, Technological Guidance, Measurements and Envisaged Outcomes

INRA's Pilot Plan	Wine Making Pilot
Introduction & Specific Goals	The INRA's experimental unit of Pech Rouge (UEPR) is dedicated to research in the fields of viticulture and oenology with an integrated point of view that allows a transversal approach from the vineyard to the packaged final product. The unit conducts research and technological experiments on: • Viticulture and the ecophysiology of the vine, with as a main issue a better knowledge and better control of grape quality. • Enology with, as major research axes, the expression of quality potential existing in the grapes and wines and the on-line monitoring and control of the alcoholic fermentation. • Technological processes with the aim to propose and study innovative technologies applicable to various steps of winemaking. • The valuation of coproducts, extraction of molecules and environmental impacts.
Technical Guidelines/ Methodology	*Site Description* The INRA Pech Rouge Experimental Unit is located N43°08'47'', E03°07'19' WGS84, in the Languedoc-Roussillon region (Aude department) of France. The landfield of Pech Rouge includes a total area of 170 ha of land planted with 38 hectares of vines, distributed in three areas. The INRA Pech Rouge Experimental Unit also contains analytical laboratories, technological tools and finally a Sensory Analysis Laboratory which enables the tasting of different wines.  Figure 12: Landfield of Pech Rouge (INRA, France) (Google Maps)

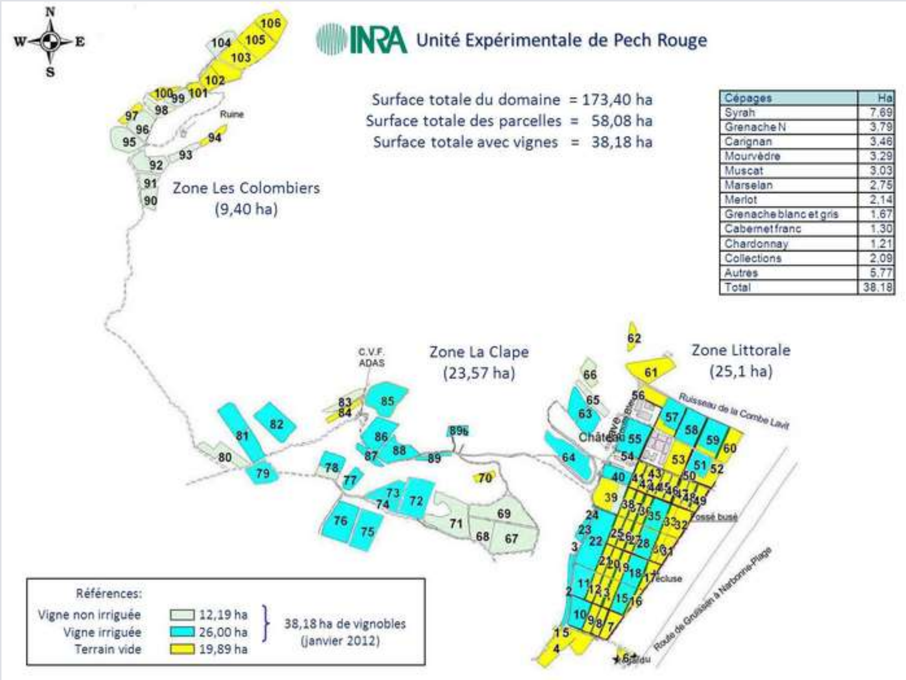


Figure 13: INRA Pech Rouge Experimental Unit

Equipment Used

The experimental unit possess 5000 m² of buildings representing experimental facilities and different installations (winemaking unit, microbiology, delayed fermentation, extraction and separation techniques, ageing, etc.) - covering a total of nearly 5000 m²:

Experimental technological facilities:

- A technological facility dedicated to grape extraction, grape processing and winemaking for experimental work scales from 100 kg to 5 tons. This winery is equipped with various facilities: destemmer, juicer, pressing units, flash release equipment, centrifuges, tangential filters, earth filters, various tanks, etc.
- A technological facility for delayed fermentations allowing alcoholic fermentations under controlled conditions with on-line acquisition of fermentation kinetics (16 100L-fermenters and 4 10L-fermenters). This facility is equipped with a plate pasteurizer and a storage room for storage of stabilized musts under aseptic conditions (at 2 °C) with a total capacity of 210 hl. In addition, it has new online monitoring equipment for the determination of volatile compounds in fermentation gases on 4 fermenters.

Figure 14: INRA Technological Facilities – Delayed Fermentations

- A technological facility dedicated to the technologies of separation / fractionation (electro-membrane and membrane processes, distillation processes, and membrane contactors).
  - Winery (a winery with traditional concrete tanks with a total volume of 1200 hl, and a more recent technological winery with stainless steel vats and tanks for a total capacity of 1500 hl).
  - Packaging facility (two bottling lines for wine lots ranging from 20 L to 100 hl with control of dissolved gases (oxygen and carbon dioxide).
  - Barrel cellar (Chai) with a capacity of 60 oak barrels (15 to 17 ° C, with humidity control).

Figure 15: Oak Barrel Cellar

- Wine bar: for the storage of all experimental wines up to a 4 years period.

Laboratory Analysis:
Neutral sugar amount is calculated relative to the allose (Albersheim et al., 1967). Polyphenol monomers are analyzed by HPLC-DAD according to the procedure described in Ducasse et al. (2010). Tannins are analyzed by HPLC after acid-catalyzed depolymerization reaction in the presence of a nucleophilic agent. The acid-catalyzed cleavage are carried out in the presence of excess 2-mercaptoethanol, according to the protocol developed by Roumeas, Aouf, Dubreucq, and Fulcrand (2013).

- UVmc2 spectrophotometer to perform spectrophotometric measurements

Figure 16: SAFAS UV-mc² Spectrophotometer

Sensorial Analysis:
During sensory analysis sessions, the wine samples (40 mL) are served in black glasses following a monadic order (Latin square) in order to minimize carry-over effects (Macfie, Bratchell, & Greenhoff, 1989). The samples are identified by a set of three digits random codes, which are different for each judge and each sample. The wine analysis is intended to be purely olfactory. In this purpose; the glasses were covered with a lid. The terms listed by the judges are grouped together into term families in accordance with the Pearson correlation, the Wine Aroma Wheel (Noble et al., 1987).

- Sensorial analysis platform.

