Please check our wiki for help on navigating the form.

Horizon 2020

Call: H2020-SC5-2018-2019-2020

(Greening the economy in line with the Sustainable Development Goals (SDGs))

SECOND STAGE

Topic: SC5-16-2019

Type of action: IA

Proposal number: SEP-210597733

Proposal acronym: VITIGEOSS

Deadline Id: H2020-SC5-2019-2

Table of contents

How to fill in the forms

The administrative forms must be filled in for each proposal using the templates available in the submission system. Some data fields in the administrative forms are pre-filled based on the steps in the submission wizard.

1 - General information

Topic	SC5-16-2019	Type of Action	IA
Call Identifier	H2020-SC5-2018-2019-2020	Deadline Id	H2020-SC5-2019-2

Acronym	VITIGEOSS
Proposal title	Vineyard Innovative Tool based on the InteGration of Earth Observation Services and in-field Sensors

Note that for technical reasons, the following characters are not accepted in the Proposal Title and will be removed: < > " &

Duration in months	*42*
Fixed keyword 1	Innovation
Fixed keyword 2	Space
Fixed keyword 3	Earth and related environmental sciences
Fixed keyword 4	Environmental sciences
Free keywords	*satellite imagery, viticulture, wine-business operations, EuroGEOSS, sustainability, food security, economic growth, capacity building*

Abstract

The main scope of the project is to empower the potential of EO Systems by creating an innovative commercial information delivery to optimize sustainable vine cultivation via decision support systems (DSS) on phenology, irrigation, fertilizer, disease and business operations management. Satellites imagery will be combined with other data sources such as in-field measurements, models and best practices to build up an integrated but modular management tool covering the most critical operations of the business, including sustainability aspects to align the outcomes with UN SDG´s, which will directly welfare population living in rural communities around wine producers locations.

VITIGEOSS will integrate existing solutions to couple satellite imagery with in-field sensors with the aim of increasing resolution and reliability of satellite information applied to all aspects of viticulture and specific wine-business operations. Our platform will empower the usage of European open EO services by the improvement of agriculture business operations at economic, environmental and social level, and will ensure an effective engagement with EuroGEOSS by direct participation within its Action groups. The presence of 3 end-users in the consortium will facilitate a successful penetration in the market through ELEAF, who will act as commercialization partner.

VITIGEOS can contribute to EuroGEOSS by demonstrating the effective use of European EO resources in an operational application for the wine industry. The application is at the pre-operational readiness level 6 to 7 and as such can reinforce other EuroGEOSS initiatives. VITIGEOS will explore the readiness level with different EuroGEOSS Coordination Groups to ensure that it meets the EuroGEOSS requirements. Connection with these action groups is ensured with the presence of relevant members in the Advisory Board

Remaining characters 120

Has this proposal (or a very similar one) been submitted in the past 2 years in response to a call for proposals under Horizon 2020 or any other EU programme(s)? ○ Yes ◉ No

Please give the proposal reference or contract number.	
xxxxxx-x	

Declarations

1) The coordinator declares to have the explicit consent of all applicants on their participation and on the content of this proposal.	☒
2) The information contained in this proposal is correct and complete.	☒
3) This proposal complies with ethical principles (including the highest standards of research integrity — as set out, for instance, in the European Code of Conduct for Research Integrity — and including, in particular, avoiding fabrication, falsification, plagiarism or other research misconduct).	☒

4) The coordinator confirms:

- to have carried out the self-check of the financial capacity of the organisation on http://ec.europa.eu/research/participants/portal/desktop/en/organisations/lfv.html or to be covered by a financial viability check in an EU project for the last closed financial year. Where the result was "weak" or "insufficient", the coordinator confirms being aware of the measures that may be imposed in accordance with the H2020 Grants Manual (Chapter on Financial capacity check); or	◉
- is exempt from the financial capacity check being a public body including international organisations, higher or secondary education establishment or a legal entity, whose viability is guaranteed by a Member State or associated country, as defined in the H2020 Grants Manual (Chapter on Financial capacity check); or	○
- as sole participant in the proposal is exempt from the financial capacity check.	○

5) The coordinator hereby declares that each applicant has confirmed:

- they are fully eligible in accordance with the criteria set out in the specific call for proposals; and	☒
- they have the financial and operational capacity to carry out the proposed action.	☒
The coordinator is only responsible for the correctness of the information relating to his/her own organisation. Each applicant remains responsible for the correctness of the information related to him and declared above. Where the proposal to be retained for EU funding, the coordinator and each beneficiary applicant will be required to present a formal declaration in this respect.	

According to Article 131 of the Financial Regulation of 25 October 2012 on the financial rules applicable to the general budget of the Union (Official Journal L 298 of 26.10.2012, p. 1) and Article 145 of its Rules of Application (Official Journal L 362, 31.12.2012, p.1) applicants found guilty of misrepresentation may be subject to administrative and financial penalties under certain conditions.

Personal data protection

The assessment of your grant application will involve the collection and processing of personal data (such as your name, address and CV), which will be performed pursuant to Regulation (EC) No 45/2001 on the protection of individuals with regard to the processing of personal data by the Community institutions and bodies and on the free movement of such data. Unless indicated otherwise, your replies to the questions in this form and any personal data requested are required to assess your grant application in accordance with the specifications of the call for proposals and will be processed solely for that purpose. Details concerning the purposes and means of the processing of your personal data as well as information on how to exercise your rights are available in the privacy statement. Applicants may lodge a complaint about the processing of their personal data with the European Data Protection Supervisor at any time.

Your personal data may be registered in the Early Detection and Exclusion system of the European Commission (EDES), the new system established by the Commission to reinforce the protection of the Union's financial interests and to ensure sound financial management, in accordance with the provisions of articles 105a and 108 of the revised EU Financial Regulation (FR) (Regulation (EU, EURATOM) 2015/1929 of the European Parliament and of the Council of 28 October 2015 amending Regulation (EU, EURATOM) No 966/2012) and articles 143 - 144 of the corresponding Rules of Application (RAP) (COMMISSION DELEGATED REGULATION (EU) 2015/2462 of 30 October 2015 amending Delegated Regulation (EU) No 1268/2012) for more information see the Privacy statement for the EDES Database.

2 - Participants & contacts

#	Participant Legal Name	Country	Action
1	FUNDACIO EURECAT	ES	
2	FONDAZIONE LINKS - LEADING INNOVATION & KNOWLEDGE FOR SOCIETY	IT	
3	ELEAF BV	NL	
4	BARCELONA SUPERCOMPUTING CENTER - CENTRO NACIONAL DE SUPERCOMPUTACION	ES	
5	PRICEWATERHOUSECOOPERS /AG - ASSESSORIA DE GESTAO, LDA	PT	
6	UNIVERSITA DEGLI STUDI DI NAPOLI FEDERICO II	IT	
7	AZIENDA VINICOLA MICHELE MASTROBERARDINO SPA	IT	
8	MIGUEL TORRES SA	ES	
9	SYMINGTON FAMILY ESTATES, VINHOS,SA	PT	

2 - Administrative data of participating organisations

PIC	***Legal name***
928030235	*FUNDACIO EURECAT*

Short name: EURECAT

Address of the organisation

Street AVENIDA UNIVERSITAT AUTONOMA 23

Town CERDANYOLA DEL VALLES (BARCELONA)

Postcode 08290

Country Spain

Webpage www.eurecat.org/

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....yes

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....yes

Legal person .....yes

Industry (private for profit).....no

Enterprise Data

SME self-declared status.....04/05/2015 - no

SME self-assessment ..... unknown

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

Department 1

Department name: Smart Management Systems ☐ not applicable

☐ Same as proposing organisation's address

Street: Agri-food Science and Technology Park

Town: Lleida

Postcode: 25003

Country: Spain

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: ○ Male ◉ Female

First name: **María**

Last name: **Navarro**

E-Mail: **maria.navarro@eurecat.org**

Position in org.: Project Manager

Department: Public Programmes

☐ Same as organisation name

☐ Same as proposing organisation's address

Street: Carrer Bilbao 72

Town: Barcelona

Post code: 08005

Country: Spain

Website: www.eurecat.org

Phone: +34 932 381 400

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	*Last Name*	*E-mail*	*Phone*
Lucía	RECIO	lucia.recio@eurecat.org	+34 932 381 400

PIC	***Legal name***
916573856	*FONDAZIONE LINKS - LEADING INNOVATION & KNOWLEDGE FOR SOCIETY*

Short name: FONDAZIONE LINKS - LEADING INNOVATION & KNOWLEDGE FOR SOCIETY

Address of the organisation

Street VIA PIER CARLO BOGGIO 61

Town TORINO

Postcode 10138

Country Italy

Webpage www.linksfoundation.com

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....yes

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....yes

Legal person .....yes

Industry (private for profit).....no

Enterprise Data

SME self-declared status..... unknown

SME self-assessment ..... unknown

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

Department 1

Department name: Data Science For Industrial & Societal Applications

☐ not applicable

☒ Same as proposing organisation's address

Street: VIA PIER CARLO BOGGIO 61

Town: TORINO

Postcode: 10138

Country: Italy

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Rossi**

Last name: **Claudio**

E-Mail: **claudio.rossi@linksfoundation.com**

Position in org.: Project Manager & Senior Researcher

Department: Data Science For Industrial & Societal Applications

☐ Same as organisation name

☒ Same as proposing organisation's address

Street: VIA PIER CARLO BOGGIO 61

Town: TORINO

Post code: 10138

Country: Italy

Website: www.linksfoundation.com

Phone: +32 90109718

Phone 2: +39 0112276430

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Laura	Pantano	laura.pantano@linksfoundation.com	+xxx xxxxxxxxx
Fabrizio	Dominici	fabrizio.dominici@linksfoundation.com	+xxx xxxxxxxxx

PIC	***Legal name***
998872827	*ELEAF BV*

Short name: eLEAF bv

Address of the organisation

Street HESSELINK VAN SUCHTELENWEG 6

Town WAGENINGEN

Postcode 6703 CT

Country Netherlands

Webpage www.eleaf.com

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....no

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....no

Legal person .....yes

Industry (private for profit).....yes

Enterprise Data

SME self-declared status.....31/12/2018 - yes

SME self-assessment .....31/12/2018 - yes

SME validation sme.....06/08/2008 - yes

Based on the above details of the Beneficiary Registry the organisation is an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Mr.

Sex: (•) Male ( ) Female

First name: **Remco**

Last name: **Dost**

E-Mail: **remco.dost@eleaf.com**

Position in org.: Senior Project Manager

Department: ELEAF BV

☒ Same as organisation name

☒ Same as proposing organisation's address

Street: HESSELINK VAN SUCHTELENWEG 6

Town: WAGENINGEN

Post code: 6703 CT

Country: Netherlands

Website: www.eleaf.com

Phone: +31 (0)317 729003

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Mechteld	Andriessen	mechteld.andriessen@eleaf.com	+xxx xxxxxxxxx
Vicent	Dupre	vincent.dupre@eleaf.com	+xxx xxxxxxxxx

PIC	***Legal name***
999655520	*BARCELONA SUPERCOMPUTING CENTER - CENTRO NACIONAL DE SUPERCOMPUTACION*

Short name: BSC

Address of the organisation

Street Calle Jordi Girona 31

Town BARCELONA

Postcode 08034

Country Spain

Webpage www.bsc.es

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....yes

Non-profit .....yes

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....yes

Legal person .....yes

Industry (private for profit).....no

Enterprise Data

SME self-declared status.....01/03/2005 - no

SME self-assessment ..... unknown

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

Department 1

Department name: Eart Science Department ☐ not applicable

☒ Same as proposing organisation's address

Street: Calle Jordi Girona 31

Town: BARCELONA

Postcode: 08034

Country: Spain

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Albert**

Last name: **Soret**

E-Mail: **albert.soret@bsc.es**

Position in org.: Earth System Services Group Coordinator

Department: Eart Science Department

☐ Same as organisation name

☒ Same as proposing organisation's address

Street: Calle Jordi Girona 31

Town: BARCELONA

Post code: 08034

Country: Spain

Website: www.bsc.es

Phone: +34 934134076

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

PIC	***Legal name***
901151050	*PRICEWATERHOUSECOOPERS /AG - ASSESSORIA DE GESTAO, LDA*

Short name: PwC, AG, Lda.

Address of the organisation

Street PALACIO SOTTOMAYOR, RUA SOUSA MART

Town LISBOA

Postcode 1050 217

Country Portugal

Webpage www.pwc.pt

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....no

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....no

Legal person .....yes

Industry (private for profit).....yes

Enterprise Data

SME self-declared status..... unknown

SME self-assessment ..... unknown

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

No department involved

Department name *Name of the department/institute carrying out the work.* ☒ not applicable

☐ Same as proposing organisation's address

Street *Please enter street name and number.*

Town *Please enter the name of the town.*

Postcode *Area code.*

Country *Please select a country*

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Mrs

Sex: ○ Male ◉ Female

First name: **Cláudia**

Last name: **Rocha**

E-Mail: **claudia.rocha@pwc.com**

Position in org.: Partner

Department: Partner Strategy & Corporate Finance Advisory

☐ Same as organisation name

☒ Same as proposing organisation's address

Street: PALACIO SOTTOMAYOR, RUA SOUSA MARTINS, N. 1, 5 AND

Town: LISBOA

Post code: 1050 217

Country: Portugal

Website: www.pwc.pt

Phone: +351918621261

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Marta	Carvalho	marta.alves.carvalho@pwc.com	+351918621261

PIC	***Legal name***
999976590	*UNIVERSITA DEGLI STUDI DI NAPOLI FEDERICO II*

Short name: UNINA

Address of the organisation

Street CORSO UMBERTO I, 40

Town NAPOLI

Postcode 80138

Country Italy

Webpage www.unina.it

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....yes

Non-profit .....yes

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....yes

Research organisation .....yes

Legal person .....yes

Industry (private for profit).....no

Enterprise Data

SME self-declared status..... unknown

SME self-assessment ..... unknown

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

Department 1

Department name: Department of Agricultural Sciences ☐ not applicable

☐ Same as proposing organisation's address

Street: Via Università, 100

Town: Portici (Napoli)

Postcode: 80055

Country: Italy

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof.

Sex: (•) Male ( ) Female

First name: **Boris**

Last name: **Basile**

E-Mail: **boris.basile@unina.it**

Position in org.: Associate Professor

Department: Department of Agricultural Sciences

☐ Same as organisation name

☐ Same as proposing organisation's address

Street: Via Università, 100

Town: Napoli

Post code: 80055

Country: Italy

Website: www.unina.it

Phone: +39 0812539387

Phone 2: +xxx xxxxxxxxx

Fax: +39 0812531714

PIC	***Legal name***
920262669	*AZIENDA VINICOLA MICHELE MASTROBERARDINO SPA*

Short name: MASTROBERARDINO SPA

Address of the organisation

Street VIA MANFREDI 75 81

Town ATRIPALDA AV

Postcode 83042

Country Italy

Webpage www.mastroberardino.com

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....no

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....no

Legal person .....yes

Industry (private for profit).....yes

Enterprise Data

SME self-declared status..... unknown

SME self-assessment ..... unknown

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

Department 1

Department name: VITICULTURE OFFICE OF MASTROBERARDINO SPA

☐ not applicable

☒ Same as proposing organisation's address

Street: VIA MANFREDI 75 81

Town: ATRIPALDA AV

Postcode: 83042

Country: Italy

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **ANTONIO**

Last name: **DENTE**

E-Mail: **antonio.dente@mastroberardino.com**

Position in org.: CHIEF AGRONOMIST

Department: MASTROBERARDINO SPA – VITICULTURE OFFICE

☐ Same as organisation name

☒ Same as proposing organisation's address

Street: VIA MANFREDI 75 81

Town: ATRIPALDA AV

Post code: 83042

Country: Italy

Website: www.mastroberardino.com

Phone: 348 1302793

Phone 2: 0825 614111

Fax: 0825 614231

PIC	***Legal name***
953962118	*MIGUEL TORRES SA*

Short name: MTSA

Address of the organisation

Street	MIGUEL TORRES I CARBO 6
Town	VILAFRANCA DEL PENEDES
Postcode	08720
Country	Spain
Webpage	www.torres.es

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....no

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....no

Legal person .....yes

Industry (private for profit).....yes

Enterprise Data

SME self-declared status.....21/12/2018 - no

SME self-assessment ..... unknown

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

Department 1

Department name: Information Technology

☐ not applicable

☒ Same as proposing organisation's address

Street: MIGUEL TORRES I CARBO 6

Town: VILAFRANCA DEL PENEDES

Postcode: 08720

Country: Spain

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Ms

Sex: ○ Male ◉ Female

First name: **Montserrat**

Last name: **Torres Viñals**

E-Mail: **mtorresv@torres.es**

Position in org.: Head of Viticulture R+D Miguel Torres, S.A.

Department: Viticulture R+D

☐ Same as organisation name

☒ Same as proposing organisation's address

Street: MIGUEL TORRES I CARBO 6

Town: VILAFRANCA DEL PENEDES

Post code: 08720

Country: Spain

Website: www.torres.es

Phone: +34 938177504

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

PIC	***Legal name***
907189785	*SYMINGTON FAMILY ESTATES, VINHOS,SA*

Short name: SYMINGTON FAMILY ESTATES, VINHOS,SA

Address of the organisation

Street TRAVESSA BARAO DE FORRESTER 86

Town VILA NOVA DE GAIA

Postcode 4400 034

Country Portugal

Webpage www.symington.com

Legal Status of your organisation

Research and Innovation legal statuses

Public body .....no

Non-profit .....no

International organisation .....no

International organisation of European interest .....no

Secondary or Higher education establishment .....no

Research organisation .....no

Legal person .....yes

Industry (private for profit).....yes

Enterprise Data

SME self-declared status..... unknown

SME self-assessment ..... unknown

SME validation sme..... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

Department(s) carrying out the proposed work

Department 1

Department name: Viticulture

☐ not applicable

☒ Same as proposing organisation's address

Street: TRAVESSA BARAO DE FORRESTER 86

Town: VILA NOVA DE GAIA

Postcode: 4400 034

Country: Portugal

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Mr.