	 **Figure 17: Sensorial Analysis Platform** *Climatic Data*: Climatic Data are monitored by a weather station. These climatic data are used to compute the reference evapotranspiration (ETo) according to Allen et al. (1998). Vines predawn leaf water potential measurements will be carried out between 3 and 5a.m. with a pressure chamber (Scholander et al., 1965). *Expected Timeline* Whilst a huge number of data is already available, measurements related to the Wine Making pilot will take place during the whole duration of the project. In order to adapt crop varieties, crop management practices and modes of canopy dressing to the requirements of research, the vineyard of Pech Rouge will continuously be evolved. But, to achieve the goals of the pilot, the following tasks will be continuously performed: • Collecting existing data from our partners • Collecting information of fields, terrain, product quality Measuring and monitoring field activities and winemaking activities
Measurements	• *Climatic variables,* • *Soil characteristics,* • *Information coming from farms activities (treatments/fertilizing (when, what, how much), ground handling, or tasks related to the culture management, pest control, water status, yield etc)* • *Grape and berry mechanical properties (weight, length, width, density etc.)* • *Grape and berry chemical properties (anthocyanin etc.)* • *Qualitative and quantitative characteristics of must (sugar content, alcohol, pH etc.);* • *Information coming from winemaking activities (Bioconversion of sugar into ethanol and CO_2, Monitoring of alcoholic fermentation and sugar content, yeast characteristics etc.)* • *Expert panel of tasters' sensory analysis (wine bitterness, astringency, phenol content, aroma etc.)* • *Wine commercial information (number of bottles produced, number of bottles sold)*

Envisaged Outcomes	Previous and on-going experimentation on Pech Rouge experimental Unit will provide a large-scale datasets about winemaking and the vine-grape-wine continuum. Those data and datasets will be benefit for: • The application and test of the BigDataGrapes solution • The validation of the BigDataGrapes components in real-life conditions and with complex dataset. Our goal is also: • To have a device to improve data quality (correction) and make FAIR data • To have a better understanding of 'How data from the field can affect the wine quality?' and 'How vine water status can affect the wine quality?' • To discovery knowledge in order to design new viticulture / vinification systems

The proposed stage at which the Wine Making pilot is going to conduct each testing throughout the course of the BigDataGrapes project, as well as its replications has been designated. Any pilot trial taking place within the Wine Making pilot is accounted for in a timeline, illustrating all relevant testing in a chronological order per growing season and throughout the course of the project.

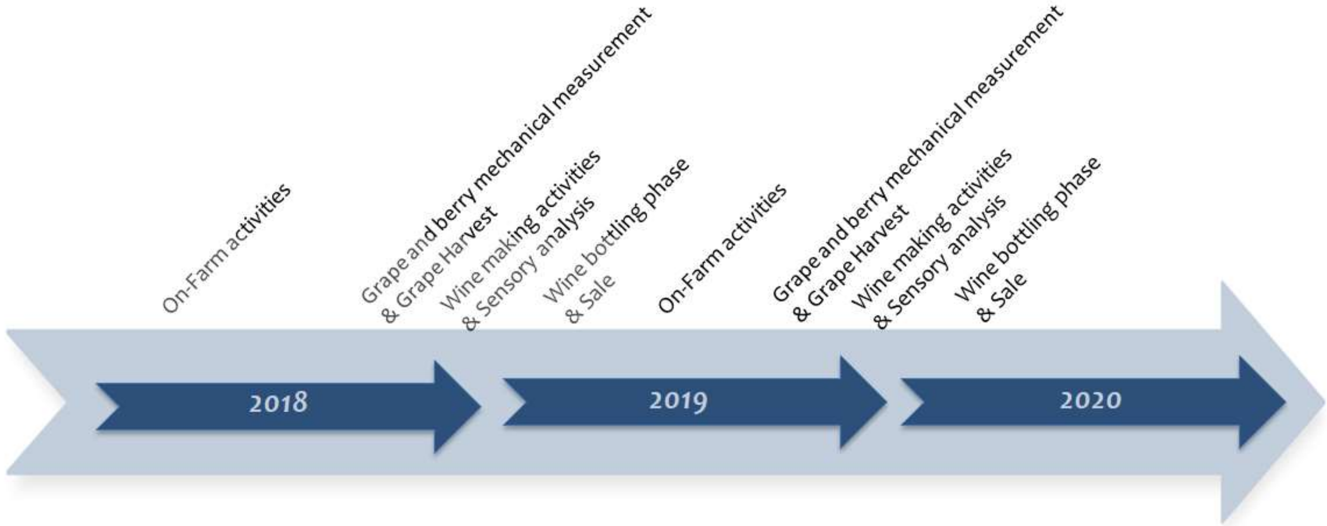


Figure 18: Timeline of Wine Making piloting plan

2.2.2 Assess Wine Making Pilot Results

The table below provide an overview of the data and the datasets that will be gathered once the Wine Making pilot will have run its course over a season/ year.

Table 2: Overview of data and datasets that will be gathered once the Wine Making pilot will have run its course over a season/ year

Name	DataSet Description	Priority	Provenance	Data Type Format	Data size
Genetic Data	Genetic profile, Morphological description, origin, etc.	Essential	French Network of Grapevine Repositories (Database of the collections)	csv or api	MB
Soil characteristics	Texture, pH etc.	Essential	Field measurement	xls	MB
Plot management	Treatments/fertilizing (when, what, how much), ground handling, or tasks related to the culture management, pest control, water status, yield etc	Essential	Field measurement	Pdf,doc, xls	MB
Climatic data	Rainfall, temperature, radiation etc.	Essential	Field measurement	xls	MB
Grape and berry mechanical and chemical properties	Anthocyanin content, weight, length, width, density etc.	Essential	Field measurement	xls	MB
Qualitative and quantitative characteristics of must	Sugar content, alcohol, pH etc.	Essential	Laboratory equipment		MB
Winemaking activities	Bioconversion of sugar into ethanol and CO_2, Monitoring of alcoholic fermentation and sugar content, yeast characteristics etc.	Essential	Laboratory equipment	xls, pdf	MB

Sensory analysis	Expert panel of tasters' sensory analysis (wine bitterness, astringency, phenol content, aroma etc.)	Essential	Expert analysis	xls	MB
Wine commercial information	Number of bottles produced, number of bottles sold	Additional Data	Selling point	xls	MB

2.3 FARM MANAGEMENT PILOT (ABACO – GEOCLEDIAN)

2.3.1 Specific Goals, Technological Guidance, Measurements and Envisaged Outcomes

Abaco - Geocledian Pilot Plan	Farm Management Pilot
Introduction & Specific Goals	The ABACO and Geocledian Farm Management Pilot is focused on developing a unique system that satisfies these needs: • Farm Management with all the functionalities to support the farmer in his day by day activities and gather data from the field • Hosting data from different sources with proper tools and functionalities for comparisons and easy data management • Data exchange. A "day by day" data producer, to feed the generated data into the other BDG components and make use of the incoming information from the other BDG components. • Data visualization. The data relevant for the farmer should be displayed in a way that provides an added value and new insights to the farmer for his activities. Two wine makers were identified as actors in this pilot. They will be involved in the pilot in two ways: • They will be supported in their work by making the developed products and systems available to them. In addition to the farm management system itself this includes sensors and measurements that will provide data as basis for decision support. • On the other hand, these actors can help in designing the new system by providing input and knowhow about their needs and activities. They can also give insights on how to disseminate results, approach and ideas of the BigDataGrapes Project.
Technical Guidelines/ Methodology	*Site Description* The approach expects to involve 2 wineries, making them an active part of the project, collecting data from the field, in automatic and manual manners, and therefore contribute to the results.