Sex: (•) Male ( ) Female

First name: **Fernando**

Last name: **Alves**

E-Mail: **fernando.alves@symington.com**

Position in org.: R&D Viticulture

Department: R&D Viticulture

☐ Same as organisation name

☒ Same as proposing organisation's address

Street: TRAVESSA BARAO DE FORRESTER 86

Town: VILA NOVA DE GAIA

Post code: 4400 034

Country: Portugal

Website: www.symington.com

Phone: +351 918 242 929

Phone 2: +351 254 730 366

Fax: +xxx xxxxxxxxx

Proposal ID **SEP-210597733** *Acronym* **VITIGEOSS**

3 - Budget

No	Participant	Country	(A) Direct personnel costs/€ ?	(B) Other direct costs/€ ?	(C) Direct costs of sub-contracting/€ ?	(D) Direct costs of providing financial support to third parties/€ ?	(E) Costs of inkind contributions not used on the beneficiary's premises/€ ?	(F) Indirect Costs / € (=0.25(A+B-E)) ?	(G) Special unit costs covering direct & indirect costs / € ?	(H) Total estimated eligible costs / € (=A+B+C+D+F+G) BENEFICIARY ?	(I) Reimburse-ment rate (%) BENEFICIARY ?	(J) Max.EU Contribution / € (=H*I) BENEFICIARY ?	(K) Costs of third parties linked to participant THIRD PARTIES ?	(L) Max.EU Contribution / € THIRD PARTIES ?	(M) Total Costs for BENEFICIARY & THIRD PARTIES (=H+K) ?	(N) Max.EU Contribution / € BENEFICIARY & THIRD PARTIES (=J+L) ?	(O) Requested EU Contribution / € BENEFICIARY & THIRD PARTIES ?
1	Eurecat	ES	462250	60500	0	0	0	130687,50	0	653437,50	100	653437,50	0	0	653437,50	653437,50	653437,50
2	Fondazione Links - Leading Innovation & Knowledge For Society	IT	275400	41300	0	0	0	79175,00	0	395875,00	100	395875,00	0	0	395875,00	395875,00	395875,00
3	Eleaf Bv	NL	458144	27000	0	0	0	121286,00	0	606430,00	70	424501,00	0	0	606430,00	424501,00	424501,00
4	Bsc	ES	297000	20500	0	0	0	79375,00	0	396875,00	100	396875,00	0	0	396875,00	396875,00	396875,00
5	Pwc, Ag, Lda.	PT	88000	11250	0	0	0	24812,50	0	124062,50	70	86843,75	0	0	124062,50	86843,75	86843,75
6	Unina	IT	202350	11250	0	0	0	53400,00	0	267000,00	100	267000,00	0	0	267000,00	267000,00	267000,00
7	Mastroberardino Spa	IT	137500	31250	0	0	0	42187,50	0	210937,50	70	147656,25	0	0	210937,50	147656,25	147656,25
8	Mtsa	ES	114552	31250	0	0	0	36450,50	0	182252,50	70	127576,75	0	0	182252,50	127576,75	127576,75

9	Symington Family Estates, Vinhos,sa	PT	119700	31250	0	0	0	37737,50	0	188687,50	70	132081,25	0	0	188687,50	132081,25	132081,25
	Total		2154896	265550	0	0	0	605111,50	0	3025557,50		2631846,50	0,00	0,00	3025557,50	2631846,50	2631846,50

4 - Ethics

1. HUMAN EMBRYOS/FOETUSES		Page
Does your research involve Human Embryonic Stem Cells (hESCs)?	○ Yes ◉ No	
Does your research involve the use of human embryos?	○ Yes ◉ No	
Does your research involve the use of human foetal tissues / cells?	○ Yes ◉ No	
2. HUMANS		**Page**
Does your research involve human participants?	○ Yes ◉ No	
Does your research involve physical interventions on the study participants?	○ Yes ◉ No	
3. HUMAN CELLS / TISSUES		**Page**
Does your research involve human cells or tissues (other than from Human Embryos/ Foetuses, i.e. section 1)?	○ Yes ◉ No	
4. PERSONAL DATA		**Page**
Does your research involve personal data collection and/or processing?	○ Yes ◉ No	
Does your research involve further processing of previously collected personal data (secondary use)?	○ Yes ◉ No	
5. ANIMALS		**Page**
Does your research involve animals?	○ Yes ◉ No	
6. THIRD COUNTRIES		**Page**
In case non-EU countries are involved, do the research related activities undertaken in these countries raise potential ethics issues?	○ Yes ◉ No	
Do you plan to use local resources (e.g. animal and/or human tissue samples, genetic material, live animals, human remains, materials of historical value, endangered fauna or flora samples, etc.)?	○ Yes ◉ No	
Do you plan to import any material - including personal data - from non-EU countries into the EU?	○ Yes ◉ No	
Do you plan to export any material - including personal data - from the EU to non-EU countries?	○ Yes ◉ No	
In case your research involves low and/or lower middle income countries, are any benefits-sharing actions planned?	○ Yes ◉ No	
Could the situation in the country put the individuals taking part in the research at risk?	○ Yes ◉ No	

7. ENVIRONMENT & HEALTH and SAFETY		Page
Does your research involve the use of elements that may cause harm to the environment, to animals or plants?	◯ Yes ◉ No	
Does your research deal with endangered fauna and/or flora and/or protected areas?	◯ Yes ◉ No	
Does your research involve the use of elements that may cause harm to humans, including research staff?	◯ Yes ◉ No	
8. DUAL USE		**Page**
Does your research involve dual-use items in the sense of Regulation 428/2009, or other items for which an authorisation is required?	◯ Yes ◉ No	
9. EXCLUSIVE FOCUS ON CIVIL APPLICATIONS		**Page**
Could your research raise concerns regarding the exclusive focus on civil applications?	◯ Yes ◉ No	
10. MISUSE		**Page**
Does your research have the potential for misuse of research results?	◯ Yes ◉ No	
11. OTHER ETHICS ISSUES		**Page**
Are there any other ethics issues that should be taken into consideration? Please specify	◯ Yes ◉ No	

I confirm that I have taken into account all ethics issues described above and that, if any ethics issues apply, I will complete the ethics self-assessment and attach the required documents. ☒

How to Complete your Ethics Self-Assessment

5 - Call specific questions

Declarations on stage-2 changes

The full stage-2 proposal must be consistent with the short outline proposal submitted to the stage-1- in particular with respect to the proposal characteristics addressing the concepts of excellence and impact.

Are there substantial differences compared to the stage-1 proposal?	○ Yes	◉ No

Extended Open Research Data Pilot in Horizon 2020

If selected, applicants will by default participate in the Pilot on Open Research Data in Horizon 2020[1] , which aims to improve and maximise access to and re-use of research data generated by actions.

However, participation in the Pilot is flexible in the sense that it does not mean that all research data needs to be open. After the action has started, participants will formulate a Data Management Plan (DMP), which should address the relevant aspects of making data FAIR – findable, accessible, interoperable and re-usable, including what data the project will generate, whether and how it will be made accessible for verification and re-use, and how it will be curated and preserved. Through this DMP projects can define certain datasets to remain closed according to the principle "as open as possible, as closed as necessary". A Data Management Plan does not have to be submitted at the proposal stage.

Furthermore, applicants also have the possibility to opt out of this Pilot completely at any stage (before or after the grant signature). In this case, applicants must indicate a reason for this choice (see options below).

Please note that participation in this Pilot does not constitute part of the evaluation process. Proposals will not be penalised for opting out.

We wish to opt out of the Pilot on Open Research Data in Horizon 2020.	○ Yes	◉ No

Further guidance on open access and research data management is available on the participant portal: http://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-dissemination_en.htm and in general annex L of the Work Programme.

[1] *According to article 43.2 of Regulation (EU) No 1290/2013 of the European Parliament and of the Council, of 11 December 2013, laying down the rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)" and repealing Regulation (EC) No 1906/2006.*

Innovation action
Horizon 2020
Call: H2020-SC5-16-2019
Topic: Development of commercial activities and services through the use of GEOSS and Copernicus data
Type of action: IA
Proposal number: SEP-210597733
Proposal acronym: VITIGEOSS

Vineyard Innovative Tool based on the InteGration of Earth Observation Services and in-field Sensors

List of participants

Participant No	Participant organisation name	Short Name	Country
1 (Coordinator)	FUNDACIO EURECAT	EUT	Spain
2	FONDAZIONE LINKS	LINKS	Italy
3	eLEAF BV	ELEAF	Netherlands
4	BARCELONA SUPERCOMPUTING CENTER-CENTRO NACIONAL DE SUPERCOMPUTACIÓN	BSC	Spain
5	PRICEWATERHOUSECOOPERS	PWC	Portugal
6	UNIVERSITA DEGLI STUDI DI NAPOLI FEDERICO II	NAP	Italy
7	AZIENDA VINICOLA MICHELE MASTROBERARDINO SPA	MBD	Italy
8	MIGUEL TORRES SA	TOR	Spain
9	SYMINGTON FAMILY ESTATES, VINHOS,SA	SYM	Portugal

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1. Excellence

Sustainable agriculture aims at maximizing the net benefit for people by developing new farming practices **to meet current and future societal needs for food, ecosystem services and human health without compromising** the ability of **future generations** to meet their own needs.

The wine sector invests heavily in state-of-the-art technology due to their intrinsic quality requirements and maintenance of production under sustainable labels (e.g. organic). **Innovative solutions applied to this particular sector can be extended to other crops to respond to future challenges of the worldwide food industry**[1], which requires to **intensify the production within agro-food systems in a sustainable way**[2], mitigating the effects of climate change, reducing negative environmental externalities and promoting local **economic growth**.[3] **The European Union is the world's biggest wine producer** (60% of the world wine production) and winemaking is the main economic activity of many regions in the South of Europe[4]. Some studies have forecasted a decrease between 25% - 73% of major wine producing regions by 2050 due to the shifting patterns of agricultural production in response to climate change[5]. If the latter fulfils, **the direct effect on these regions will be catastrophic, from economic, social and cultural points of view** (massive losses of jobs and centuries-accumulated knowledge on regional viticulture, etc.).

The maturity of open Earth Observation (EO) initiatives like GEOSS and Copernicus (free of charge, high-frequency and detailed information about the land surface), **allows for the deployment of specific added value products for the agriculture sector**, even at local level. The integration of Earth Observation data with other in-field data sources (weather stations, machinery sensors, cameras and drones) and the subsequent data assimilation through specific models provides a priceless opportunity to obtain **operational customised information on crop status in the form of agro-monitoring systems, aimed at delivering yield forecasting, early warnings and robust information for decision makers on different aspects such as irrigation, use of fertilizers & pesticides, early detection of diseases, timings of field operations, business management, etc**. The development of these applications represents a **major technological challenge**, as they require gathering and integrating a huge amount of heterogeneous information and incorporating interoperability best practices.

VITIGEOSS will integrate and improve existing solutions - VISCA & FruitLook - coupling **satellite imagery with in-field sensors** to **increase resolution and reliability of satellite information** applied to **all aspects of viticulture and specific wine-business operations.** Our solution will **empower the usage of European open EO services** by the improvement of agriculture business operations at economic, environmental and social[6] level, and will ensure an **effective engagement with EuroGEOSS** by direct participation within its Action groups. **The presence of 3 end-users in the consortium will facilitate a successful penetration in the market through eLEAF, who will act as commercialization partner.**

1.1 Objectives

The main scope of the project is to **empower the potential of European EO initiatives by deploying an innovative commercial information solution to optimize sustainable grapevine cultivation via decision support systems (DSS) on phenology, irrigation, fertilizer, disease and business & sustainability management**. Satellites imagery will be combined with in-field measurements, models and best practices to build up an integrated but modular management tool covering the most critical operations of the business, **including sustainability aspects to align the outcomes with UN SDG´s**[7]**,** which will directly welfare population living in rural communities around wine producers locations. The realization of the aforementioned system is linked to the following specific objectives:

[1] https://www.researchgate.net/publication/232862903_Climate_Change_Viticulture_and_Wine_Challenges_and_Opportunities
[2] http://www.fao.org/fileadmin/templates/wsfs/docs/Issues_papers/HLEF2050_Global_Agriculture.pdf
[3] A. Sarkar. Sustainable Solutions for Food Security (2019). Springer. ISBN: 3319778781, 9783319778785
[4] http://ec.europa.eu/agriculture/wine/statistics/market-situation-2014-07_en.pdf
[5] http://www.pnas.org/content/110/17/6907.full.pdf
[6] By education of rural communities on sustainability based on lessons learnt
[7] https://www.un.org/sustainabledevelopment/sustainable-development-goals/

O1. To deploy a **weather/climate forecast intelligent service** exploring the frontiers of sub-seasonal climate predictions and their synthesis with weather forecast and seasonal climate predictions **to provide robust forecast for decision making processes in the wine sector.** (WP2) (M20)	
Result & Impact	As the best of our knowledge, it is the first time that services for sub-seasonal predictions and their synthesis with weather forecast and seasonal forecasts taking into account wine sectors needs are offered. This will be achieved by co-developing methodologies to maximize the use of the forecasts systems for the wine sector to design a real-time tailored forecast system. It will result in the detection of windows of opportunity for the different time scales.
Metrics & KPIs	Number of systems to analyse, verify and coordinate: 3 (minimum) - Short-term weather forecast (MONARCH) - Sub-seasonal forecasts (ECMWF monthly prediction system) - Seasonal predictions (ECMWF System 5). The quality of the forecasts and the applied post-processing will be evaluated against current methodologies (use of climatology) considering at least 2 metrics: CFRPSS (continuous ranked probability skill score) and FRPSS (Fair Ranked Probability Skill Score). It will result in the detection of windows of opportunity at different time scales, periods in which the previous mentioned skill cores are higher than 0.
Relation to the call	The new service will integrate the seasonal forecasts available in the Copernicus Climate Data Store (Copernicus Climate Change Service) with the National Centres for Environmental Prediction (NCEP) sub-seasonal forecast and state of the art short-term weather forecasts systems to better inform decision making process.
O2. To deploy a disease management service capable of **launching warning alerts on the appearance of most important diseases based on the symptoms and characteristics of each geographical area (and their climate conditions)** and creating contingency plans according to user's available tools. (WP2) (M20)	
Result & Impact	To improve current disease warning systems based on meteorological and climate data by creating new machine and deep learning models, including EO data, capable to make predictions in wider terms, trying to deal with different disease types and behaviours, field variability and benefitting from improved weather forecasts. These services will improve application and dosage of plant protection products benefitting end users expenditures and also the environment applying only the required precise treatments.
Metrics & KPIs	When data available: • % Reduction of resources used • % Reduction of appearance/impact of diseases Confidence in forecasts > 75%
Relation to the call	The new services will be using direct EO data or processed by other project services and will be demonstrated in relevant environments enabling its future commercialization by the project partners.
O3. Build a **set of Copernicus and GEOSS downstream services integrating satellite with in-situ data to optimize the crop management using the highest quality data**. Recent advancements on Artificial Neural Networks (a.k.a deep learning) and the availability of both EO and in-field imagery will be used to combine novel algorithms aimed to estimate key crop management indicators (leaf water potential, leaf area index, grapevine phenology stages) (WP2) (M20)	
Result & Impact	The usage of satellite Earth Observation high resolution imagery and weather data, combined with data extracted from in-situ sensors such as installed cameras and local

	weather stations, will feed and train advanced Intelligent Services based on Deep Learning techniques for automated monitoring of the vineyard status. Usage of such techniques will allow those services to generalize and be able to work also outside of the test sites. These services will help improving both vineyard management effectiveness and saving resources such as irrigation water, labour, fuel and treatments, with the ultimate goal of achieving better crops quality and lower costs.
Metrics & KPIs	≥ 4 Number of phenological phases monitored between bud break, flowering, fruit set, veraison (red variety), maturity (red variety) and leaf fall. ≥ 5 key crop management indicators (like leaf water potential, leaf area index, grapevine phenology stages) ≥ 2 Copernicus or GEOSS data products used in the establishment of VITIGEOSS data services, including, for example, Sentinel-2 Level 1C and EUTMETSAT MSG-CPP data
Relation to the call	The new services will consume Copernicus and GEOSS products and potentially could be commercialized within the whole platform or as a separate service by the consortium partners
O4. Establish an **integrated, modular management solution for vineyard cultivation in 3 demo-sites** of Portugal, Italy and Spain using Earth Observation Systems and field monitoring tools (WP3) (M19)	
Result & Impact	The one-stop-shop VITIGEOSS will provide end-users the opportunity to attain state-of-art applications for optimization of vineyard management under a single point of entry. The portal is based on requirements from both end-users and service providers. This ensures ease of use, relevancy and value on the side of the end-user and the data service providers. A successful demonstration in Portugal, Italy and Spain proves the operational usability of the portal and applications developed under VITIGEOSS, allowing for commercial roll-out after the finalization of the project.
Metrics & KPIs	≥ 5 innovative vineyard management applications available via one portal to the end-user at the end of the project ≥ End-users in project rate VITIGEOSS application portal at least 7 out of 10 End-users log on to the VITIGEOSS application portal ≥ 3 times per month ≥ 95% uptime of the VITIGEOSS application portal during the demonstration phase of the project
Relation to the call	The VITIGEOSS application portal will make innovative services consuming Copernicus and GEOSS data products available to end-users, enabling ground level application and commercial value creation/roll-out. Specifically, VITIGEOSS enables engagement of actors in the European commercial sector, **opening opportunities for cross-domain exploitation of EO data for vineyard management purposes and connecting these to the market**.
O5. Validation of **sustainable wine production indicators** (relative yield %, CFP[8], GHGI[9], erosion hazard, benefit–cost ratio, availability of farm labour, etc.) via an integration of EO and field monitoring techniques **to empower decision makers in the wine sector with the necessary toolbox to make wine production in Europe environmentally and commercially sustainable** (WP4) (M42)	
Result & Impact	By monitoring and optimizing the use of resources in farms on experimental fields using IoT technology and other remote (drones and satellite) data sources, connecting to FMIS throw secure APIs and extrapolating the available data to those non-tech fields, winemakers can track the real environmental impact of their products and activities. This impact will be calculated by the sustainability manager of VITIGEOSS in WP2 and validated during WP4