Company Name: CASATO PRIME DONNE CIRCA
Address: Località Casato – Montalcino, Tuscany, IT
GPS Coordinates : 43.088196° N 11.464319° E
Internet Site: www.cinellicolombini.it

12 HA of Vineyards of Brunello of Montalcino

Figure 19: 12 HA of wineyards of Brunello of Montalcino

Company Name: CANTINA IL PALAZZO
Address: Loc. Antria, Arezzo, Tuscany, IT
GPS Coordinates: 43.502773, 11.904402
Internet Site: www.tenutailpalazzo.it

35 HA of Vineyards of CHIANTI D.O.C.

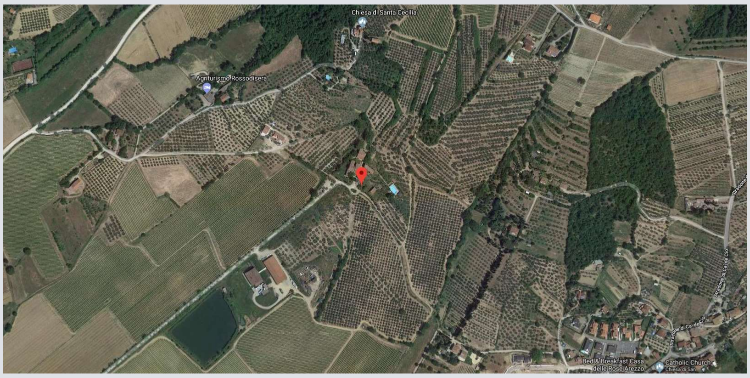


Figure 20: 35 HA of Wineyards of CHIANTI D.O.C.

Geocledian plans to acquire satellite data of one additional test site with pergola cultivation to compare the spectral behaviour of different vineyard cultivation types.

Equipment Used

- Abaco is going to release a version of its product; SITI4farmer is ready to be used in the field, by the 2 different winemakers, and all the project partners.

SITI4farmer is able to (with just an internet connection trough browser):

- Prepare the graphical crop plan

- Manage farming practices and phenology phases
- Analyze indices and dashboards to support decisions (agro-meteorology and vegetation)
- Keeping farm data organized and accessible
- Recording field data with the SITI4l and app
- Printing and export data

Furthermore, it's able to integrate weather data and services from different sources, also, it can use open databases and local land registries made available by everyone that has an exposed service.

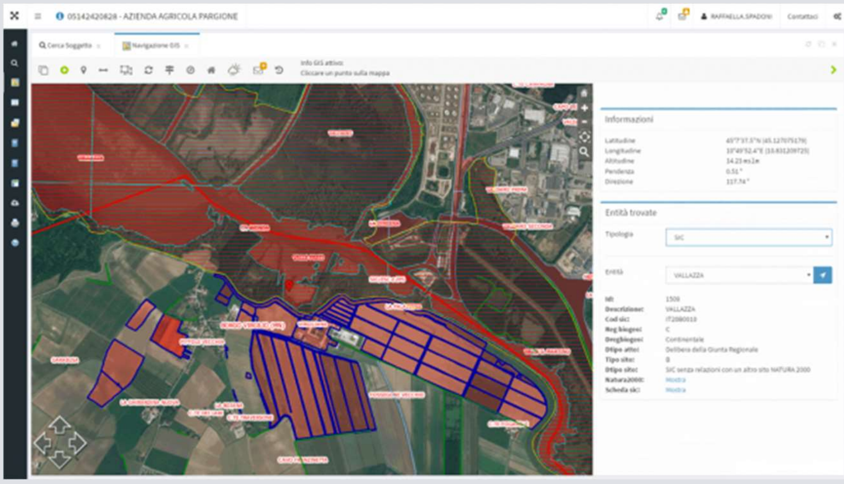


Figure 21: SITI4farmer screen view

- In order to make full and comprehensive measurements in the fields, automatizing as much as possible, Abaco is going to finance the acquirement and the integration within the system of 2 sensors stations dedicated to this purpose.

Sensor Stations will be purchased directly from Abaco, and installed within two farms, after Abaco's experts implement a deep study, in order to find the right place, right position in accordance with quality measurements expected from the project (that's will be discuss from project partners).

Sensors and weather station are going to set for working via radio with a central server, and then transmit data directly to SITI4farmer. They'll be equipped (for example) with:

- Modem, aerial, battery, solar panel;
- Rain Gauge Module
- Temperature and humidity sensors
- Wind direction system
- Wind speed measurement sensors
- Solar Radiation sensor
- Single Leaf Temperature Sensor
- Infrared Temperature Module
- IR Temperature sensor
- Instruments Leaf Wetness Sensor Module with 5 meter of cable
- Drill & Drop Sensor (Temperature and soil moisture sensors)

Figure 22: Sensor & Weather Station

Figure 23. Rain Gauge Module

- Geocledian will acquire and process Copernicus Sentinel-2 and USGS Landsat-8 images for all sites during the pilot run time.
- Geocledian plans to acquire and process VHR Satellite data sets for all test sites.
- Geocledian's Processing Platform provides the existing service ag|knowledge that allows the automatic crop monitoring for fields with basic products like visible images and NDVI (based on 4 spectral bands). In the frame of the pilot Geocledian will develop the current data processing platform further into a Big Data Processing Platform as described below.

Expected Timeline

Abaco's main Tasks and Operations, that will be performed to achieve the goals of the pilot are:

- Formal Engagement of the winery companies
- Collecting information of fields, terrain, product quality
- Analysis for the sensors set up on the right spot and configuration
- Setup of SITI4farmer for the 2 companies
- Development of the system sensors station interfacing

- Measurements and monitoring of field activities

Piloting activating (in particular the last one) will be part of the entire project and is going to be considered as an activity in continuous improvement, where data and results will be presented to the other partners regularly.

Macro Activity	Time
Geocledian: Data acquisition, processing & provision	Q3-Q4.2018
Winery Company formal engagement	Q3.2018
Abaco's Hardware & Software supplying	Q3.2018
Deploying of SITI4farmer	Q4.2018
Abaco's Development & Configuration for sensors integration	Q4.2018
Training of user on the system	Q4.2018
Geocledian: Integration of new data sources	Q1-Q2.2019
Field Measurements & monitoring	Q1.2019 to Q4.2020
Geocledian: Development of Management Zones & data anomaly detection	Q1-Q4.2019
Geocledian: Improvement of vineyard specific products with feedback from users	Q1-Q4.2020

Throughout the pilot duration Geocledian will acquire and process the described satellite data of all sites. Visible images and Vegetation Index Maps will be produced in our Processing platform and the data will be provided to all project partners in near real-time.