[8] Product Carbon Footprint
[9] Greenhouse Gas Inventory

	through the VITIGEOSS platform by visualizing and analysing the main sustainability indicators. The VITIGEOSS platform establishes a peer to peer learning platform for sustainability. Businesses are empowered to improve sustainable practices, increasing their profitability while improving the sustainability of the industry as a whole.
Metrics & KPIs	Wine industry's key sustainability variables identified in the environmental, social and economic domain (relative yield %, CFP, GHGI, erosion hazard, benefit–cost ratio, availability of farm labour, etc.) Production partners access sustainability app on platform at least once per week. Demonstration to stakeholders and policy makers (min.15).
Relation to the call	Improving sustainable practices in the wine industry is essential for survival of the European wine sector. VITIGEOSS supports a sustainable wine sector by collecting real time data for sustainability advisory services. These services are delivered via a single platform to players throughout the wine production chain. This provides transparency in sustainable production practices and allows for peer to peer knowledge exchange in the value chain.
O6. Develop a **successful market entry strategy**, based on market analysis and stakeholder consultation (WP5) (M42)	
Result & Impact	The value proposition, business case, potential market entries and overall business strategies are clarified. This ensures project achievements can be commercialized after the end of the project. As a result VITIGEOSS becomes the standard entry point for viticulture applications in the European wine sector connecting end users to data suppliers and service providers
Metrics & KPIs	• Comprehensive market analysis and competitive assessment of European wine sector • Comprehensive value proposition and development of business case • Wide-ranging market entry plan and commercialization strategy
Relation to the call	The clarification of the business case for VITIGEOSS enables the establishment of new commercial products and services in the European wine sector. It thereby contributes to the commercialization of GEOSS and Copernicus based data services.
O7. **Build capacity among technology developers and commercialization partners** to ensure the **usability of project results**. This will be implemented through the organisation of **2 workshops**[10] comprised of seminars and training courses **on data analysis, satellite data acquisition & probabilistic climate forecast for appropriate decision making** among technology developers and commercialization partners, supported with the presence of **relevant stakeholders of wine, agricultural sector and EuroGEOSS participants** (WP6) (M42)	
Result & Impact	Allow users to apply the results of the project in an efficient way, ensuring the uptake of the developed platform by relevant stakeholders and therefore guaranteeing its sustainability in the long term.
Metrics & KPIs	> 40 attendants to each participatory workshops organised (2) > 25 attendants to each technical webinar > 30 attendants to every local session (3, in end users premises)
Relation to the call	The project will build capacity among current and potential developers of commercial products, which can contribute to the development of a market for the provided services

[10] Co-located in existing sectorial events like fairs or conferences to take advantage of the participating audiences

1.2 Relation to the work programme

TOPIC: SC5-16-2019. Development of commercial activities and services through the use of GEOSS and Copernicus data b)
Actions should deliver solutions addressing citizens' needs and contributing to the development of new markets of products and services through integrating EO data and information, e.g. from GEOSS and Copernicus, with other data sources
Coupling EO data from Copernicus with in-field measurements provides **a high quality and timely basis source of data for the optimization of winery operations by having a reliable time window to make decisions related to fertilisation, disease control, sustainability and business operations. This has a significant** positive impact on local growers (e.g. timely and guaranteed delivery of grapes due to an improved yield management (predictability of yields, disease early warning) will support rural communities close to wine producers). Sustainable practices will be **empowered with sustainability indicators** (see section 1.3.2) that will act **as a source of information to maintain and increase sustainability practices in the sector.** Other actors in the business (insurance companies, traders, large cooperatives and policy makers) are direct beneficiaries, since they can easily monitor agro-tendencies and strategies through the analysis of the information provided. **Public authorities can promote the use of VITIGEOSS to support small farmers, enabling digital innovation in the sector,** which presumably will lead to social development of rural communities. By innovating on easy to use tools based one image processing and deep learning applied to such a high-value added sector like wine, **VITIGEOSS will encourage the use of Copernicus and GEOSS data sources among agricultural sectors, by making companies aware of the benefits that these services could bring into their businesses.**
These products and services should incorporate assimilation techniques and interoperability best practices, automation, systemization and integrated web-based services, and be brought – at least – into pre-operational service provision, going beyond the demonstration phase
With a **track record of completed projects and running services in the wine production** sector in several countries, **the consortium brings the necessary knowledge to build a robust service for wine producers**. Several challenges facing the wine production sector in Europe are identified in cooperation with the end users represented in the consortium. The proposed services confront these challenges by integrating the latest technological developments within the Earth Observation, machine learning and related segments. **These improvements are presented as intelligent services which can be linked into commercial wine dashboard of the partner ELEAF**; this forms an integrated solution to achieve sustainable and resource efficient vineyard cultivation. **By including Symington[11], Mastroberardino[12] and Miguel Torres[13]** as partners in our consortium, we ensure that the established solutions fit the need of the sector and will be carried on after the project closes (the product has been co-design with them, following their priorities). The services developed under this project will be **linked via interoperable APIs to a central platform**. **Automation of data production** using established technologies means t**he products produced are scalable and cost-efficient**. **Data is assimilated from various platforms, including Earth Observation, weather observations and predictions, in-field cameras and any other monitoring devices available to the farmer.** These data products form the basis for various automated advisory services which are developed through machine learning, to establish a service that is scalable and operationally available to the farmers.
Activities are expected to focus on Technology Readiness Levels (TRLs) 5 to 7 and to be developed in close coordination with EuroGEOSS.

[11] https://www.symington.com/
[12] https://www.mastroberardino.com/
[13] https://www.torres.es/es/inicio

VITIGEOS can contribute to EuroGEOSS by demonstrating the effective use of European EO resources (space, airborne, in-situ measurements and citizen observations) in an operational environmental (forecasting) application **for the wine industry**. The application is at the pre-operational readiness level 6 to 7 and as such can reinforce other EuroGEOSS initiatives.

VITIGEOSS already has strong connection with for example GEOGLAM[14] (GEO Group on Earth Observations**) and G4AW** (Geodata for Agriculture and Water facility), where the partner eLEAF participates in a number of projects under the theme *Earth Observation for Food Security*. **VITIGEOS will explore the readiness level with different EuroGEOSS Action Groups** to ensure that it meets the EuroGEOSS requirements. **Connection with these action groups will be ensured with the presence of relevant members in the Advisory Board.**

CALL: Greening the economy in line with the Sustainable Development Goals (SDGs)

The services developed under this project aim at **the efficient use of the resources by the appropriate crop management actions at the right time on the right place,** so the vine can be managed more effectively during its growth and production of grapes. Consequently, our system will arouse **a decrease of the environmental impact (less use of fossil fuels, nitrogen and chemicals), empowering the sustainability within the wine companies**. This will be empowered with **3 local sessions** at end user's premises addressed to local farmers and rural communities, **to explain sustainable practices based on VITIGEOSS results and outcomes** (task 6.3.2)
The efficient use of resources by appropriate crop management actions will lead inevitably to a decrease of wastes, as well as reduction of CO_2 emissions due to optimization of tasks done in the field. If these practices were to be extrapolated to all sectors of agriculture, this would turn out in a **noticeable improvement of the worldwide welfare in terms of mitigation of climate change effects and development of more efficient agro-food systems**.

Thanks to the precise application of the recommendations generated by the VITIGEOSS services, the **optimization of resources used in the vineyards will enable to make the most of each available resource avoiding its misuse or overdosing**. The continuous monitoring of the vineyards by field sensors and Earth observations will also allow the **permanent control of the vineyard status, enabling the immediate decision making based on accurate data, refine predictive algorithms and forecasts in order to adapt the wineries strategies for optimal management**.

VITIGEOSS directly aligns with SDG3 "promote health practices", SDG6 "avoid wasting water, sustainable management of water", SDG8 "sustainable economic growth", SDG12 "sustainable production patterns", SDG13 "combat climate change and its impacts" and SDG15 "sustainable use of terrestrial ecosystems, reverse land degradation and halt biodiversity loss", by providing the means for winemakers to:

- Prepare and manage periods of extreme events (such as droughts and wet conditions) by having access to reliable meteorological information combined with actual crop status measurements providing actionable advice as to when to irrigate and what are the optimum harvesting dates; (SDG6 & SDG12)
- Predict phenological stages and scheduling critical vineyard management practices, improving the resources management, reducing greenhouse gases and the amounts of chemicals and nitrogen used in the fields; (SDG3, SDG6, SDG12, SDG13, SDG15)
- Identify and prevent diseases in plants, through continuously monitoring of pest presence and pest enabling environmental conditions permitting pest management with reduced amounts of pesticides due to early warning and point source application; (SDG3, SDG6, SDG12)
- Having reliable meteorological information combined with crop status measurements will support wineries to manage resources better, creating a stable local economy. Collection of relevant KPI's about the wine production process and communicating them to end consumers if desired and improve consumer acceptation (SDG8)
- Maintain, start or optimise sustainable winegrowing by understanding the climatologic, agronomic and policy frameworks affecting the winegrowers' businesses; (SDG13)

[14] https://cropmonitor.org/

1.3 Concept and approach

1.3.1. Concept description

Being agriculture fully dependent on weather conditions, **high reliable meteorological/climate information coupled with crop status measurements will be critical for the wineries** to be prepared for extreme scenarios. The immediate consequence that upward-move in seasonal temperature had on the wine sector has been the shift of the normal pattern of grapevine development toward an earlier onset of budbreak, flowering, veraison, and harvest. These shifts in the main vine phenological stages may have significant impact on (a) vine vulnerability to biotic and abiotic stresses and (b) on vineyard performances in terms of both fruit yield and berry composition at harvest. Earlier bud breaks and blooms expose vine vegetative and reproductive organs to higher risks of damages due to spring frosts and pathogens attacks, because these periods of the year are often characterized by a higher frequency of air temperature drops below the damage thresholds for vine organs and higher rainfall compared to later months. This often results in dramatic yield losses in both the current and the following vegetative season. Moreover, an earlier onset of veraison also represents a major concern for viticulturists growing specific cultivars in some important wine grape areas, mainly because an anticipated veraison results in a shift of berry ripening toward periods that are most probably characterized by relatively higher air temperatures. This can significantly affect fruit ripening kinetics and, therefore, berry, must and wine composition (increases in sugar accumulation rates in the berry, higher wine alcohol concentration, lower acidity, changes in wine sensory attributes).

Providing viticulturists simultaneously with weather and vine phenology-stage forecasts may represent a critical information to support their decisions about the necessity of adopting specific vineyard management strategies to delay bud break and early vegetative growth (such as delayed winter pruning) or to delay berry ripening (crop forcing, post-veraison defoliation, etc.)[15]. In addition, with grapes accumulating high levels of sugar much sooner than they used to, **winemakers must have accurate information to decide on the optimum harvesting dates**.[16] There are other climate-driven impacts that are affecting the vineyards to a large extent, such as the increase in diseases. **Many regions that were out of climate range of certain pests are now suffering from infestation and contagion** (Downy mildew, Powdery mildew, etc.)[17]. Therefore, **another urgent need is the early identification of diseases in the plant, besides a continuous and thorough pest management**.

Agriculture also plays an important role in climate change effects itself (Agriculture is responsible for more than 20% of CO_2 emissions, which makes the agricultural sector the world's second-largest emitter, after the energy sector)[18]. Better prediction of the main grapevine phenological stages (beginning of shoot growth, blooming, fruit set, veraison, berries harvest-ripe, etc.) and scheduling of critical vineyard management practices (like summer and dormant pruning, pest management, fertilization, harvesting, etc.) help to improve the wineries resource and tasks planning, **reducing emissions of greenhouse gases** by optimization of operations that involve the use of fossil fuels and **reducing the amounts of chemicals and nitrogen used on fields.**

The richness of remote sensing data is of great help to obtain up-to-date information on farmland and agricultural processes. When coupled with in-field measurements from specific tools available to farmers through advanced deep learning algorithms **this information is used to improve precision of remote sensing data, enabling precise assessments for effective agricultural management steps**. In addition, in order to have a global crop monitoring system, **an effort is required to gather and integrate huge amounts of information derived from remote sensing, weather, in-field measurements, modelling, economical and management data**. The use of Big Data technologies and service oriented architectures through interoperable APIs allows to build independent and specialized services capable to parallelize data processing and storage, and to create modular and heterogeneous systems. These can be effectively exploited in commercial products and services, making VITIGEOSS data services accessible to third party

[15] Palliotti A., Tombesi S., Silvestroni O., Lanari V., Gatti M., Poni S., 2014. Changes in vineyard establishment and canopy management urged by earlier climate-related grape ripening: a review. Scientia Horticulturae, 178:43-54.
[16] https://www.theguardian.com/food/2018/sep/16/climate-change-wine-industry-bordeaux-california
[17] M. R. Mozell and L. Thach. The impact of climate change on the global wine industry: Challenges & solutions. Wine Economics and Policy 3, 81-89 (2014).
[18] https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data

data processing systems or to usable graphical interfaces and dashboards for decision support that can be directly delivered in the hands of end-users. The visualization systems or dashboards using the information generated from these data services should follow usability standards and responsive designs in order to delivered the information to end users in an understandable and user-friendly way.

To winegrowers, VITIGEOSS offers the opportunity to make the most of open resources like Copernicus and GEOSS data services to improve the efficiency and profitability of vineyards thanks to **accurate mapping of each plot, novel production KPI's, image and times series processing, accurate (weather, phenology, crop status and disease) forecasts, algorithms and modelling, altogether combined with viticulture their know-how** that makes possible to extract useful indicators for a better management of vineyards and the optimisation of agricultural practices.

1.3.2. Overall approach

VITIGEOSS will build an operational and distributed ecosystem where a set of advanced models (smart services) **will deliver essential forecasts, estimations as well as recommendations to wine makers** in order to optimize the vineyard management processes. **VITIGEOSS will use free-of charge satellite imagery and EO products from the European Copernicus Programme** (e.g. Sentinel-1/2A data, SPOT/VEGETATION - PROBA-V (GEOV1) LAI) and NASA (e.g. MODIS and OLI data), **coupling them with in-field and near in-field data sources aggregated in a unique repository to give rise to 5 smart services:**

1. Weather/Climate forecast:

While many sectors have routinely been using weather forecasts of up to 15 days, beyond this time horizon, climatological data (typically between 5-30-year average) are used. However, assuming that future conditions will be similar to average past conditions has several inherent shortcomings. VITIGEOSS aims to address these shortcomings by demonstrating the potential application of sub-seasonal (up to 1 month) to seasonal forecasts (above a month) in combination with short term forecasts (up to 10 days). These forecasts will enable farmers to prepare in advance before unusual climate conditions, and manage periods of extreme events (such as droughts and wet conditions) by having access to reliable meteorological information combined with actual crop status measurements, which will provide actionable advice as to when to irrigate and what are the optimum harvesting dates. In addition, those improved forecasts will be used by other intelligent services like the disease warning system to prevent about possible treatments to apply. The methods to implement short term weather forecast, sub-seasonal and seasonal climate predictions will be developed to provide skilful predictions and deliver weather and climate forecast that will be integrated in the final VITIGEOSS Solution.

Assessment and maximization of the performance of sub-seasonal and seasonal forecast systems and their synthesis with weather forecast (MONARCH[19]) as well as climate predictions from COPERNICUS Climate Data Store (CDS) and the North American Multi-Model Ensemble will be post-processed and evaluated against observations for operational implementation.

2. **Phenological estimation:**

NAP will use a phenological model to provide predictions, that will be validated through automated monitoring achieved using satellites, fixed cameras and drones. This will allow to detect and assess the phenological phases and give a feedback to the phenological model, avoiding drifts and improving the accuracy of subsequent predictions. In this way, we will create an automated system that can predict and monitor the whole phenological annual cycle through the synergic use of phenological models, satellite and in-field (cameras and drones) observations. The prediction and monitoring of phenological stages will provide viticulturists with important strategic information that will help them in better plan and organize the whole vineyard management.

In-fields fixed-position cameras will be installed by LINKS in the first six months of the project, which will be calibrated and connected in order to provide near-plant imagery data with a programmable

[19] Pérez, C., Haustein, K., Janjic, Z., Jorba, O., Huneeus, N., Baldasano, J. M., Black, T., Basart, S., Nickovic, S., Miller, R. L., Perlwitz, J. P., Schulz, M., and Thomson, M.: Atmospheric dust modeling from meso to global scales with the online NMMB/BSC-Dust model – Part 1: Model description, annual simulations and evaluation, Atmos. Chem. Phys., 11, 13001-13027, https://doi.org/10.5194/acp-11-13001-2011, 2011.

periodicity. The cameras will be also equipped with additional sensors, such infra-red or thermal sensors, to extend the range of the collected data outside the visible spectrum. The analysis of the data coming from the cameras, combined with those retrieved from GEOSS services (e.g. Copernicus Sentinel), will be the input for train and operate novel intelligent services based on advanced machine learning techniques (Deep Learning) with the target of automate the monitoring process of the vineyard phenological phases (beginning of shoot growth, veraison, harvest, and the end of the vegetative season) and other key crop indicators. The list of the parameters to be monitored will be drawn up in collaboration with the end-users, which will possibly provide also historical data. The historical data, together with GEOSS historical dataset of vegetative growth where available, could also help improve the predictive effectiveness of the proposed algorithms. The algorithms will be released following an iterative, agile-like, release cycle, across the two seasons, in order to allow to test and fine-tune the algorithms themselves with the actual achieved phases and indicators (monitored by the end-users), that will work as ground truth. In addition to the aforementioned process that involves fixed-position cameras, further data augmentation with imagery acquired by deploying drones on selected fields will be considered, in the attempt to obtain a more precise and generalized solution.