Measurements

- *Abaco, with its SITI4farmer system, is engaged to make a big picture of farm data on multiple views:*

✓ Chemical and physical info on grapes
✓ Day by Day Activities in term of treatments, fertilization, field operation
✓ Plot and Fields information georeferenced
✓ Weather and soil main parameters measurements

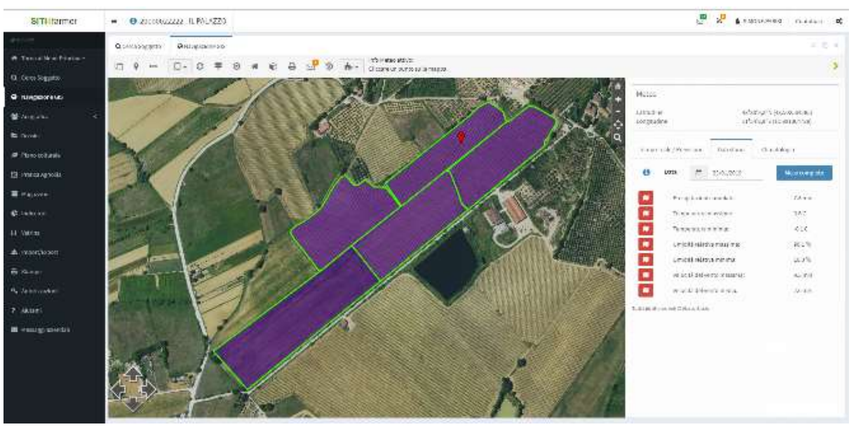
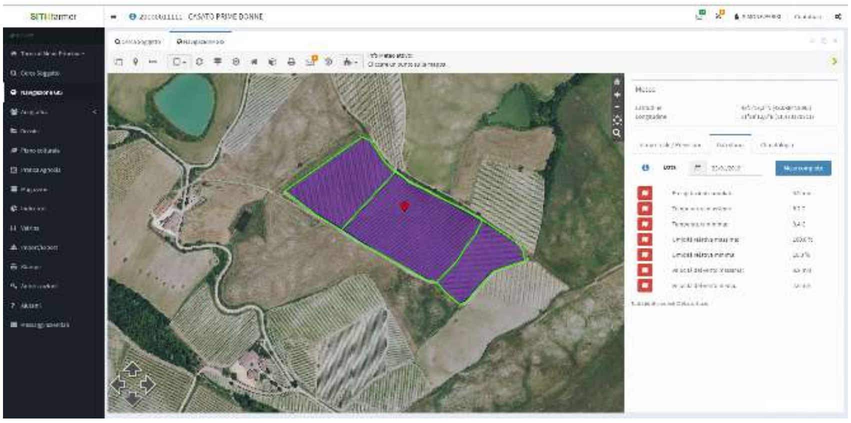


Figure 24: "Il Palazzo" farm GIS plot and related historical meteorological data display example

	 **Figure 25: "Casato Prime Donne" farm GIS plot and related historical meteorological data display example** *This means to measure all environment variables as presented in previous paragraph, and in table 1.2, together with all information coming from farms activities, for example: treatments/fertilizing (when, what, how much), ground handling, or tasks related to the culture management; and with data from the position, shape, terrain, geographically localized.* • *Geocledian will acquire and process all Sentinel-2 data sets available (until a certain cloud cover threshold) for all sites during the pilot run time (max. every 2/3 days). Visible images and Vegetation indexes will be produced and the data will be provided to all project partners.* • *Geocledian will acquire and process all Landsat-8 data sets available (until a certain cloud cover threshold) for all sites during the pilot run time (max. every 16 days). Visible images and Vegetation indexes will be produced and the data will be provided to all project partners.* • *Geocledian plans to acquire and process a certain amount of VHR data sets. Visible images and Vegetation indexes will be produced and the data will be provided to all project partners.*
Envisaged Outcomes	In the frame of the pilot, Geocledian will further develop the current data processing platform into a Big Data Processing Platform that will allow the scalable production, provision & analysis of large scale data sets. In particular, will allow the new vineyard-specific products of all test sites of the project to be integrated into farm management systems like Abaco's SITI4Farmer. The combination of remote sensing with in situ field & weather data will enable the following developments: - Improved cloud & cloud shadow detection algorithms & atmospheric correction procedures (necessary for all further developments) - Management Zones Maps - Combined analysis methods of combined field & weather data provided by Abaco with remote sensing data - New, grape-specific higher level information products - Integration of VHR data and additional data sources - Data anomaly detection procedures to detect features in the satellite data that will allow issuing warnings to farmers when potentially interesting farm management related issues will be

	detected. - User-specific Visualization of big data analytics that are relevant for the farmer Abaco is going to make use of the output from Geocledian, from sensors, and from the users of the system, to create knowledge maps and data systems to put in relation the culture quality with all the other variables. These outputs are going to be discussed with the other partners periodically, in order to collect input from every different approach. Geocledian & Abaco will assess the added value of the developed products for the farmers and improve them with the farmers' input.

The proposed stage at which the Farm Management pilot is going to conduct each testing throughout the course of the BigDataGrapes project, as well as its replications has been designated. Any pilot trial taking place within the Farm Management pilot is accounted for in a timeline, illustrating all relevant testing in a chronological order per growing season and throughout the course of the project.