3. Crop status:

Vegetation health status, crop productivity, crop water use and crop nitrogen content will be monitored by ELEAF via satellite imagery. The crop status products are produced on a weekly timestep for all fields of the 3 end-users. The model used to calculate these parameters is named ETLook[20]. The ETLook model is a peer reviewed two-layer energy balance model that computes evaporation from soil and water surfaces (E) and transpiration (T) from canopies using transport resistances in conjunction with the Penman-Monteith equation. The algorithms can run independent from user inputs; if data from field level is available this can be used to calibrate the models to attain higher quality of output data. The base information used comes largely from GEOSS services: the bio-physical parameters needed are retrieved from Copernicus Sentinel satellite data, while the meteorological data is gained from EUMETSAT, GEOS-5 or/and retrieved from meteorological stations on the farm.

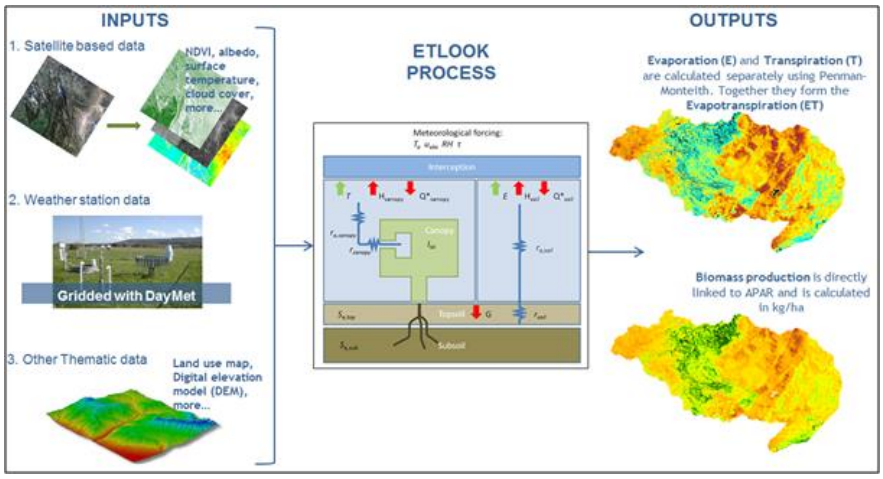


Figure 1. Example of ETLOOK Process for the monitoring of Crop Status

The crop water consumption data is used in combination with weather forecasts to calculate future crop water demand one week ahead. This information can help end-users plan irrigation optimally. Both crop status and crop water demand data is made available in the VITIGEOSS portal to the end-user, using the FruitLook interface of eLEAF. The data products are additionally used for in-field zonal delineation to identify management zones using segmentation techniques. These zones can inform decision making on irrigation, sampling and/or selective harvesting leading to better grape (and thus wine) quality. A statistical analysis is performed on the degree of variation in a production block to detect possible issues; by looking into the coefficient of variation it can be determined whether a block is stable in terms of growth variation, often induced by soil conditions, or whether sudden changes take place which can be flagged. In combination with phenological forecast and weather information, the crop production data is used to develop tools to forecast timing and amount of yield. Using historical and contemporary yield information

[20] Bastiaanssen *et al*., 2012: https://doi.org/10.1029/2011WR010482

the relationship between aforementioned data products and actual yield is examined using statistical and machine learning methods. These tools and services will be developed in communication with and made available to the end-user as the demonstration phase proceeds.

4. Disease management:

The lifecycle and potential focus of downy mildew and powdery mildew diseases will be forecasted by machine learning models developed by Eurecat. Those two diseases are the most important seasonal diseases according to end users in the Mediterranean area, provoking significant losses on yield every year if the right treatments are not applied. In order to avoid it, farmers tend to follow preventive strategies over-treating the vineyards at early phenological stages to fight the possible appearance of these diseases. These strategies can be avoided or rescheduled in many cases with an appropriate forecasting of the disease evolution taking into account the meteorological conditions of the year and the crop status. One of the models developed will take profit also of weather forecasts as well as data from weather stations in the fields, to fire alarms to farmers when situations with high probability of disease appearance happens to prepare the needed resources (machinery, drivers, phytosanitary products, …). The other one, will schedule the best range of dates and recipe (the dose to apply the spraying treatments on each field) optimizing the number of treatments and the resources used and assuring its effectivity when spraying, avoiding irreversible situations. This second model will use more precise outputs from the early warning model, the crop status maps like vegetation health and zonal delineation and also the weather forecasts to avoid rains after spraying that could wash the vines weakening the treatment effects. Both models will be trained to deal with powdery mildew and downy mildew diseases considering the different environmental conditions and possible different variants of the diseases of each pilot plot considering historical data provided by end users. The models will be based on current methods available in the literature improved with forecasting data and farmer's knowledge.

Finally, another functionality will be the comparison between the dosing maps or recipes from the second model, allowing different doses between fields and even in the same field, with respect the real application with the objective to know the effectivity of the recipes and treatments. This real application will be obtained thanks to the data-logging system installed in spraying machinery that will help farmers to apply the recipes, to check how it is applied an also to assure the sustainability level of their products. The results of this functionality will be used in the business/sustainability service as well, to calculate resources optimization.

5. Business & Sustainability:

Two new services will empower the improvement of business and sustainability indicators by end users. The overall output data from all services mentioned above, together with data from end users management tools and in-field data from machinery records will be used create those services. The first one will be based on a resource optimizer and planner service capable to (i) plan best timing for field operations e.g. summer pruning, harvesting, etc., (ii) calculate personnel resources needed (critical for the harvesting period), (iii) guarantee a better planning of resources (e.g. grapes from nearby local growers) and (iv) reduce usage of raw materials (pesticides, fertilizers, water, fossil fuels). The optimizer is based in a model for winemaking management scenarios and tuned for each end user according to their strategy and consequently optimization objectives. Several optimization solvers will be tested to find the best solving approach and parametrization according to constrains defined. In addition a new module based in crop status outputs will be built to (ii) improve predictability of production and (vi) automate "zonal delineation" for selective harvesting[21] and specific management to predict ideal production zones for different wine cultivars (based on slope, heat units, cold units, solar radiation, type of soils, etc).

All previous indicators will fit the second service, a sustainability manager that allows the evaluation of production standards based on the analysis of sustainability indicators on (i) Productivity (fruit and water yield %), (ii) Environment (PCF, GHGI)22, (iii) Protection (percentile 10 and 90 of wind and precipitation to predict erosion & flooding hazards) and (iv) Economic viability (benefit–cost ratio, availability of farm labour). This new sustainability manager will be based, not only on data from management tools of end users but also on in-field data from sensors and machinery and satellite data from GEOSS services.

[21] different wine styles according to the quality and characteristics offered by the different areas

[22] http://www.viticolturasostenibile.org/EN/AirIndicator.aspx

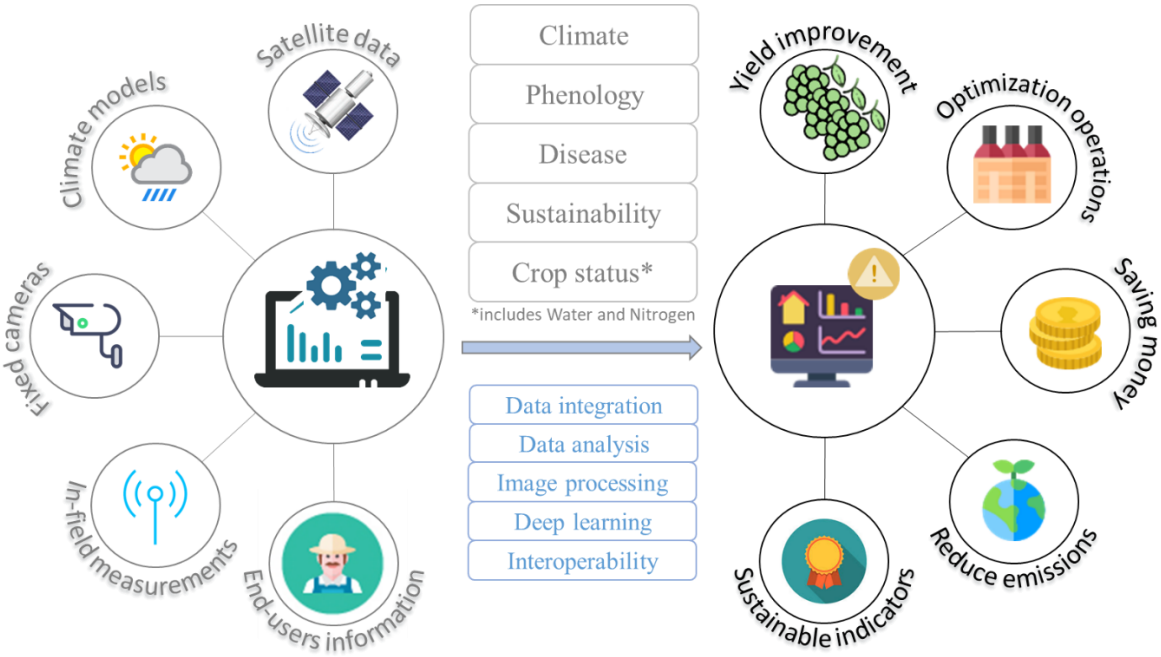


Figure 2. Input data used in the back-end (left), processed to feed the intelligent services (weather, phenology, crop status, disease, and business&sustainability), which will generate outcomes for the front-end (right).

*Data sets listed and briefly described included as an Annex in Section 4.

In order to improve their marketability, all VITIGEOSS intelligent services will be designed and implemented so as to be interoperable through web-based APIs and standards and to be deployable as stand-alone applications that will be integrated in WP3. Standard protocols, metadata, and data exchange formats will be used in order to make the **VITIGEOSS ecosystem fully interoperable with existing solutions** and allow its output data to be published in GEOSS/DIAS repositories, making them discoverable through such platforms. Specifically, the INSPIRE directive and OGC standards will be used for geospatial data, while W3C standards will be used for all web-based solutions. Also, ISO, ETSI and CEN/CENELEC standards will be followed for all processes and communication protocols. Our objective is the deployment of a platform that is able to create, manage and disseminate EO-derived data and services relevant for the wine industry.

VITIGEOSS will use Hyperledger technology to ensure transparent auditability, achieving trust through shared distributed ledgers. VITIGEOSS will use the enterprise Hyperledger Fabric that provides the proper tooling to be able to function in the context of data protection legislation, such as Europe's General Data Protection Regulation (GDPR). This because different levels of data privacy are used for data channels, private transactions and zero-knowledge proofs where the latter cryptographic tools for example allow the consortium to proof the validity of a customer's id to gain access to part of the system, without actually revealing the identity of the person.

The services of the project and lessons learnt will be used for building capacity amongst rural communities on sustainability that will benefit the local economies (by ensuring productivity at long term, thus safeguarding creation of jobs in the region). The latter approach can be used by policy makers to monitor and map general irrigation and crop cultivation activities in their management area, both historic and in near real-time, which can support decision making processes on future sustainability strategies.

1.3.2.1. Technology Readiness Level

The solutions will be based on and derived from already existing cutting-edge technologies provided by the project partners so at the end the project all main components will be ready and made available to the market, providing immediate uptake for the technical partners that build the consortium. VITIGEOSS will advance the technology to a minimum level of TRL7 (system prototype demonstration in operational environment), that will be validated during the demonstration pilots that will take place during 2 years.

Table 1. Technology Readiness Level of the technologies involved in VITIGEOSS

Technology description [owner]	Current TRL	Expected TRL	Projects tasks
Sub-seasonal and seasonal climate predictions [BSC]	4-5	7	2.2
Phenological stage prediction [LINKS]	4-5	**7**	2.3
Phenological stage monitoring [LINKS]	4-5	7	2.3
In-season production issues [ELEAF]	6	8	2.4
Crop monitoring [ELEAF]	8	9	2.4
Crop water demand forecast [ELEAF]	6	8	2.4
Vineyard management zones [ELEAF]	5-6	7	2.4
Harvest date [ELEAF]	4	7	2.4
Yield forecast [ELEAF]	3	7	2.4
Disease early warning system [EUT]	3-4	7	2.5
Disease sustainable management [EUT]	3-4	7	2.5
Resource optimizer and planner [EUT]	5	7	2.6
Sustainability indicators monitoring [EUT-ELEAF]	4-5	7	2.6
API service store [ALL]	7	9	3.2
Application portal [ELEAF]	6	7	3.2
Hyperledger trusting system [ELEAF]	4	7	3.3

1.3.3. Methodology

The project will entail a total of 42 months, ensuring that we will have time to work over 3 seasons in the different pilots[23]. From M04 untill M32, we will create a set of Intelligent Services (ISs) for an integrated vineyard management and decision support (WP2), all of them co-developed with end users that are full partners of the project. These services include the operational provision of sub-seasonal climate predictions, the monitoring of both phenological stages and crop key indicators, the alerting in case of high risk of disease, the suggestion of operational activities - together with the appropriate workforce required - and sustainability mapping. The co-development of the ISs will start in the first season (M04-M16) and will be validated in the second season. Data collected during the second season will also be used to update the models and improve their accuracy. The same process will be also iterated in the 3rd and final season (WP4). In-field measurements will be stored and used to downscale the models and provide better accuracy to satellite data. Fixed cameras, drones and data loggers in machinery will be used to provide precise information to the data analysts in order to improve granularity of satellite data wining precision in the information presented and actions recommended. The predictive accuracy of the models will be also further augmented by analysing the historical data provided by the end-users. This large data-fusion process will yield to high-value Intelligent Service that will be made available in the VITIGEOSS Platform.

WP3 will deploy the VITIGEOSS cloud-based Applications Portal. The portal will be co-designed with the end-users, following Agile development cycles[24] and based on FruitLook and VISCA technologies. The VITIGEOSS infrastructure has two distinctive components, the API Service Store (light blue) for **service providers** and the Application Dashboard (dark blue) for **wine producers (**Figure 3).

The API service store forms a repository of consortium data-services and enables the connection of these data-services to the applications available to the end-user. The Application dashboard represents the user interface from which different applications can be attained and used via a single point of entry. A platform test and validation will be performed on the use cases supported by the application. Set up of the system will be done during the first year of the project, which implies the specification of all data formats and protocols for the information exchanges between the main VITIGEOSS services.

[23] If the project is awarded we will start in June, therefore the season of 2020 cannot be used (season starts in March)
[24] https://en.wikipedia.org/wiki/Agile_software_development

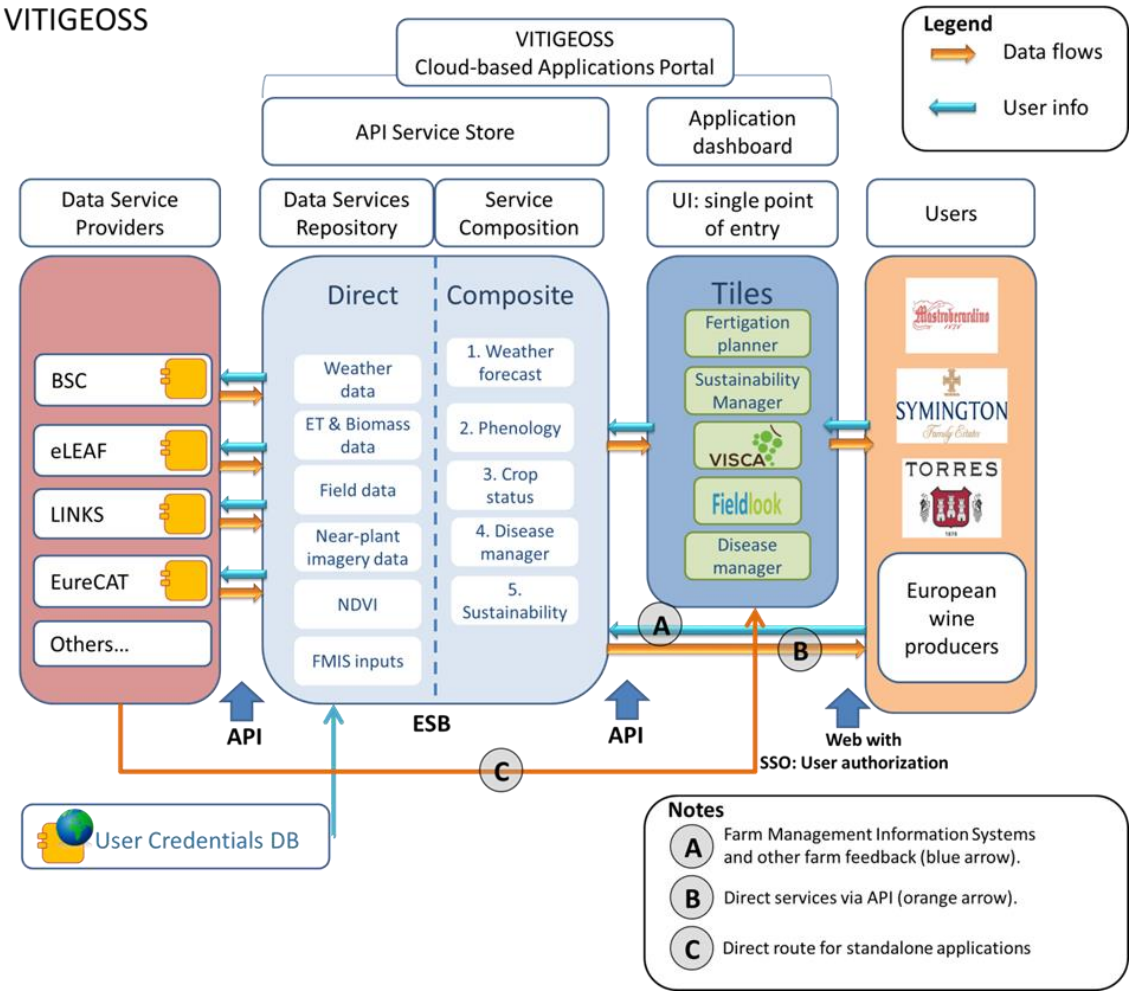


Figure 3. VITIGEOSS Portal Architecture

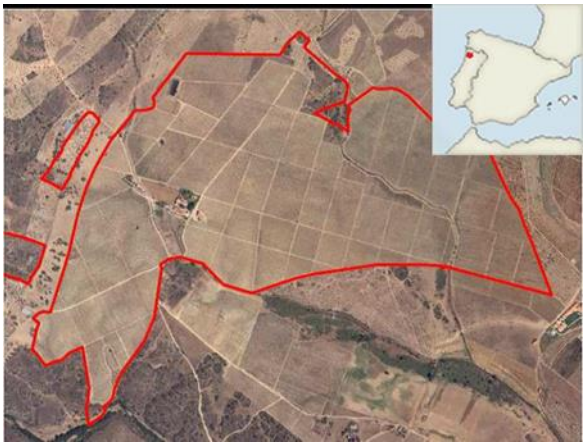
*Description of terminology of this figure is presented as an Annex in Section 4.

From the 2nd year the system will run in operation mode adding new versions of the services until the end of the project. A user acceptance test and validation will be performed on the use cases supported by the application and an implementation of a trusting system (based on hyperledger) to secure the data exchange between service providers and end will be implemented in a trial. Service providers with operational services can expose these services (like VISCA or FruitLook) immediately on the Application dashboard via a direct connection between service provider and Application dashboard (Standalone application via Direct route (C)).

Demonstration in 3 Pilots by 3 end-users

VITIGEOSS will be validated in WP4 with end-users on three demo sites belonging to **Symington, Mastroberardino and Miguel Torres**, who participate as full partners in the consortium, therefore co-developers of the solution, according to their requirements and needs at short, medium and long term. All sites will devote a pilot vineyard for the project (min. 2 hectares). During the first year of the project, those vineyards will be used for the calibration of all services. Starting in the second vegetative season, all services will run operationally (M21). In the second and third year, the services will be validated, tested and deviations analysed for possible further corrections of models (included sub-seasonal predictions). Each demo site will receive the information through VITIGEOSS, and in return end users will feed the tool with field data. The latter, together with historical data, will be used by the software developers to improve the accuracy of the tool, by means of machine learning and by the validation of the models.

Portugal (Symington)



Symington Family Estates is one of the principal Port Wine and Douro wine producers and is the leading vineyard owner in the Douro Valley with a total area of 1100 hectares of vines spread across 29 Quintas dotted around the Douro's three sub regions (Baixo Corgo, Cima Corgo and Douro Superior) in what is the world's largest mountain vineyard. Portugal's geographic isolation, as well as some past conservatism on the part of its wine producers has worked in the country's favor in terms of the preservation of the rich genetic diversity of its indigenous grape varieties.
The demonstration site, Quinta do Ataíde, is located in Douro Superior and it has in total 85 ha vineyards.

Climate: The Douro enjoys its own micro-climate, which is an important reason for the quality and style of its wines. The most important geological features responsible for this are several mountain ranges sheltering it from the Atlantic Ocean influence, giving it a continental climate, with hot and dry summers and cooler and wetter winters. Average annual temperatures shown an average of 16.5ºC, with an growing season temperature average of 20 ºC.. Rainfall ranges throughout the year from 75.6 mm in the wettest month down to 7.3 mm during the driest month, for an average total of 510 mm.

Grape varieties: Touriga Nacional and Touriga Franca

Soil composition: silt-loam and loam.

Italy (Mastroberardino)

Mastroberardino is an Italian winery located in the Campania region, fully committed to traditional cultivation of ancient grape varietals, with ability to blend modern technology with time-tested techniques. The Mastroberardino long term goal has been focusing on wines reflecting the typical characters and notes of the Irpinia territory (located in the province of Avellino – Campania region – Italy). The family owns an extensive network of vineyards in the DOCG's area and the vineyards located in the archeological site of Pompeii. Mastroberardino has been working to identify different zones with distinctive type of soil in the Irpinia areas, in order to select the most quality sites to get the best grapes for making wines with personality. A micro-vinification center located in the old winery of Atripalda (Avellino) is the key to analyze the specific character and peculiar notes of the grapes coming from the different vines in the family estates.
The demonstration site is located in Mirabella Eclano Estate, in the heart of the Taurasi DOC area. The vineyards are surrounded by a large natural landscape, not far from the archaeological excavations of Aeclanum. The estate covers 65 hectares on hill territory with an altitude between 350 and 450 meters above sea level. The epicentre of the company production, research and experimentation, this estate is spread over several hills with different exposures.

Climate: The climate is continental and characterized by large thermal day-night excursions (up to 20 °C). Average annual rainfall is around 750 mm.

Grape variety: Aglianico

Soil composition: Deep soil of volcanic origin, with layers of clay and traces of limestone along the profile, sandy loam texture.

Spain (Miguel Torres)

Torres is a family owned winery with vineyards in Spain, Chile and California exporting premium quality wine and brandy to over 150 countries. Since it was founded in 1870, Familia Torres has managed to combine tradition and innovation with the aim of leading the premium quality wine and brandy sector, always producing with the utmost respect for the environment. Torres owns 2.272 hectares of vineyards in Spain, Chile and California. Torres has a turnover of 260 million EUR (2017) and employs more than 1.300 people worldwide. The Torres family's philosophy of winegrowing begins with respect for the land. In all vineyards and land, Torres completely avoids the use of chemical treatments, replacing them with biological alternatives, following the viticulture traditions of Torres' ancestors. Torres investment in "green" projects has been accelerated even more with the Torres & Earth program, put in place in 2007 with a 10 million EUR budget for a 10 years' period Torres has committed itself to reduce CO_2 emissions by 30% per bottle by 2020 compared to 2008 levels. On sector level, Torres was one of the initiator's of WCP ("Wineries for Climate Protection") that started in 2011, calling for a 20% reduction in CO_2 emissions by 2020 and other 5 environmental action points. The ecological record of Bodegas Torres is valued internationally by the Drinks Business Green Award of 2011.
The pilot plot is in Aranyó estate, which is located in the area of Juneda (Lleida). This estate, which was planted with cereals and Arbequina olive trees by the Duke of Medinaceli, later belonged to the monks of Montserrat. At the end of the nineties Torres began to grow vines here in a typically continental climate about 400 meters above sea level.

Climate: This area is characterized by continental climate, influenced by the proximity of the mountains, but with rather scarce rainfall. There are wide temperature fluctuations on the same day.
The average annual temperature is 14ºC to 15°C, but the minimum temperature is below 0ºC in winter and it can reach 35ºC in summer.

Grape variety: Syrah

Soil composition: very deep and well drained Eutric Fluvisol soil (FAO's classification). It has low organic matter content and high calcium carbonate content.

After the pilots' implementation labour and the intensive technical work of first year are done (M12), WP5 will start to evaluate the commercial sustainability of VITIGEOSS, analysing market critical policies and financial constraints required to promote the sustainable wine growing approach. Activities included in this WP will allow for the commercial exploitation of the project results, co-developed with end users and at an international scale, and the preparation of a realistic business plan to penetrate the market through the commercialization partner ELEAF. The latter will be possible with agreement of the rest of technical partners, by the creation of a financial model to estimate revenue for all services providers (LINKS, BSC, ELAF, EUT).

Last but not least, WP6 will make the knowledge generated by the project easy to understand and access by stakeholders. Lessons learned during the lifetime of the project will be used to advance EuroGEOSS objectives through capacity building addressed to industrial partners and stakeholders. This WP includes include dissemination activities addressed to build capacity among industrial partners and other potential stakeholders (through the use of webinars, workshops and a demo video), as well as activities to transfer knowledge to target groups, highlighting the added value of the products developed in VITIGEOSS (through info sheets, stakeholder sessions, an executive summary, sharing of lessons learned and participation to relevant events) to increase EO data exploitation and commercial products based on them.

1.3.3.1. Sex and/or gender analysis

VITIGEOSS consortium will promote equal opportunities in the human resources acquisitions or collaborations arisen during the execution of the project, besides ensuring that any meeting, workshop or high profile presentation will be planned from a gender balance perspective. VITIGEOSS will endorse the principles of the *European Charter for Researchers and Code of Conduct for the Recruitment of Researchers*[25] regarding women recruitment. Special attention has been paid in the inclusion of women with leading roles in the different WPs (WP1, WP5 and WP6 will be led by women).

1.4 Ambition

1.4.1. Advance beyond the State of the Art

1. **Weather/Climate forecast**: VITIGEOSS will develop state of the art techniques for forecasting temperature and precipitation in a weekly and monthly basis facilitating the adaptation of agriculture to climate variability (e.g. applying statistical downscaling techniques to adapt the different model outputs to the particular climate conditions of the specific region of interest). In addition, cutting-edge bias correction techniques for improving the accuracy of forecasts will be deployed to enhance model skill and forecasts reliability. Climate forecast (sub-seasonal and seasonal) will be merged with weather forecast to provide seamless predictions for the forthcoming days, weeks and months.
2. **Phenological monitoring**: The application of image processing to the agriculture and crop management, also aided by deep learning techniques, is not an entirely novel application, especially in the field of diseases prediction. In literature there are several examples [26,27,28] where computer vision and machine learning are applied to detection of diseases or phenological phases using either close-field or aerial imagery. However, detecting phenological stages using deep learning algorithm where the input sources are EO imagery and data combined with in-field imagery and data is an innovative trait of the VITIGEOSS project. Phenological stages will be automatically detected using EO-derived indexes and in-field images acquired through in-field fixed-position cameras. The cameras will be also equipped with additional sensors, such as IR or thermal sensors, in order to get a wider range of data that range outside the visible spectrum. Furthermore, in this case, deep learning machine learning approaches will be used, combining both sources of imagery together with weather data coming from both satellites' observation and local weather stations. The deep learning approach will improve image segmentation and analysis, extracting relevant features for the estimation algorithm.
3. **Crop status**: Crop status is assessed via key indicators describing crop health, crop production, crop water consumption and crop nitrogen content. These indicators are improved via calibration through in-field information coming from the service providers in the consortium as well as the end-users. Additionally, the combination of services available through VITIGEOSS enables configuration and establishment of new products. The combination of phenological monitoring with satellite-based key crop indicators, and informed by harvest data coming from the end-users, allows for advancements in harvest date forecasts and yield estimations via machine learning and other statistical approaches. Forecasts of harvest date and expected yield can inform, for example, optimal logistical planning by wineries around harvest time. The combination of satellite-based key crop indicators and phenological stages can also aid in determination of a pruning strategy by the farmer. Secondly, image segmentation techniques will be used for automated delineation of harvest zones, based on in-season crop production data captured by satellite imagery and produced via the ETLook model. These harvest zones allow for selective harvesting of wine

[25] https://euraxess.ec.europa.eu/jobs/charter

[26] Font, Davinia & Tresanchez, Marcel & Martinez, Dani & Javier Moreno, Javier & Clotet, E & Palacín, Jordi. (2015). Vineyard Yield Estimation Based on the Analysis of High Resolution Images Obtained with Artificial Illumination at Night. Sensors. 15. 8284-8301. 10.3390/s150408284.

[27] Zhang, Xin & Han, Liangxiu & Dong, Yingying & Shi, Yue & Huang, Wenjiang & HAN, Lianghao & González-Moreno, Pablo & Ma, Huiqin & Ye, Huichun & Sobeih, Tam. (2019). A Deep Learning-Based Approach for Automated Yellow Rust Disease Detection from High-Resolution Hyperspectral UAV Images. Remote Sensing. 11. 1554. 10.3390/rs11131554.

[28] K. P. Seng, L. Ang, L. M. Schmidtke and S. Y. Rogiers, "Computer Vision and Machine Learning for Viticulture Technology," in *IEEE Access*, vol. 6, pp. 67494-67510, 2018. https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8502206&isnumber=8274985.

grapes. As a result the best grapes can be harvested in one batch, meaning a better quality of wine and a higher income to the farmers. Additionally, week-by-week monitoring of crop production is complemented with an automated warning system related to detection of growth problems in a block. The spatial composition of a block is consistently monitored over time and sudden detrimental changes to this composition will be detected by our statistical models. Lastly, optimization of irrigation will be achieved via the combinationof crop water consumption and weather forecast, leading to a weekly crop water demand forecast to the farmer.

4. **Disease management**: Our approach combines the most well tested and adopted approaches like Goidanich[29], EPI[30] or PLASMO[31] with new deep/machine learning models including the analysis of pre-processed satellite data from the crop status and phenology services and tuned with the historical data of end users together with their knowledge. The main parameters from field sensors to be used in the project to tune the generic forecasts will be based on the analysis of most critical parameters (Tª, humidity, rain, leaf area, phenology) and the experience of end users on their fields, determining if the conditions given for an infection are going to happen. If so, the winegrowers have a window action to spray before the vines get infected, thus saving the vines from irreversible situations. This window action will be defined also considering weather forecasts, resources availability and appropriate doses for treatments according to disease geographical distribution and intensity. In addition, a recipe with recommended doses and zones where apply the treatments will be given to farmers.

5. **Business and Sustainability manager:** By aggregating and analysing all data sources VITIGEOSS will promote sustainable winegrowing by providing the tools to evaluate production standards and be able to compare them with current practises and policy compliances. On one side the optimization and better planning of resources will help to remove inefficiencies in the day-to-day operation in wineries. This is usually implemented in industrial environments where lots of suppliers and processes have to be considered, however, it is not common in agricultural domains more centred on yield improving. Thus this application provides insight in the actual production status required for optimization of tasks to optimise economic and environmental sustainability while also providing alternative practices from peers. This provides direct insight in the sustainability of the production from the field to the vineyard and regional level. In addition, VITIGEOSS will use the inputs from all partners to provide sustainability data in similar fashion to the sustainability monitor shown in Figure 4.

Figure 4. Example of optimized production figures of a vineyard.

1.4.2. Innovation potential

VITIGEOSS will be the first application offering integrated services for sub-seasonal and seasonal predictions, crop management, disease warnings, business operations and sustainability monitoring. **VITIGEOSS** will transform existing solutions from a local grower service to a regional platform that **not only provides support to growers, but will be a single access point for wine producers that aims to be sustainable and support a circular economy**. The addition of partner services that are at the demonstration level, will significantly boost its functionality without the need for research and development and will make the application unique. **There are no other existing applications combining fruit support, monitoring, disease management, water management and sustainability mapping, thus VITIGEOSS**

[29] G.Goidanich: *Manuale di Patologia Vegetale*. Edizioni Agricole, Bologna, 1959

[30] V.Rossi, T.Caffi, A.Cossu, F.Fronteddu, *Empirical vs Mechanistic models for primay infections of Plasmopara viticola*, Wagenigem, 17 Octubre 2006

[31] P. Spencer-Philips,M.Jeger: *Advances in downy mildew research*, Volume 2, Kluwer Academic Publishers, 2004

will not only showcase European capabilities, it will make them available to the European wine industry.
Current products and potential innovations:

Innovation	Commercial Solutions	Innovative aspects implemented in VITIGEOSS
Crop management (ETLook)	FruitLook Vintel®, AGRICOLUS,	• Embedded EU sustainability variables • Delivery of ETlook data back to EUROGEOSS according to standards • Configuration of fruitlook to European context • Use of an application store as single point of entry for European wine industry • Integration of other key applications in the store • Growth of the platform allowing additional services to be added in future by public API • Scalability of the services to Europe wide users • Use of a ledger for data transparency, ownership and GDPR
Seamless forecasts	Customweather, Weather.com, agro-weather tool	• Development of climate service at sub-seasonal time scale. • Merge of the following time scales in a seamless forecast system: weather forecasts, sub-seasonal and seasonal climate predictions.