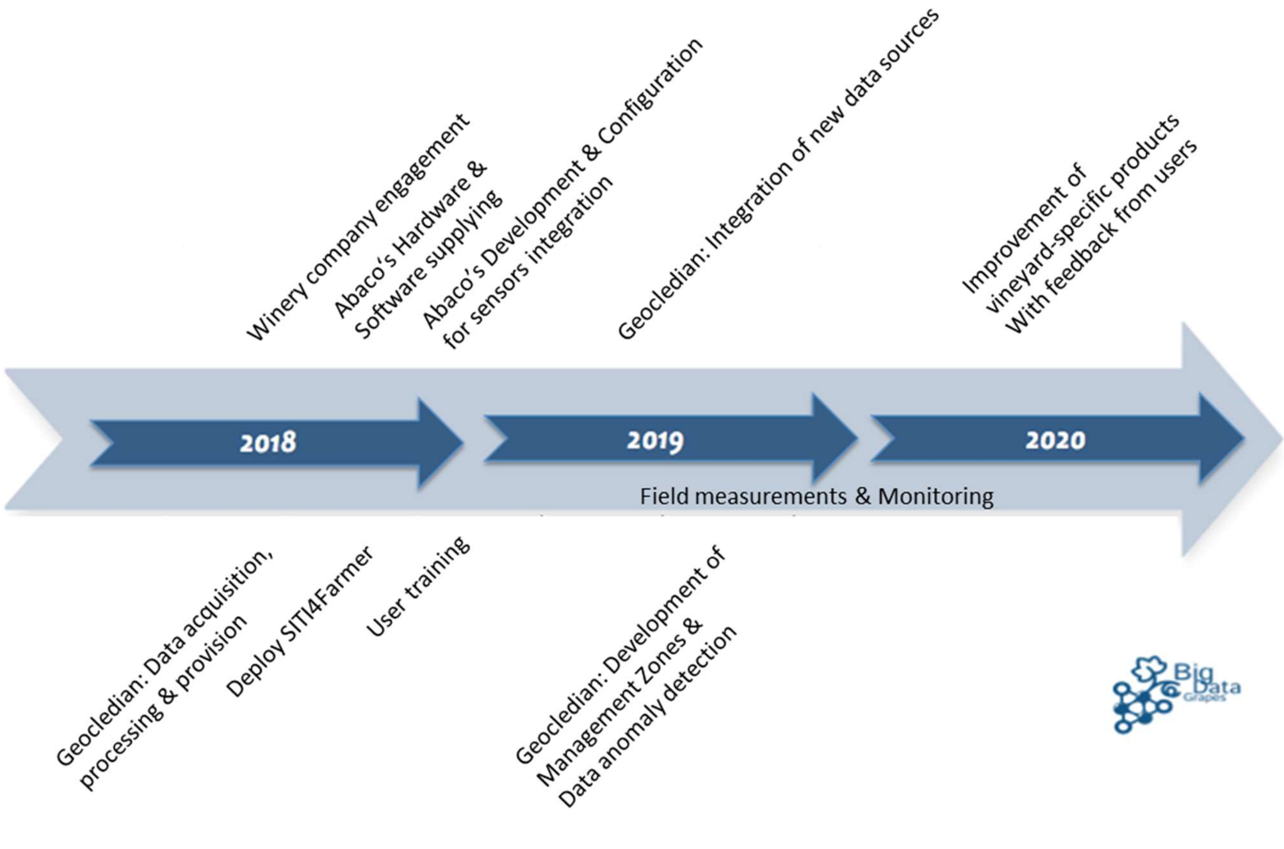


Figure 26: Timeline of Farm Management piloting plan

2.3.2 Assess Farm Management Pilot Results

The table below provide an overview of the data and the datasets that will be gathered once the Farm Management pilot will have run its course over a season/ year.

Table 3: Overview of the data and datasets that will be gathered once the Farm Management pilot will have run its course over a season/ year

Name	DataSet Description	Priority	Provenance	Data Type Format	Data size
Sentinel-2	Sentinel-2A/B MSI visible & NIR bands, NDVI time series & advanced products	Essential	Copernicus EO Programme, ESA	JSON, GEOTIFF, PNG	150 GB/year*site
Landsat-8	Landsat-8 OLI visible & NIR bands & advanced products	Essential	USGS, NASA	JSON, GEOTIFF, PNG	6 GB/year*site
VHR data	VHR satellite data, e.g. TripleSat VHR optical bands	Additional	TBD, e.g. 21AT	TBD, e.g. GEOTIFF	TBD
Chemical and physical info on grapes	Antocyanins, Ph, Brix values during maturation	Additional	Excel table file	XLS	TBD
Day by Day Activities in term of treatments, fertilization, field operation	Diary where farmer or operators can record and /or plan all the activities on their fields	Essential	SITI4farmer	Text file	TBD
Plot and Fields information georeferenced	Information of Plots position, shaping, cultures, type of seed, dates, and everything related on the culture and the farm itself (form official and not official point of view)	Essential	Form the field through SITI4farmer	Test files	TBD
Relative Humidity	Relative humidity (RH) is the ratio of the	Essential	Field Sensors	Decimal Data	TBD

	partial pressure of water vapor to the equilibrium vapor pressure of water at a given temperature				
Air Temperature		Essential	Field Sensors	Decimal Data	TBD
Global Solar Radiation	It's the power per unit area received from the Sun in the form of electromagnetic radiation in the wavelength range of the measuring instrument	Additional	Field Sensors	Decimal Data	TBD
Wind Speed and Direction		Essential	Field Sensors	Decimal Data	TBD
Soil Temperature		Additional	Field Sensors	Decimal Data	TBD
Soil Moisture	Measurement of the water in the large and intermediate size pores that can move about in the soil and be easily used by plants	Essential	Field Sensors	Decimal Data	TBD
Precipitation	Rainfall measurements	Essential	Field Sensors	Decimal Data	TBD
Infrared Surface Temperature	Temperature Surface calculated with infrared measurements	Essential	Field Sensors	Decimal Data	TBD

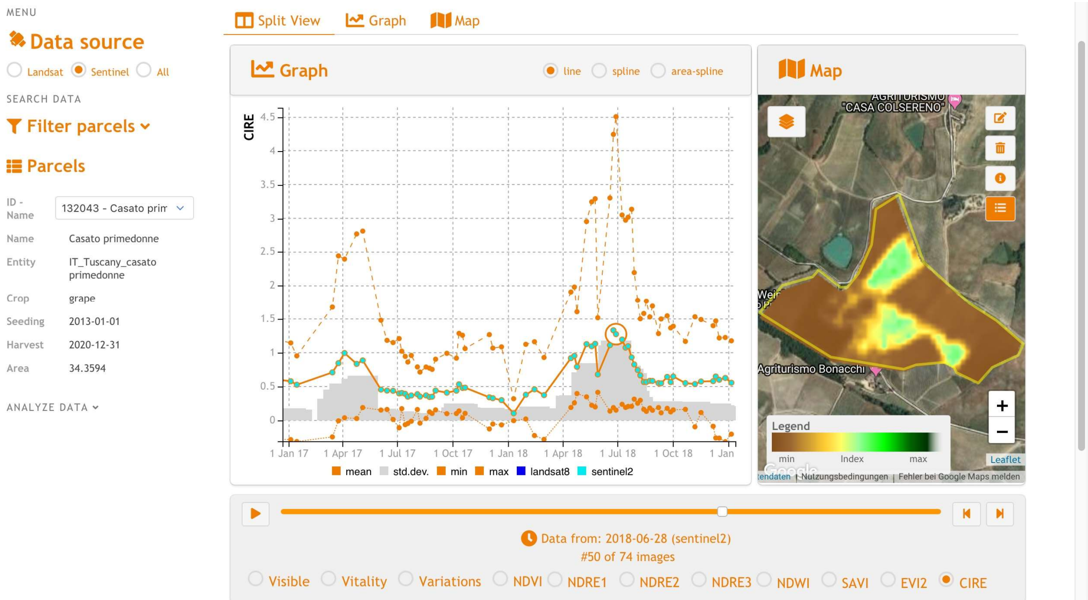


Figure 27: A Sentinel-2 Chlorophyll Index Red Edge (CI-RE) time series for 2017 & 2018 over parts of the Casato Prime donne site in Tuscany, visualized in a data analysis and review client