Detection of phenological stages with satellite data	No commercial products, only projects such as VISCA and PERPHECLIM *To our best Knowledge	• Exploit global information provided by satellite imagery, such as GEOSS services, Copernicus Global Land Services, and high-scale, precise, weather information
		• Implement data fusion with local information provided by in-field, fixed-position cameras, drones and local weather stations. In particular:
		  ○ Cameras will provide higher frequency high-resolution imagery on selected vineyard spots
		  ○ Drones will provide lower frequency high-resolution imagery covering the whole vineyard
		• Upgrade the predictive features of phenological stages of VISCA, enhancing them with the automated detection and monitoring of phenological stages using advanced, state-of-the-art, ML techniques

Disease warning system and management tool	SmartVineyard, AgWeatherNet (only for USA), Rawdata disease models	The solution will use a fusion of state of the art early disease detection of powdery mildew and downey mildew approaches based on data from weather stations combining them with high reliable weather subseasonal forecasts by using ML techniques. In addition a forecasting treatment recommender will be delivered to improve effectivity of treatments reducing its number and doses when possible by monitoring its real application
Optimizer and planer for sustainable use of resources	Climate FieldView™,	Several tools are available in the market for optimization purposes (mainly on industry), however our approach is centred in vineyards use of resources with a multi objective optimization capacity, prioritizing sustainable versus economic objectives, improved with the experience of 3 well known winemakers; and with capacity to work with forecasts

VITIGEOSS project results are foreseen to generate new products and knowledge (datasets, services and software). The table below gives an overview of the main types of data, services or software collected or generated by VITIGEOSS:

Type of data/ service/ software	Details	Standards	Availability / exploitation
Seasonal climatic forecast predictions	Based Copernicus Climate Change datasets. Temperature and precipitation	INSPIRE conform metadata	Made available to authorized users via VITIGEOSS Portal
Sub-seasonal climatic forecast predictions & Real time short-term meteorological forecast data	Precipitation, temperature, relative humidity	INSPIRE conform metadata	Made available to authorized users via VITIGEOSS Portal
Phenological monitoring	Based on data fusion between Copernicus Sentinel and in-field acquisition from fixed cameras.	INSPIRE conform metadata	Made available to authorized users via VITIGEOSS Portal
Harvest timing and yield forecasting tool	Determining best moment for harvesting and make a yield prediction by applying statistical and machine learning methods to historical and contemporary yield information, phenological stages and crop management actions.	INSPIRE conform metadata	Made available to authorized users via VITIGEOSS Portal
Early warning disease algorithms	Alarms when critical episodes are forecasted or treatments recommended	INSPIRE conform metadata	Made available to authorized users via VITIGEOSS Portal
Disease recipes management	Maps of doses to apply for disease prevention. Monitoring of effectivity and sustainability of disease treatments	INSPIRE conform metadata	Made available to authorized users via VITIGEOSS Portal
Resources optimizer	Planning of best resources usage	INSPIRE conform metadata	Made available to authorized users via VITIGEOSS Portal
Sustainability manager	Calculation of sustainability indicators from multi ties data sources and dashboard to show possible improvements on them	INSPIRE conform metadata	Made available to authorized users via VITIGEOSS Portal
VITIGEOSS Portal	Online portal for wine industry players to access the individual service providers' data and services and combined Vitigeoss data and services	Web standards	Public to see, access to services for authorized users only (initially free-of-charge)
API Web store	Online portal for agri service providers to access and contribute to Vitigeoss data and (combined) services	Open API	Made available to authorized service providers (initially free of charge)
Quantitative crop measurements	valuable information on crop water use, productivity and nitrogen content based on satellite, meteo and ground data.	INSPIRE conform metadata	Made available as crop KPI's to authorized users via VITIGEOSS Portal
In situ data / in- field information / End user requirements	Data gathered from sensors in the field or provided by pilots	INSPIRE conform metadata	Made available to authorized users in case that the permission is given by the owners of the information

Table 2. National or international research and innovation activities linked with the project

Activity & Brief description	Outcomes that will feed the Project
Agrorobfood (**EUT**) agROBOfood builds the European ecosystem for the effective adoption of robotics technologies in the agri food sector.	The project started on Jun2019 will be a ridge to combine technologies and find synergies to define a commercial strategy with possibly links with the agri-tech community.
IoECrops (**EUT**) This project works to connect agricultural machinery to several agronomic cloud services from different partners to improve the management of extensive crop farms. In addition a	The knowledge from the project will be easily adapted to other type of crops: A selection of standards used to enable the interoperability between clouds; the technology developed to connect the agricultural machinery to Internet; and the data analytics infrastructure and

data analysis platform is developed to optimize the resources used.	application used will allow the optimization of resources in wineries.
VISCA **(LINKS, BSC, SYM, MBD, NAP):** Climate Service (CS) and Decision Support System (DSS) capable of handling weather, phenological and irrigation forecasts, and deliver them to wineries through a dashboard for decision support.	In cooperation with eLEAF, selected modules of the VISCA system will be chosen for improvement and adoption within VITIGEOSS so as to fully benefit from the existing solutions that have been implemented by the consortium partners and deliver a competitive solution that can be effectively exploited towards the wine industry and other cultivars.
FruitLook (**ELEAF**): The FruitLook pre-operational service demonstrates the benefits to wine farmers of integrated satellite technologies in their daily water and farm management in the Western Cape of South Africa. The project makes the pre-operational service freely accessible to all potential farmers, who indicate improvements in water use efficiency of up to 30%.	The FruitLook platform consists of an advanced front- and back-end architecture that is at the operational level for its current applications, providing the proper infrastructure to combine data and applications emerged from VITIGEOSS partners to progress to the TRL7 level. The platform already serves a customer base and this allows for a quick scale-up to the market once VITIGEOSS is operational.
WEAM4i (**ELEAF**). The aim of the project was to improve the efficiency of water use and reduce the costs of power irrigation systems. eLEAF`s role was to provide a water demand module, what we would call an application these days, that prognoses the irrigation water demand of various intensive crops allowing for optimized water management.	Quantifiable sustainable crop production indicators related to intensive crop production in terms of water consumption versus growth that will now be used for vineyards. Climatic configuration variables required to derive these indicators in Southern European countries where obtained and will be reused. During the project eLEAF`s infrastructure was upgraded to semi-automated satellite processing that allows for (commercial) applications where the time between satellite acquisition and service delivery must be minimal, as is the case in VITIGEOSS.
S2S4E (**BSC**): Innovative service to improve the management of renewable energy variability by combining seasonal and sub-seasonal climate predictions	Comprehensive sub-seasonal and seasonal forecast quality assessment for climate variables that affect the agriculture sector (Temperature and precipitation).
MED-GOLD (**BSC**): MED-GOLD will build pilot climate services focusing on three key crops of the Mediterranean area: grapes, olives and durum wheat.	Tailored services using seasonal climate predictions will be developed within the project and evaluated in terms of user impact.
C3S 512 (**BSC**): Aim to ensure that the Copernicus Climate Change Service (C3S) meets the needs of a range of users for high-quality data and information	Ensure that the data used in the project (observations, models, satellite data, etc.) is of high quality.
I-REACT (**LINKS**): integrate emergency management data coming from multiple sources, including weather information, Copernicus products, drones. I-REACT provides both citizens and first responders an information tool for preventing and facing more effectively the challenges coming from climate changes and natural disasters on wide areas.	Automatic exploitation of Copernicus products, concerning the extraction of sensible information related to weather and EO data for monitoring and forecasting. Deep knowledge of drone imagery and big data processing

2. Impact

2.1 Expected impacts

2.1.1. Impacts mentioned in the work programme

VITIGEOSS will move from stand-alone observations (satellite, in-field) to downstream information services presented in a one-stop shop platform for the wine sector. Even though it is co-designed to serve to this specific sector, VITIGEOSS, as example of a successful application of integrated services for agriculture, can be used to the demonstrate the potential to others agriculture sectors in a EuroGEOSS context, therefore empowering exploitation of EO data and creation of other commercial products and services through capacity building among potential developers (fairs, workshops) and the whole European wine industry value chain (local sessions at end users premises).

Effective engagement of the European commercial sector within EuroGEOSS

VITIGEOSS consortium is formed by strong European commercial partners with successful track-records in developing solutions for agriculture digitalization (EUT, LINKS), use of satellite data on agriculture (ELAF, BSC) and disaster resilience (BSC, LINKS), among others.
In the VITIGEOSS consortium European commercial and research partners work together enabling a range of effective solutions for decision support in vineyard management. VITIGEOSS will interact with the European Commercial sector by submitting an Expressions of Intent to the next EuroGEOSS request of the EuroGEOSS action groups as a joint proposal, aiming to become part of the community. Connection with the action groups will be ensured with the presence of relevant members in the Advisory Board, such as the already confirmed below (Annex I in Section 4): Copernicus Climate Change Service (ECMWF) - who belongs to the action groups Climate, Atmosphere and Energy – and HCP – they belong to the Action group of Agriculture -.
EUT is member of the Open Geospatial Consortium (OGC), who is a partner of the NextGEOSS initiative. Through this direct contact we will support and contribute to the NextGEOSS data catalogue - with data obtained during WP4 -, therefore contributing to a fast and scalable transformation of Earth observation data into actionable information and knowledge **across all 17 SDGs**. As part of our project sustainability strategy, we also intend to showcase our services in NextGEOSS platform, in order to support European investments on GEO and GEO community with new information. Until this opportunity arrives, VITIGEOSS will actively work with the European Association of Remote Sensing Companies (EARSC), who promotes the use of Earth Observation (EO) technology and especially the companies in Europe which offer EO-related products and services. As part of the activities in WP6, we will work with other H2020 projects and associated initiatives for the promotion of Earth observation applications to explore synergies and find ways to interact with existing EuroGEOSS initiatives, such as the project, if any, resulting from call SC5-16a-2019 on the coordination of European innovators in the domain of Earth observation. Representatives from VITIGEOSS will actively participate in EuroGEOSS events, such as the annual workshop and conferences.

KPI_1: Submission Expression of Interest to join EuroGEOSS community and interact with their services.
KPI_2: Association of VITIGEOSS with at least 2 Action Groups of EuroGEOSS to input into their activities.
KPI_3: Showcase VITIGEOSS services in NextGEOSS platform before the end of the project

New commercial products and services using GEOSS and Copernicus data and services

VITIGEOSS will be a Platform that will couple satellite imagery with in-field sensors to increase resolution and reliability of satellite information applied to all aspects of viticulture and specific wine-business operations. During the project we aim at advance on existing solutions to improve and tailor most critical aspects of agriculture (wine) management into a pack of 5 intelligent services:

Weather & Climate forecast, aims to address the potential application of sub-seasonal (up to 1 month) to seasonal forecasts (above a month) in combination with short term forecasts (up to 10 days). These forecasts will enable farmers to better prepare for atypical climate conditions, and manage extreme events (floods, droughts) that may damage the crop, harming irreversibly the production of the season.
Phenological estimation targets at automating the monitoring process of the vineyard phenological phases (beginning of shoot growth, veraison, harvest, and the end of the vegetative season) and other key crop indicators, to help farmers a better planning of field works (fertilization, pruning, harvesting) and optimization of resources.
Crop status monitors Crop health, crop production, crop water use and crop nitrogen content, to help farmers to optimize irrigation, sampling and/or selective harvesting leading to better grape (and thus wine) quality, forecast timing and amount of yield, etc.
Disease management, for an appropriate forecasting of the disease evolution taking into account the meteorological conditions of the year and the crop status, to optimize the number of treatments and the resources used and to assure its effectivity when spraying, avoiding irreversible situations.
Business & Sustainability aiming at using the output data from the other services to evaluate and calculate parameters for the management of the business (plan best timing for field operations, improve predictability of production, calculate personnel resources needed, automate “zonal delineation” for selective harvesting

and specific management to predict ideal production zones for different wine cultivars, Economic viability), and for sustainability (guarantee a better planning of resources, reduce usage of raw materials, fruit and water yield %, prediction of erosion and flooding hazards, PCF and Greenhouse Gas Inventory).
Our solution will empower the usage of European open EO services by the improvement of agriculture business operations at economic, environmental and social level. GEOSS and Copernicus data and services are core inputs for the perceived service package. Integration of weather forecasts with real-time observations enhance capabilities for efficient commercial wine farming. By doing so, farmers are better advised when to act and in which manner, both in-field and after harvest. High-resolution Sentinel-2 information are essential for integrated crop monitoring and management solutions at vineyard level. The availability of open and accessible satellite and weather information via GEOSS and Copernicus enables the establishment of proposed solutions for vineyard management and makes the provision of commercial services based on contemporary technologies feasible and cost-effective. Integration and enrichment of this open-source base information leads to an all-round management package for wine producers in Europe which is scalable and affordable.

KPI_1: 5 new downstream services using Copernicus/GEOSS deployed as standalone applications.
KPI_2: 1 modular and interoperable platform for crop management and decision support.

Capacity building among current and potential developers of commercial products

The services developed within the project and lessons learned will be used for building **capacity on sustainability among agricultural communities**, which is expected to benefit local economies (e.g., by ensuring productivity in the long term, thus safeguarding the creation of jobs in the region), strengthen skills, competencies and abilities to advance the development of services and products based on the use of EO systems, and to be used by policy makers to monitor and map general irrigation and crop cultivation activities within specific management areas, supporting decision making processes on future sustainability strategies.
VITIGEOSS will organise 3 technical webinars on the technical aspects of probabilistic climate predictions, data analysis on agriculture, and use of satellite data in agriculture, all tailored to the needs of potential service providers within the wine sector and beyond (to foster the possibility of the exploitation of some particular components of the platform outside of the wine producer's community). The latter will strengthen skills, competencies and abilities to advance the development of services and products based on the use of EO systems. **Two participatory workshops will** be delivered to present the portal to the wine community and disseminate the main project achievements, with focus on spreading the use of EO services. They will comprise seminars and training courses on topics such as geo/remote sensing in agriculture, application of remote sensing and EO in viticulture and probabilistic climate forecasts for decision-making. **They will address technology developers and commercialization partners**, supported with the presence of relevant stakeholders of the wine and the agriculture sector as well as EuroGEOSS and Copernicus members.
The learning process of climate services co-production will also be shared with the broader climate and EO services community, that could benefit from VITIGEOSS experience **regarding the creation of commercial services**. Lessons learned r**egarding the use of Earth Observations for the optimisation of decision making** in the agriculture sector will be shared with the Copernicus and EuroGEOSS communities. The VITIGEOSS consortium is involved in the Climate Services Network of Projects coordinated by the EU-H2020 Climateurope coordination and support action, and has collaboration with the JPI Climate initiative. Both initiatives can serve as launch pad for the dissemination of this task among potentially interested actors. In addition, we will develop a high quality video to guide users through the different smart services developed in WP2 and the portal deployed by WP3.

KPI_1: Number of participants in events organized by VITIGEOSS addressing the wine community (min.40).
KPI_2: Number of participants in events organized by VITIGEOSS addressing technology companies linked to EO (min.60).
KPI_3: Improvement of technical capabilities learned after technical webinars organized during the project, by completion of evaluation forms after it (min. 15 evaluation forms filled, indicating a successful understanding with a positive score of the specific technology embraced in the webinar)

Demonstrated capability and reliability of novel EO products and services through the whole value chain

The added value of VITIGEOSS will be demonstrated throughout the whole European wine industry value chain. In fact, it will positively affect:

1. Farmers, able to increase the yield of their cultivations by enhancing the productivity of existing cultivations and by exploiting new fields previously unproductive. In 2015, the total world area under vines (corresponding to the total surface area planted with vines, including that not yet in production or not yet harvested) reached 7,534 kha. EU vineyards[32] should stand at 3,362 kha, a reduction of 26 kha between 2014 and 2015. [33]
2. Downstream operators (chiefly Wine producers and Distributors) benefitting from a timely and guaranteed delivery of grapes due to an improved predictability of yields (in terms of both quantity and quality). In 2015 the global market (considered here as the total exports of all countries) should reach 104.3 mhl in terms of volume – an increase of 1.8% compared with 2014 – and 28.3 bn EUR in terms of value – a rise of 10.6%. In terms of volume, there was a rise in exports from Spain (1.7 mhl). Italy and France exports decrease by around 2%. In terms of value, Italy and France continued to dominate the market with shares of 19% and 29% respectively.[33]
3. Upstream operators (e.g., Fertilizers, pesticides producers), guaranteeing them a better planning of resources and the possibility of improving their products, being involved in the development and improvement of a cutting edge technological solution.
4. Other stakeholders (e.g., retailers, policy makers, environmental organizations, technological research centers, society as a whole), all interested in the enhancement of the sustainable products for final customers and/or the eco-sustainability of their business.

We will present VITIGEOSS results at conferences, fairs, exhibitions and workshops at national, EU and international levels. The final conference of VITIGEOSS will ensure the presence of the above mentioned actors of the chain. A demo video will be shown, and a training sessions will be carried out during this event, where we will be able to show the calculated parameters in terms of productivity, optimization of resources management, sustainable practices (especially addressed to upstream operators and policy makers). First objective of the conference is to boost exploitation strategy of the tool, and the second objective is to increase awareness on benefits and positive impacts that the use of EO data and satellite imagery can have for their business.

Since the VITIGEOSS consortium includes a commercial partner with connections to the wine industry, the penetration of the market in terms of commercialization is assured from the 1st day of the project. In addition, cooperation and networks existing from the past among the technical partners working together in projects related already exist, therefore the time needed to achieve market readiness time is expected to be shortened considerably and commercial roll-out becomes feasible. Therefore, the market analysis to be performed will be focused on acceptance of the application by wine and agriculture producers. The company in charge of exploitation and market penetration, PriceWaterhouseCoopers (PwC) has a network with an extensive knowledge of wine and agriculture sector, and the team has been engaged with several companies on strategic plans, market entry studies, market analyses and business plans in these sectors. Like ELEAF, they have already penetrated products in wine sector in South Africa and released publications (can you see the trend? The south African wine industry insight survey 2015)

KPI_1: Wine industry value chain actors reached (and documented) through specific communication and exploitation activities: min. 30 local farmers (local sessions), min. 30 downstream operators & 10 upstream operators (technical webinars, participatory workshops and final conference), min. 15 policy makers and society as a whole (local sessions, participatory workshops and final conference)
KPI_2: Business plan completed in draft version by month 18 and in final version by month 30
KPI_3: Successful customer addition by registration, who is able to use VITIGEOSS services (min. 1)

Mobilising the most dynamic actors of the European commercial sector, developing new EO-derived mass markets and increasing cross-domain exploitation of EO data

[32] Vines for wine grapes, table grapes or dried grapes, in production or awaiting production.
[33] http://www.oiv.int/public/medias/4587/oiv-noteconjmars2016-en.pdf

VITIGEOSS will build an operational Decision Support System (DSS) where a set of advanced models (intelligent services) will deliver essential forecasts, estimations as well as recommendations to wine makers in order to optimize the vineyard management processes, coupling EO data and imagery with in-field data sources. The DSS dashboard will be co-created with the end-users, and based on the FruitLook and VISCA technologies. The primary focus of VITIGEOSS is at the European wine sector, within which we aim to reach to majority of the players ensuring substantial impact of application of EO data in this domain.
VITIGEOSS contributes to a responsible production of wine by ensuring sustainable production of its raw material (grapes) minimising inputs as chemical fertilisers and pesticides and by managing water resources with an intelligent DSS. As such, VITIGEOS aims to become the reference for the European wine industry by providing winegrowers the tools to evaluate their production standards and be able to compare them current practises and policy compliances. This will be done with the business & sustainability intelligent service which allows a better planning of resources, a reduce usage of raw materials, calculation of fruit and water yield %, prediction of erosion and flooding hazards, and evaluation of Product Carbon Footprint and Greenhouse Gas Inventory. In summary, VITIGEOSS will promote sustainability through wine companies by a) supporting sustainable production of wine by providing a toolbox, and b) by providing unbiased sustainability information that clearly indicates how sustainable a winery is operating. This is a niche market that will mobilise the most dynamic actors of the wine industry supporting a new mass market for wineries, wine buyers, importers and purchase managers as well as investors and consumers who aim to have a sustainable circular lifestyle.

Being the southern European wine producers (large-scale agricultural and horticultural business segment) the main target of customers during the project and short-term, the second to reach in the medium term would be agri-service providers, who will offer an attractive portal where they display their own applications and services alongside VITIGEOSS'. The portal will have a base set of users (VITIGEOSS) and generates exposure of all partners' users to the services and applications. This segment will enable the expansion of the user base to new regions and new crops.
Last, but not least, subtask 6.3.1 has been designed to share lessons learnt to the most relevant sectors using GEOSS and Copernicus (within agriculture), which are both the climate services and Earth Observation. These lessons will include the knowledge exploitation of creating commercial services, with the ultimate goal of increasing EO-derived mass markets.
The consortium has a broad network to capitalize results and outcomes for a later commercialization of the tool and increase the cross-domain exploitation of EO data and EO services: Gabriel Anzaldi (EUT) is director of DIH Agritech Big Data, through which we may achieve a direct impact among agri-services companies. BSC is involved in the Climate Services Network of Projects coordinated by the EU-H2020 Climateurope coordination and support action, and has collaboration with the JPI Climate initiative. Both initiatives can serve as launch pad for the dissemination of this task among potentially interested actors.

KPI_1: Production of sustainability mapping displayed in the DSS for the 3 sites
KPI_2:Report on knowledge exploitation regarding the co-production approach of creating commercial services (climate and earth observation) – D6.5

2.1.2 Substantial impacts not mentioned in the work programme

Economic: wine commercial activities play a major role in the EU economy, especially for Southern European countries, where it can account for up to 10% of the agricultural production. **In 2005, the sector represented more than 20% total employment in EU agriculture, and employed over 3M people (being the family source still prevalent)**. In addition, there is a very important local economy activity around the main wine business, such as trade and marketing of wine, development of wine tourism (hotels, bars, restaurants), etc.[34]
The sustainability of the sector is threatened by increasing vulnerability to droughts due to climate change. Efficient planning and proper management of resources are therefore vital for local farmers to sustain vineyard cultivation and keep production levels at a viable level. VITIGEOSS supports farmers by providing early warning systems to potential risks in terms of extreme weather and disease pressure as well as giving them the tools to make better decisions in crop management. By doing so, the viability and

[34] https://www.ceev.eu/about-the-eu-wine-sector. Checked on 29/08/2019

economic sustainability of these farms is increased boosting rural economies in Southern Europe. Consumer demands are increasingly strict (using less or no chemicals, organic production etc.). With the VITIGEOSS platform, partners in the chain can collect relevant KPI's about the wine production process and communicate towards the end consumer if desired. It is therefore a valuable tool for chain partners and improves consumer acceptation. The 3 local sessions envisaged during the at each of the 3 users' premises will be address to local farmers and rural communities, and it will focus on sustainable practices to improve productivity.
**SDG8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all*
**SDG12: Ensure sustainable consumption and production patterns*

Social: The majority of the wine production is done by conventional production methods. In contrary to organic production, the use of artificial fertilisers and pesticides is allowed here. Whilst applications are presumed to be done safely while regarding the product label, recent reports show that **a growing number of farm workers are suffering from the chemicals they are getting in contact with during their work**[35]. The French government has already pledged reductions in the use of pesticides, but since its promise the use has increased. Part of this due to the commercial pressure on farm owners. The **VITIGEOSS platform will finally enable these farmers to tackle the issues they face with less use of chemicals or by changing their production methods completely in order to reduce or abolish pesticide use**. By integrating inputs from a wide range of data providers and by identifying requirements throughout the production chain VITIGEOSS makes the wine industry more sustainable.
**SDG3: Ensure healthy lives and promote well-being for all at all ages*

Environmental:
Water: The Mediterranean is vulnerable to climate change increasing the likelihood of drought and bringing more variation in rainfall patterns. As a result of this change the commercial cultivation of wine grapes is becoming increasingly dependent of the use of irrigation systems. As fresh water resources are limited agriculture needs to compete with the urban and industrial sector. Also, natural areas need sufficient access to water to remain vital. This means efficient irrigation is key. This does not mean efficient use of water is easily achieved. Insufficient irrigation leads to crop production losses, meaning a direct loss of income to the farmer. To be able to manage water effectively, crop water demand and crop water use needs to be monitored. Within VITIGEOSS we will provide the tools to do so, giving both insights in crop water consumption via satellite-based evapotranspiration data products and crop water demand forecasts. By doing so, **the farmer is supported to optimize his decision making in irrigation management and decrease the water footprint of wine grape cultivation. This means less irrigation water is extracted from regional water resources meaning more water remains available for natural areas**. **An improved management of the crop reduces the number of pesticide applications and prevents runoff through the soil into the water. Water quality can thereby greatly benefit from reduced applications**.
**SDG6: Ensure availability and sustainable management of water and sanitation for all*

Air/climate*:* Optimization of usage of raw materials by improving efficiency and decrease the usage of fossil fuels by reducing the number of passes or number of treatments/tasks with machinery involve direct reduction of CO_2 emission to the atmosphere, which in turn will allow for a relief in the effects of climate change, therefore supporting its own sector of economic activity (Mediterranean countries have a very important agriculture activity, which strongly depends on climate)
**SDG13: Take urgent action to combat climate change and its impacts*

Soil & Bio-diversity*:* Knowledge of the crops' status and the timely updates can greatly reduce the amount of pesticide applications used to ensure productivity. This is better for farm-workers that are working with hazardous products[36], the soil and end-product and finally consumers who are ensured the product they consume is produced with less pesticides where possible. Using satellite imagery to map vineyards plots allows to differentiate plant vigour in specific areas, and thus to be able to apply the precise amount of

[35] https://www.theguardian.com/sustainable-business/2015/oct/29/france-wine-pesticides-organic-workers-vineyards-lawsuits-cancer
[36] http://www.dicat.csic.es/rdcsic/index.php/recursos-naturales-2/121-proyectos/224-nuevos-datos-del-efecto-de-los-fertilizantes-y-herbicidas-sobre-la-biodiversidad

fertilizer to prevent unsustainable use. In addition, appropriate management of pesticides impacts positively on biodiversity in the vineyards, due to toxic chemicals contained on them. in addition to that, VITIGEOSS will encourage a change of practices among the end users involved, such as growing cover crops between vine rows to decrease erosion and increase organic matter, being the cover a natural habitat for several species, or using natural fertilizers as a source of nitrogen. TOR is already applying some friendly techniques to support the protection of biodiversity in vineyards in its project Torres&Earth.

**SDG15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss*

2.1.3 Barriers and framework conditions determining the impacts achievement

	Barrier	Proposed measure to overcome it
Technological	Data access related problems to real-time climate predictions forecasts	VITIGEOSS tasks have been defined according to the plans of the Copernicus Climate Change Services (C3S) and the National Centers for Environmental Prediction (NCEP) to provide real time climate predictions. Within this context, Dr. Carlo Bountempo has been involved in the External Advisory Board of VITIGEOSS and provided a support letter to the project.
	Low digitalisation of the agriculture sector	Fruitlook offers farm digitisation tools where users can draw their plots before starting to use the service.
	Complexity of the solutions	Clear objectives stated in the project ambitions and co-development of the solution with interested end users will guarantee usability at the end of the project.
Legal, regulatory	The possibilities to use and share end-users' data is legally restricted by GDPR while many services will depend at least partly on information provided by the end-user.	Users need to comply with sharing certain information to enable service providers to deliver their services via a tickbox on the VITIGEOSS webportal. VITIGEOSS will ensure a safe environment for storage of user information. For this reason **hyperledger technology** is explored during the project to create a trusted environment between service providers and end users regulating the authorization of use of their information.
Social	Low uptake of the platform by the wine industry (could be due also to technological barriers)	The platform and login will be as easy as possible so users find their required services without hassle. One of the measures is to have a single sign on for the platform.
	There could be possible objections to the availability of insights (e.g. sustainability indicators of the farmers) to third-parties or just the existence of sensitive data from farmers.	End-users will be given power over their own data.
	Gain of trust in the platform by the end-users. Fear for the use of data, storage of user data, sharing etc.	The platform will be created with safety, trust and transparency in mind. Hyperledger could play a key role here.
Economic	Too high implementation costs of the platform hindering its adoption by the market; Insufficient added value of the applications for end-users thereby not competitive and viable to pay for itself and all service providers' services.	An elaborate business plan is developed during the project including a market entry strategy with various financial models and a chain analysis to identify relevant sustainability variables in WP5.
	Dependencies of the platform on individual partner's services. Does the platform remain relevant if one or more of the project partners decides to leave the platform/project?	Standardisation of the data-inputs enable quick switch of core data providers. Service providers benefit from the business model developed in WP5.

2.2 Measures to maximise impact

2.2.1 Exploitation of results

Exploitation
Taking advantage of the maturity of operational Earth Observation services and the continuously innovating in-field technology, VITIGEOSS has a great potential for exploitation within the wine sector. Although there are geodata sets available already (like Copernicus and GEOSS), this data might be difficult to find, to process and to interpret correctly. The **right interpretation of these resources**, alongside smart information devices' technology can have a significant impact on the efficiency, sustainability and adaptability of the farming industry. As the demand for this type of services will increase towards the future, **VITIGEOSS has an opportunity to expand the market, create visibility and impact in the wine sector.** Its end users will be farmers and wineries that might have **different type of problems and needs**, which VITIGEOSS' diverse offer is able to cover and therefore, be of interest to a wide range of end users. VITIGEOSS will also service third parties developing solutions for the sector by integrating them or by offering data from any intelligent service. The use of pest control and fertilisers are currently closely monitored by farmers and government to find methods of practice that ensure a sustainable production that minimizes negative effects to soil and workforce while maintaining a profitable production. VITIGEOSS supports this development by **integrating the potential of EO Systems with in-field measurements**, models, **policy** and **best practices**, providing a management tool for a sustainable grapevine cultivation via **decision support systems** (phenology, irrigation, fertilizer, disease, business operations and sustainability aspects). The exploitation of VITIGEOSS will bring innovative solutions to the wine sector, which **can be extended to other (large) crops**.

Business Plan Outline
Although European countries are considered to be a landmark regarding wine production due to their unique shape, terroir, climate and geology, **there are environmental problems that have been undermining the whole sector for the last years**, with major impact in Europe. **The falling production of grapes in this region is a primary driver for the decline of the market**, therefore other worldwide countries are arising competition, like the US, Argentina, Chile, South Africa, China, Australia, Brazil, and Canada.

Having this in mind, VITIGEOSS was designed to **promote sustainable winegrowing** that is a comprehensive set of practices that are **environmentally sound, socially equitable and economically viable**. VITIGEOSS provides the means for winemakers to:

- Prepare and manage periods of extreme events (such as droughts and wet conditions) by having access to reliable meteorological information combined with actual crop status measurements providing actionable advice as to when to irrigate and what are the optimum harvesting dates;
- Predict phenological stages and scheduling critical vineyard management practices, improving the resources management, reducing greenhouse gases and the amounts of chemicals and nitrogen used in the fields;
- Identify and prevent diseases in plants, through continuously monitoring of pest presence and pest enabling environmental conditions permitting pest management with reduced amounts of pesticides due to early warning and point source application;
- Have accurate information to decide on optimum task execution like harvesting dates. Having reliable meteorological information combined with crop status measurements will support wineries to be prepared for extreme scenarios and making the most of all resources;
- Maintain, start or optimise sustainable winegrowing by understanding the climatologic, agronomic and policy frameworks affecting the winegrowers' businesses.

The technology will use **free of charge satellite imagery and EO products from the European Copernicus Programme and NASA, coupling them with in-field data sources to provide 5 smart applications** (Climate forecast, Phenological forecast, Crop status, Disease management, Business and Sustainability). This combination ensures near real-time scalable information that allows for a comparison of best practises between estates thus promoting sustainable winegrowing and required practises between the communities. The required operational technology is readily available for VITIGEOSS having a solid background brought by VISCA, FruitLook, IoECrops, S2S4E, and MED-GOLD.

As the first focus of this technology is on the wine sector, bellow follows a market analysis on this industry:

Market Assessment

As mentioned before, European countries are the main wine producers (60% of global wine production). However, there are some countries from other continents that are fastening their ace regarding production, increasing competition, as for example the USA, Argentina, Chile, South Africa and Australia.

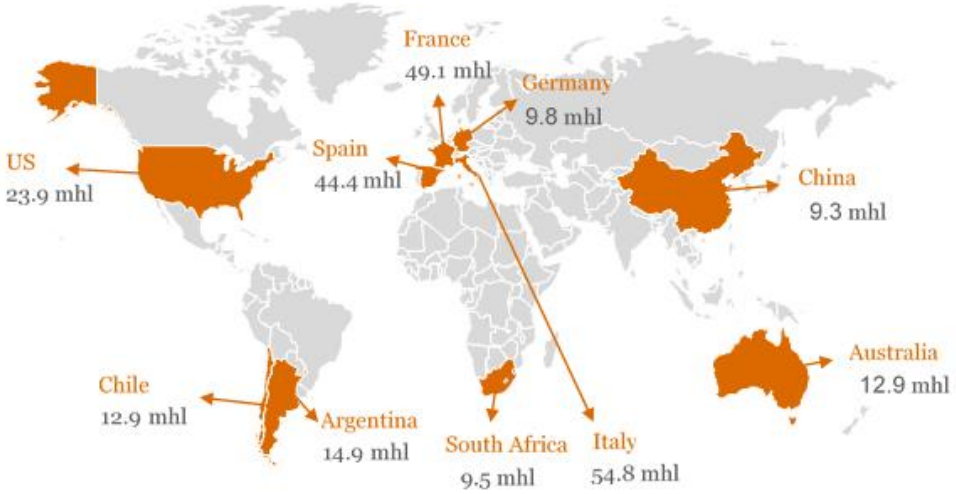


Figure 5. Main Wine Production Countries (2018, mhl)

Viticultural Production Potential

The 2018 world area under vines is estimated to be **almost equivalent to the one in 2017, 7.4 mha**. Since 2014, there has been a continuous fall in the worldwide area under vines, due to the reduction of vineyard surface area in Turkey, Iran, US and Portugal. In Europe, the latest available data indicates a **stabilization in the vineyard surface area** of most of the countries, with Italy presenting increases regarding the prior, while Portugal and Moldova present slight decreases. **Spain continues to be the clear leader**, with a vineyard's area of **969 kha**, followed by **China** (875 kha), **France** (789 kha), **Italy** (702) and **Turkey** (448 kha). These 5 countries represent **51%** of the world vineyards surface. Asia also appears to be stabilizing its vineyard surface area, as the Chinese growth slowed and Turkey stabilized. North and South America exhibited downward trends within 2017 and 2018.

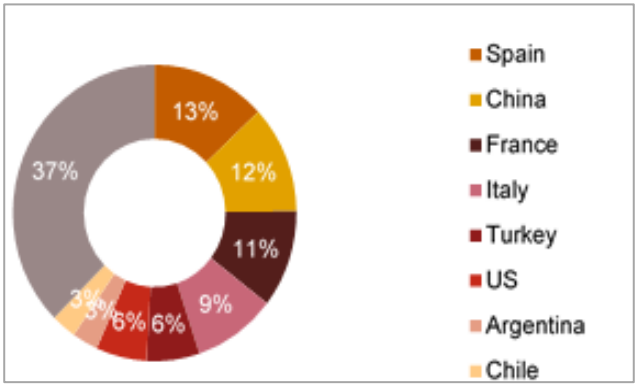


Figure 6. Area under vines (2018; mha)

Wine Production (excluding juices and musts)

Compared with 2017, the production for the majority of European countries has seen a significant increase. Wine production in **Italy** (12.3 mhl), **France** (12.7 mhl), and **Spain** (11.9 mhl) grew notably, as 2017 was a year marked by a historically low harvest due to unfavorable weather conditions[37]. These conditions were more felt in countries like Portugal, Russia, Greece and Bulgaria.

European Union's production in 2018 is estimated to have reached **181.9 mhl, rising 28.3%** when compared with 2017. This is a result of better climate conditions in the main European producer countries, as 2017 was a difficult year regarding this matter. For the worldwide production, it has also seen an **increase of 42 mhl from 2017 to 2018**. The largest wine producers in 2018 were **Italy, France and Spain**.

Wine Consumption

Since 2014, there was observed an almost constant upward trend in the worldwide consumption, as well as a stabilization of consumption in the main European wine-producing countries. However, **in 2018 this growth in the worldwide wine consumption seems to be ending,** which is influenced primarily by a

[37] State of the Vitiviniculture World Market 2018 – OIV, April 2019

slight decrease in the consumption of China and UK. Therefore, in 2018, worldwide consumption is **estimated at 246 mhl**. The **US**, the largest consumer since 2011, continues to record an increase in domestic demand, reaching 33 mhl in 2018. Following the US, comes **France** (26.8 mhl), **Italy** (22.4 mhl) and **Germany** (20 mhl), which continue stable compared to the previous year. Portugal (+5.4%), Australia (+6.15), and Russia (+6.9%) recorded increases in their wine consumptions. Europe still accounts for **~49%** of worldwide consumption.

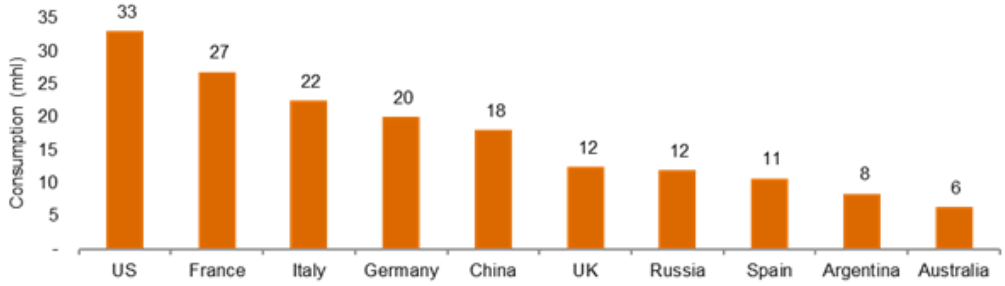


Figure 7. Worldwide Wine Consumption (2018; mhl)[38]

International Trade

In 2018, the world wine market **increased modestly its growth**, both in terms of volume (0.40%) with **108 mhl**, and in terms of value (+1.2%), reaching **€31.3 bn.** Wine trade is largely dominated by **Spain, Italy and France**, which together represent 51% of the world market in terms of volume in 2018. In regards imports, there are 5 main players: **Germany, UK, US, France and China**, which continue to represent more than half of the total imports.