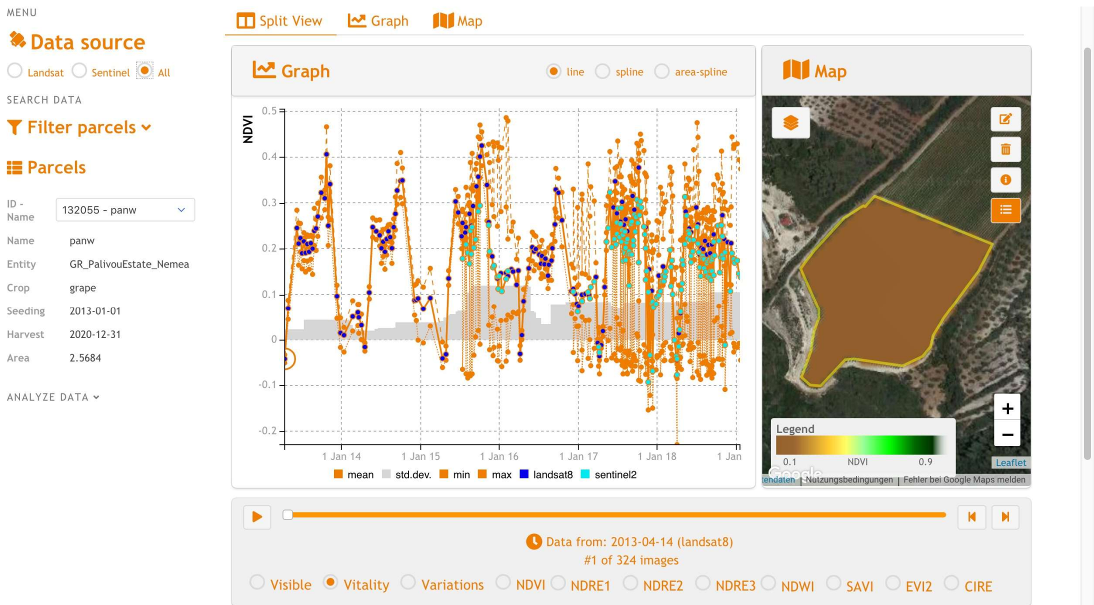


Figure 28: A combined Landsat-8 & Sentinel-2 NDVI time series for 2013 - 2019 over a parcel of the Palivou estate in Greece, visualized in a data analysis and review client

2.4 NATURAL COSMETICS PILOT (Symbeeosis)

2.4.1 Specific Goals, Technological Guidance, Measurements and Envisaged Outcomes

Symbeeosis's Pilot Plan	Natural Cosmetics Pilot
Introduction & Specific Goals	There is a need in extracting 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. Bioactive compounds from winery by-products have disclosed interesting health promoting activities both *in vitro* and *in vivo*. If properly recovered, they show a wide range of potential and remunerative applications in many industrial sectors, including cosmetics, pharmaceuticals, biomaterials and food. In fact, winemaking by-products are outstanding sources of oil, phenolic compounds and dietary fibre and possess numerous health benefits and multifunctional characteristics, such as antioxidant, colouring, antimicrobial and texturizing properties. The scenario presumes that precision farming and control of parameters linked to the quality of wine may provide by-products of superior quality. In particular, the pilot intends to gather samples of vineyard by-products across the Greek territory and more specifically vine leaves of two different grape varieties (Agiorgitiko and Mandilaria) and test their phytochemical profile and biological value after extraction.
Technical Guidelines/ Methodology	*Site Description* A. Sample Collection For the first year of the project, sixteen regions of the Greek territory have been chosen for sample collection, i.e. dried vine leaves of two different grape varieties (Agiorgitiko and Mandilaria). Also, samples of both grape varieties from the vineyard of Hellenic Agricultural Organization "DIMITRA" located in Attica will be tested. The dispersion and origin of the samples is shown in the following map, where the samples of Agiorgitiko are pictured in green and the samples of Mandilaria in red.

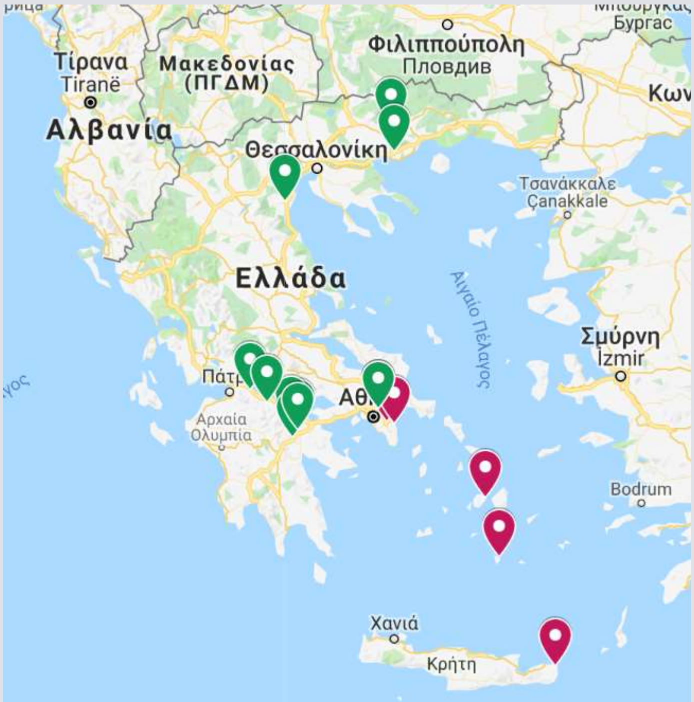


Figure 29: Dispersion of samples across the Greek territory

In the following table there is a list of the vineyards chosen for sample collection and their location.

Table 4. Vineyards chosen for sample collection

	Vineyard	Grape Variety	Region	City
1	Semeli Wines	Agiorgitiko	Peloponnese	Nemea
2	Pavlidis Estate	Agiorgitiko	Northern Greece	Drama
3	RIRA Vineyards	Agiorgitiko	Peloponnese	Aigio
4	Vassaltis Vineyards	Mandilaria	Aegean	Santorini
5	Strofilia Estate Winery	Agiorgitiko	Peloponnese	Stimfalia
6	Papagiannoulis Winery	Agiorgitiko	Northern Greece	Katerini
7	Tetramythos Wines	Agiorgitiko	Peloponnese	Ano Diakopto
8	Skouras Domaine	Agiorgitiko	Peloponnese	Argos
9	Moraitis Winery	Mandilaria	Aegean	Paros
10	Toplou Winery	Mandilaria	Crete	Sitia
11	Aoton Winery	Mandilaria	Attica	Peania
12	Biblia Chora Estate	Agiorgitiko	Northern Greece	Kavala
13	Papagiannakos Domaine	Mandilaria	Attica	Markopoulo
14	Hellenic Agricultural Organization "DIMITRA"	Mandilaria	Attica	Lykovrisi
15	Hellenic Agricultural Organization "DIMITRA"	Agiorgitiko	Attica	Lykovrisi
16	Agricultural University of Athens	Agiorgitiko	Peloponnese	Nemea

B. Laboratory testing

The preparation of vine leaf extracts and testing of biological efficacy of each sample will take place at the laboratory of collaborating Company APIVITA S.A. – Natural Cosmetics, located in Industrial Park of Markopoulo Mesogaias in Greece.

Figure 30: Collaborating Company's (APIVITA) laboratory

Equipment Used

- Extractions will be conducted using Elma S60H Elmasonic Ultrasonic Bath.

Figure 31: Elma S60H Elmasonic

- The measurement of pH will be conducted with a seven compact pH meter, METTLER-TOLEDO.

Figure 32: pHmeter, METTLER-TOLEDO

- The measurement of refractive index will be conducted with a Digital Refractometer RX-a- series ATAGO

Figure 33: **Digital Refractometer ATAGO**

- A NUVE Incubator and a Laminar Telstar BO-II-A will be used for the measurement of total microbial count with classic development of micro-organism in petri-dishes.

Figure 34: (a) NUVE Incubator, (b) Laminar Telstar BO-II-A

- A Laminar Telstar BO-II-A Memmert will be used for the measurement of yeasts and moulds with classic development of micro-organism in petri dishes.

Figure 35: Laminar Telstar BO-II-A

- A UV 1800 SPECTROPHOTOMETER, SHIMADZU EUROPA will be used for the measurement of antioxidant activity (DPPH & ABTS assay), total phenolic content and total flavonoid content.

Figure 36: UV Spectrophotometer

- A Nanoquant, infinite M200 Pro, TECAN will be used for the measurement of toxicity on skin cells (MTT assay).

Figure 37: Nanoquant, infinite M_{200} Pro

- A CFX connect Real time System, BIO-RAD will be used for the measurement of gene expression on skin cells (Target SIRT1 mRNA transcripts using real time PCR).

Figure 38: CFX connect Real time System

Expected Timeline

Measurements related to the Natural Cosmetics pilot will take place during the whole duration of the project. The collection of samples from the chosen vineyards will be repeated every year, following extraction using two different methods and measurements of biological efficacy of developed extracts.

	Extractions (Maceration & Extraction in Ultrasonic Bath) of the 21 samples are estimated to last 3 months, as well as the measurements of biological activity.
Measurements	• *pH* • *Refractive index: Measurement of Brix%* • *Total microbial count: Measurement of TPC with classic development of micro-organism in petri-dishes* • *Yeasts and moulds: Measurement of Y&M with classic development of micro-organism in petri dishes* • *Antioxidant activity: Spectrophotometric method of antioxidant capacity using DPPH & ABTS assay* • *Total phenolic content: Spectrophotometric measurement of the phenolic content in the extract using TPC assay* • *Total flavonoid content: Spectrophotometric measurement of the flavonoid content in the extract* • *Toxicity on skin cells: Cell viability assessment using MTT assay* • *Gene expression on skin cells: Target SIRT1 mRNA transcripts using real time PCR*
Envisaged Outcomes	Bioactive compounds found in wine-making by-products such as vine leaves possess multifunctional characteristics and show a wide range of potential and remunerative applications, concerning health promoting activities. Nevertheless, the quality of these by-products and more specifically their biological efficacy can vary depending on multiple parameters, such as the origin of the sample, the recovery process and more. The collected data from the natural cosmetics pilot will provide the necessary information for the evaluation of the quality of each sample, linked with the special characteristics of the vineyard of origin. The goal is to face the challenge: "how data from the field can be linked to the biological efficacy of final products - an application on wine making by-products".

The proposed stage at which the Natural Cosmetics pilot is going to conduct each testing throughout the course of the BigDataGrapes project, as well as its replications has been designated. Any pilot trial taking place within the Natural Cosmetics pilot is accounted for in a timeline, illustrating all relevant testing in a chronological order per growing season and throughout the course of the project.

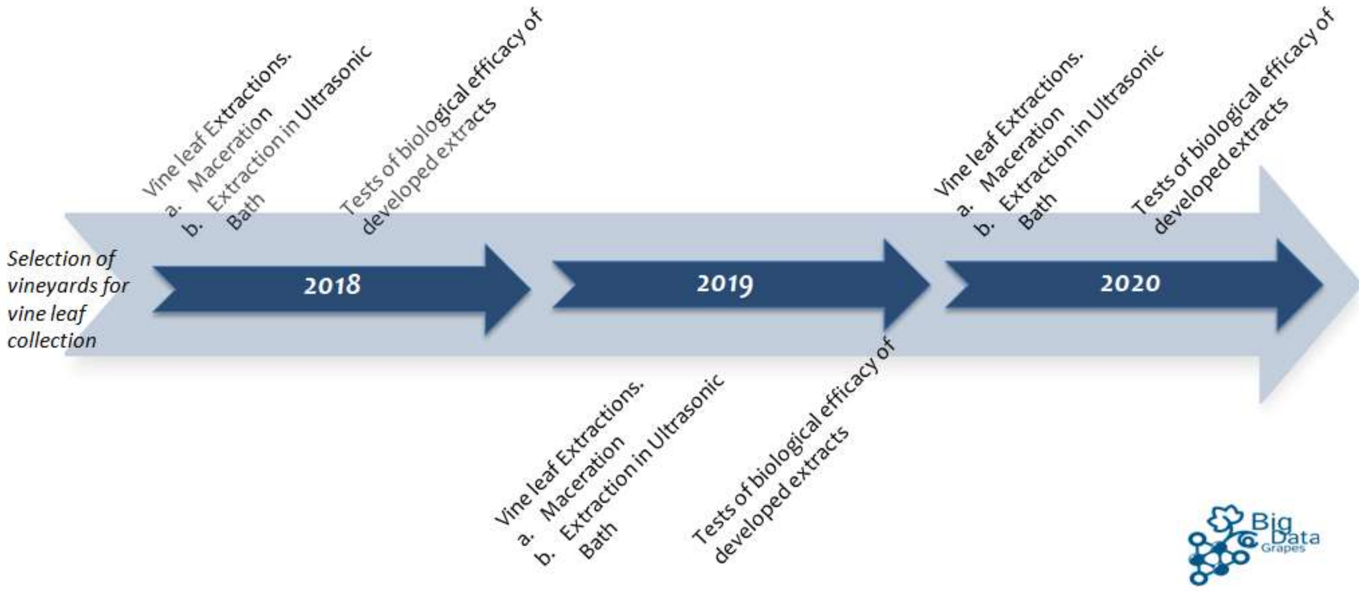


Figure 39: Timeline of Natural Cosmetics piloting plan

2.4.2 Assess Natural Cosmetics Pilot Results

The table below provides an overview of the data and the datasets that will be gathered once the Natural Cosmetics pilot will have run its course over a season/ year.

Table 5: Overview of the data and datasets that will be gathered once the Natural Cosmetics pilot will have run its course over a season/ year

Name	DataSet Description	Priority	Provenance	Data Type Format	Data size
Agiorgitiko Samples UAE (11 samples)	Data on biological efficacy of samples of Agiorgitiko dried vine leaves, developed with Ultrasound Assisted Extraction	Essential	Laboratory testing	csv, xls	MB
Agiorgitiko Samples MAC (11 samples)	Data on biological efficacy of samples of Agiorgitiko dried vine leaves,	Essential	Laboratory testing	csv, xls	MB

	developed with Maceration				
Mandilaria Samples UAE (5 samples)	Data on biological efficacy of samples of Mandilaria dried vine leaves, developed with Ultrasound Assisted Extraction	Essential	Laboratory testing	csv, xls	MB
Mandilaria Samples MAC (5 samples)	Data on biological efficacy of samples of Mandilaria dried vine leaves, developed with Maceration	Essential	Laboratory testing	csv, xls	MB
Weather Data	Weather data on the regions selected for sample gathering	Essential	Open source data		

3 DATA, DATASETS AND USE CASE SCENARIOS

Four overarching (4) use cases and ten (10) relevant scenarios, in which the use cases are divided, have been identified so far under WP2, "T2.1-Use Cases & Requirements".

Table 6. Use Cases and Scenarios

Use Cases	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)

In the BigDataGrapes pilots (WP8), data can be derived from one or more datasets that relate to each use case. The data analysis phase is part of the definition of the BigDataGrapes use cases (WP2) and the BigDataGrapes pilots (WP8) focusing on the data types and formats, metadata standards, as well as the existing licensing options used. For these use case and scenarios, an adequate number of the supporting datasets have already been described with the help of the Data Management Plan template as presented in WP2. Furthermore, it is expected that before the start of the pilots, all aspects related to the datasets that will be used/produced as part of the project pilots will have been clarified and resolved. These aspects include questions related to hosting the data (persistence), appropriately describing the data (data provenance, relevant audience for re-use, discoverability), access and sharing (rights, privacy, limitations) and information about the human and physical resources expected to carry out the data management plans per dataset.

The pilots defined will constitute instantiations of these scenarios. The table below (Table 3) includes information about the specific use case scenarios to which each pilot will be connected to, as proposed by the pilot partners.

Table 7. Use Case Scenarios' Connection to Pilots

Use Case Scenarios	Pilot	Partner
A. Earth Observation Data Anomaly Detection & Classification	A. Farm Management Pilot	A. ABACO-GEOCLEDIAN
B1. Yield Prediction B2. Predicting Biological Efficacy B3. Crop Quality Prediction	B1. Table and Wine Grapes Pilot B2. Natural Cosmetics Pilot B3-1.Table and Wine Grapes Pilot	B1. AUA B2. Symbeeosis (APIGEA) B3-1. AUA

• for Optimizing Post Harvest Treatments of Table Grapes (B3-1) • for Optimizing Winemaking (B3-2)	B3-2. Wine Making Pilot	B3-2 INRA
C1. Optimization of Farm Practices in the Vineyard C2. Management Zones Delineation for Vineyards	C1. Farm Management Pilot Table and Wine Grapes Pilot C2.Table and Wine Grapes Pilot	C1. ABACO-GEOCLEDIAN AUA C2. AUA
D1. Grape and Wine Quality Risk Assessment (safety)	D1. Wine Making Pilot	D1. INRA

4 CONCLUSIONS

This deliverable, the "Piloting Plan", belongs to WP8, which is responsible for the planning and preparation of pilot, the definition of the experimental and evaluation protocols to be followed, the execution of the pilots and ultimately, the collection and evaluation of the pilot results and their assessment over indicators defined by the end users.

One of the main goals of BigDataGrapes is to demonstrate how data value chains may be created in the grapevine-powered industries via deploying a proof-of-concept data marketplace for sharing and accessing large and heterogeneous grapevine-related data assets from both corporate and public organisations. This first deliverable, aims to provide directions on how to collect and handle big data from different sectors of the grape value chain by giving a general scope of the activities that will be undertaken during the project lifetime under the pilots. This is a report documenting the plan for the development, design and execution of the application pilots and the methodology and materials for the pilot trials. The objective of this deliverable is to provide generic guidelines to all the pilots that will constitute instantiations of the use cases already identified in WP2.

As identified through this report all four pilots contribute to the main BigDataGrapes objectives but they have different specific goals:

- AUA will continuously collect and monitor sensor, farming and phenological data derived from all test sites located in Greece. Some of the goals to be achieved through this sensor and farming data collection, is to denote associations and correlations between precision agriculture information and phenological data and grape and wine chemical analysis.
- The INRA's experimental unit of Pech Rouge (UEPR) is dedicated to research in the fields of viticulture and oenology with an integrated point of view that allows a transversal approach from the vineyard to the packaged final product.
- The ABACO and Geocledian Farm Management Pilot is focused on developing a unique system that satisfies these needs of Farm Management with all the functionalities to support the farmer in his day by day activities and gather data from the field, to host data from different sources, support data exchange and data visualization.
- Finally, the Natural Cosmetics pilot intends to gather samples of vineyard by-products across the Greek territory and more specifically vine leaves of two different grape varieties (Agiorgitiko and Mandilaria) and test their phytochemical profile and biological value after extraction.

During this formative phase, when suitable data and processes for fulfilling the requirements of the specific use cases are being identified and relevant piloting activities defined, a minimum of 6 experimental vineyards of a grand total field area of ~ 95 ha (2-Italy [~ 47 ha], 1-France [~ 38 ha], 3-Greece [~ 10 ha]) are available for immediate experimentation and data collection. At least 100 grape varieties will be observed by domain experts of INRA Pech Rouge Experimental Vineyard and AUA Experimental Vineyard and product sampling will be performed in 3 chemical labs (Symbeeosis, INRA Pech Rouge, AUA).

The project's Piloting Plan presented in this report is a constantly updating roadmap to an efficient execution of the pilots of the project and it is aligned with the project vision and objectives. Updated versions of this deliverable, including refined piloting plans, are due to M15 and M24 of the project lifetime.

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