Users, Customers and Stakeholders

The added value of VITIGEOSS will be demonstrated through the whole European wine industry:

1. **Farmers** – They will be one of the main **users/ customers** of VITIGEOSS, as it will allow them to increase the yield of cultivations due to the optimization of grapevine production via the 5 decision support systems
2. **Wine Producers** (Cooperatives, Winemakers, Private Wineries) – Another main **user/ customer** of VITIGEOSS. They will benefit from the reliable forecasts and estimations, having a timely guaranteed delivery of grapes with the quality requirements fulfilled
3. **Distributors** (Wholesalers, Merchant Traders and Auctions) – A **stakeholder** that will benefit from the timely guaranteed delivery of grapes and quality
4. **Upstream Operators** (Fertilizer Producers) – Another **stakeholder** that will benefit from a better planning of resources, which may enable them to improve their products
5. **Retailers** (Foodservices, Supermarkets and Specialty Shops) – **Stakeholder** that will be able to offer the consumers higher quality and sustainable products
6. **Policy Makers** (National, Regional and International Regulators) – **Stakeholder** benefiting from an increase in the sustainability of the business
7. **Environmental Organizations** (NGOs and Associations focused on environmental aspects in agricultural domain) - **Stakeholder** benefiting from an increase in the sustainability of the business
8. **Scientific Community** (Technological Research, Universities) – **Stakeholder** that will benefit from the introduction of innovative technology into the agricultural sector
9. **Society** – **Stakeholder** that will benefit from an increase in food security, new jobs and economic value added created. The production of waste, usage of raw materials and gas emissions will be minimized

There are two main users/ **customers of VITIGEOSS in the wine industry**, the **farmers and wine producers**. This technology assures benefits for the whole value chain, in a market that is quite vast and fragmented, particularly in the EU. Even though the wine market is characterized as being vast, there is still **no solution like VITIGEOSS**. Being products that cover business management aspects of wineries (ERPagro, eVineyard, Vintrace, ISAGRI, Vintegrate, eCellar, eVit), high resolution weather forecasts (Customweather, Weather.com, agro-weather tool), and viticulture features (Climate FieldView, Vintel, e-Stratos, AGRICOLUS, Verde), **there is not yet a tool that integrates all aspects mentioned**, interconnecting the outcomes from the different sources for an overall picture. VITIGEOSS will be the first

[38] State of the Vitiviniculture World Market 2018 – OIV, April 2019

application offering integrated services for sub-seasonal and seasonal predictions, crop management, disease warnings, business operations and **sustainability monitoring**.
In order to attract the potential main users/customers of the technology (farmers, wine producers and agri-service providers), trust in the product has to be created. To reach the potential users of VITIGEOSS, the already existing customer base of VISCA and FruitLook (ELEAF) may be used to conduct local demonstrations to end-users and, furthermore, to engage them in further developments and improvements of the technology (WP6). This will make them feel evolved and understand better how the new features and advances that VITIGEOSS provides will add value to their operations. Also, these end-users will be targeted with workshops and presentations of the product at fairs and events aimed at the viticulture sector. With this, the added value of VITIGEOSS will be demonstrated throughout the whole European wine industry chain.

Individual Business Models
The project comprises 9 partners, 5 of them having plans for exploiting their own foreground. The following exploitation interests/routes are in line with their business and/or research activities:

Table 3. Individual Business cases

ELEAF

eLEAF has existing crop monitoring services captured in the FruitLook portfolio. These services provide insight in crop water use, crop productivity and crop mineral content to clients in the agri-business sector. As example, **FruitLook, in the Western Cape of South Africa**, provides weekly data updates to farmers during their crop growth season, servicing over 70,000 hectares and more than 700 users last year. The services provided are based on satellite imagery, weather data and a range of other geo-information data. It enables agricultural business to improve productivity, reduce water use and generally increase their efficiency of farming. **FruitLook is commercially available to farmers all over the world**. eLEAF participates in VITIGEOSS to integrate FruitLook and services from other providers, allowing the establishment of a one-stop-shop for viticultural applications in Southern Europe plus the development of new innovative services to farmers. The impact and value of smart information services is demonstrated via the project. This increases the chance of successful uptake as the functionality of VITIGEOSS can be proven in an agribusiness environment. Overall this project enables us to expand our market in (southern) Europe, create visibility, demonstrate the added value of our services and those of the other partners and generating concrete impact via the VITIGEOSS portal.
eLEAF is currently active on a global scale and in a variety of high value crops (cereals, potatoes, grapes, sugarcane, fruit trees, e.g. Stone fruit, Apple, Pear, Tropical fruit etc.)**. Relevant uptake in the agri-business sector is listed below.**

Regions	Russia	Ukraine	Europe	Africa (without South Africa)	South Africa
Acreage (ha)	30,000	16,500	not active	51,000	75,000

LINKS

LINKS is a research centre with strong competences on ICT and it has participated in VISCA building a platform able to ingest weather, phenological and irrigation forecasts in order to support wine maker in fighting against the adverse effects of climate change. The main goal of LINKS in VITIGEOSS is to apply Deep Neural Networks to create a set of novel algorithms for the detection of phenological phases and key crop status coupling satellite imagery from Copernicus with images taken from fixed cameras or other devices such as drones. The aforementioned models will be operationalized into Cloud-based services to accurate and reliable data to the VITIGEOSS platform.

EUT

EUT aims to validate new predictive algorithms combining the weather, crop status and phenological services developed in the project from satellite data even select the best solution considering also current solutions in the market achieving an improvement in the precision of the disease alerts and in the treatments scheduling to allow its maximum effectivity and reduce the application of pesticides.
On the other hand, in the project we are deploying a novel monitoring environment to get information from machinery in order to know how it is being used to apply precise agriculture methodologies (different treatments in a field) and creating a new source of information to validate and improve current management and operational strategies and also to better calculate sustainability KPIs

Finally, an optimization tool is planned to be adapted to minimize the resources used and maximize its profit considering row materials like working hours of people and machinery and pesticides or water in the yearly management of vineyards.
BSC
The aim of BSC is to do user oriented research to develop climate services (software development), as well as showcase the potential applications of these systems to present the latest methodologies on sub-seasonal to seasonal climate predictions and implement advance methodologies. Within VITIGEOSS, we aim at using the co-developed Decision Support System as a successful story to promote the creation of climate services in agriculture and other sectors.
NAP
University who does research on vineyards phenology to predict and forecast the stages of the vine lifecycle. In VITIGEOSS, they provide a forecasting model that was developed and improved during many years (to take into account different grape varieties, climate conditions, etc.). The aim of NAP within VITIGEOSS is to make an agreement with the company exploiting the phenology service (here LINKS), so they will have access to the executable compiled file for the service to provide the phenology stages forecasting. During VITIGEOSS other options will be analysed (open sourcing, spin-offs, etc.)

Table 4. VITIGEOSS exploitable results

N.	Exploitable result.	Value proposition / value for outbidding competition.	Users, sectors of application	Potential IPR	Ownership & exploitation route
1	IS able to detect phenological phases coupling satellite imagery from Copernicus and in-field pictures (LINKS)	Automatic detection of phenological phases and key crop indicators (leaf area, water stress)	Agriculture	Licence	IP transfer from LINKS to a company
2	Real-time operational climate predictions system tailored to agriculture (BSC)	Tailored and robust climate prediction system	Agriculture, water management	License /pay-per-use	IP transfer from BSC to a company, licensing, scientific publications.
3	Tailored agricultural solutions/services based on eLEAF and third party services related to the wine industry (ELEAF)	Unique solutions for wine farming practices lead to direct improvements in productivity and more sustainable production.	Wine farmers and chain partners that operate on a large scale	IP owner	Individual services remain in the ownership of the respective partners, integrated services are co-owned by cooperating service providers. All partners sell their individual and composite services through VITIGEOSS.
4	API web store included in the VITIGEOSS portal which is able to connect to 3rd party services, combine services and make them public (ELEAF)	Expansion of the market by increasing the reach of existing services/service providers.	Agri service providers	IP owner	Individual services remain in the ownership of the respective partners. eLEAF makes the service available to the wine sector via the VITIGEOSS portal. Users pay a registration fee for services on the portal, part of which is going into maintenance and provision of the VITIGEOSS infrastructure.

5	The VITIGEOSS portal as the entry point for a wide range of services related to the wine industry (ELEAF)	Providing a single point-of-entry to end-users making use of smart information services more efficient and impactful.	Agricultural businesses	IP owner	Via VITIGEOSS portal point 1 and 2 are made feasible.
6	IS for disease management (EUT)	Precise early warning alerts and disease management plans	Agriculture	License /pay-per-use	To ELEAF or another service providers (Licensing) End users (pay-per-use)
7	Data platform including data from machinery for sustainable and precision agriculture management (EUT)	Data platform and multi-purpose data logger device to connect on vehicles and get data from sensors	Agriculture, industrial, construction, fleet management	License /pay-per-use/pay-per-device	To ELEAF or another service providers (Licensing) End users (pay-per-use)
8	Vineyard optimization tool for more sustainable management (EUT)	Flexible tool for optimal operation on schedules of tasks with limited resources. Usage of forecasts to improve optimization.	All companies requiring optimal task and resources planning	License /pay-per-use	To ELEAF or another service providers (Licensing) End users (pay-per-use)

VITIGEOSS "as a whole" business plan

VITIGEOSS business plan is to become a service provider for relevant actors of the whole European wine industry (mainly farmers and wine producers), to optimize resources, increase sustainability, and facilitate management of the fields. The following simplified Lean-CANVAS diagram summarises the key aspects of this business case (**Figure 8**).

Key Partners	**Key Activities**	**Value Proposition**	**Customer Relationships**	**Customer Segments**
ELEAF EUT LINKS BSC NAP	Data collection and forecasts at different levels: climate conditions, diseases identification, phonological stages, crop status Business & sustainability management operations Device Suppport Systems development Dissemination and Exploitation	To make the wine industry more resilient to climate changes, with a more efficient usage of resources, minimizing costs, improving quantity and quality, and developing a more sustainable business, meeting the current and future societal needs To improve the efficiency and profitability of the vineyard thanks to accurate mapping, image processing, algorithms and modeling, altogether combined with viticulture know-how operations that makes possible to extract useful indicators for a better management of vineyards and optimization of agricultural processes	Reliable information Data security Client assistance and maintenance Quick response	Farmers Wine Producers Agri-service providers
	Key Resources Data (Satellites, in-field), modelling and algorithms Device Support Systems Employees Direct sales management/ retailers		**Channels** Wholesale – eLEAF B2B – technology directly delivered to farmers and wine producers	

Cost Structure	**Revenue Streams**
Online data storage and processing In-field data sources and device support systems maintenance Marketing and communication costs	VITIGEOSS selling Service Fee (model updates, system maintenance)

Figure 8. Preliminary Business Canvas Model

The preferred business cases for LINKS, EUT and BSC (owners of phenology, weather, disease and business & sustainability services) **is to transfer the IP to a company that will be able to commercialize the created services** through a royalty or licencing scheme, or by selling the entire IP. **ELEAF is the main target of such IP transfer** but other options will be evaluated as well. If some end users want exclusive contracts with LINKS, EUT and BSC services, a pay per use service could be managed provably through a spin-off. To be considered after the project if opportunities are clear.
As a guarantee of the validation and evaluation of the final product, the 3 end-users belonging to the consortium (SYM, MBD, TOR), will test the tool at their own sites (pilots of more than 2 hectars each), and it is expected that these **partners remain as customers (**During the project and thereafter this fact is **key to gain market share)**. In addition, BSC and EUT, with remarkable communication departments, will support the capacity building among commercial developers and knowledge transfer to stakeholders and local communities.

The fact that the **platform is modular and interoperable** will facilitate the commercial activity, since farmers or producers will be able to **pay for the service of their highest interest** (we are aware that in many cases, farmers have already tools e.g. for irrigation management, or weather forecasting), facilitating its penetration among different actors of the wine European sector, or even to stakeholders belonging to other agricultural sectors: some services (weather, crop status, business & sustainability) don´t work with specific models for vineyards, so they can be directly sold after the project. The others (phenology, disease) can be easily adapted by changing the prediction model to the one used for the desired crop.

ELEAF would enter the South European agricultural production market thanks to VITIGEOSS and will focus on commercial sales to, primarily, farming operations in the wine sector as well as potential other agricultural clients. **eLEAF will look to introduce VITGEOSS in South Africa and Australia, where they already have larger farming operations as customers**. Moreover, **some of the activities linked with the project already have a customer's base** that can be used for a quick scale-up to the market.

Business Strategy

1. Product

VITIGEOSS main feature is to provide **tailor-made services combining data collected from satellites, climate models, fixed cameras, in-field technologies, and end-users information under a single platform.** It provides a wide range of services, from **real-time operational climate predictions** tailored to agriculture, to services able to **detect phenological phases and key crop status**, services to **disease management** and logistic applications. This technology will help farmers **managing their harvesting operations** and **optimizing their vineyards**, which entails **cost reductions and higher efficiencies while contributing to emissions reduction and achievement of sustainable indicators**

2. Targets

There are two customer target groups. The first is in the **large-scale agricultural and horticultural business segment**, mainly to southern European wine producers. In this case, the strategy will be based on: (i) Generate trust in the services with a local demonstration in this project, (ii) Increase the relevance to the target group by involving the end-users in the development of services and (iii) Increase the value of the portal by bundling 5 services together. The second target are the **agri-service providers who will offer an attractive portal where they display their own applications and services alongside VITIGEOSS'**. The portal will have a base set of users (VITIGEOSS) and generates exposure of all partners' users to the services and applications. This segment will enable the expansion of the user base to new regions and new crops. Here the business strategy will be based in (i) Find the right way of billing different partners, (ii) Make development as easy as possible so new and improved services occur on the portal, and (iii) Inclusion: service providers benefit from having more (data) resources for their services.

3. Channels

There are **two main preliminary channels** that have been identified: **B2B and wholesale.**

- VITIGEOSS may be commercialized in the future by either be transferred to a company that is able to commercialize the created services through a royalty or licensing scheme, or even by selling the business. eLEAF is the main target for this transfer/ sell, but other options will be evaluated as well.

- Also, if some end users in the viticulture sector want exclusive contracts, a pay per use service could be managed.

Additional dissemination channels have also been thought:
- Articles detailing success stories in relevant sector journals/magazines (popular science)
- Direct engagement with stakeholders during VITIGEOSS Workshops
- Presentations at conferences, trade shows or similar events aimed at the viticulture sector.

4. Financials

This section aims at estimating on a very broad level the potential revenues for this product over 10 years. It is important to note that this preliminary valuation of revenue excludes other business opportunities generated by the technology such worldwide market, other crops in the agriculture industry or even other industries outside the agriculture domain where similar technology can be leveraged.

Considering the information provided by eLeaf, the **southern European wine sector (which represents the primary addressable market) counts with about 2.5 m hectares**. eLeaf estimates that VITIGEOSS will cover **10% of the market share in terms of area covered**. Considering FruitLook technology's current price tag of **€10 per hectare, per year**, VITIGEOSS would generate an additional **€ 2.5 million in revenue over 10 years.** Additionally, LINKS has estimated an additional a 3% revenue growth in 5 years, which represents **€ 0.5 million.** This value has been extrapolated over the 10-year horizon assuming the same CAGR. A graph containing the aforementioned assumptions can be found below.

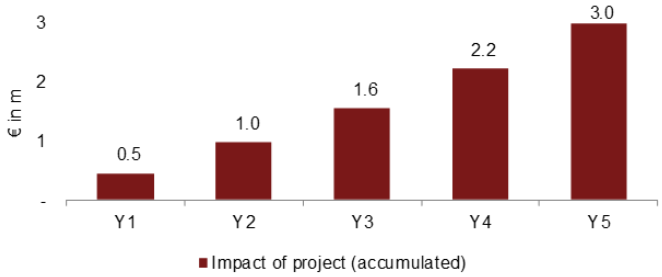


Figure 9. Preliminary accumulated revenue of VITIGEOSS

This forecast is only limited to Southern European, although it is foreseen European and Worldwide penetration as well. These assumptions will be reviewed during the project to validate customer's willingness to pay.

Knowledge Management Strategy and IPR

VITIGEOSS is designed to advance the state-of-the-art in several domains, including weather forecasts, hazard now casting and forecasting, data management and data analytics, which are areas where significant findings subject to intellectual property protection are expected to be generated. Thus, there is a strong need to manage IPR issues and the innovations that will result. VITIGEOSS will rely upon open standards for representing and processing multilingual and semantic data to assure interoperability, sustainability, and broad uptake across industries and countries. Where possible, data will be shared and thus made accessible for its reuse. Some data will not be published due to its confidentiality and IPR protection by businesses that consider their data as branding assets. EUT, as coordinator, will take the supervision of this activity in accordance with H2020 Guidelines for IPR:

- **Ownership of background knowledge**, including methods and technologies, is unaffected by the project. Details on key IP background brought by project partners will be specified in the Consortium Agreement.
- **Access rights to background** is granted to project partners in need-to-know basis during project implementation and for exploitation purposes.
- **Ownership of foreground** has already been identified at proposal stage (Table 4) and will be regularly monitored in case new results or sub-results arise, ownership rights change or IP protection mechanisms are to be established. Partners owning IP will assess the existing IP in the field that it is likely to affect their research in order to determine their freedom to operate and develop a sound protection strategy. If appropriate, they will start the patent filing process.

- Finally, **access rights to foreground** will be mapped against the final list of exploitable results and agreed under fair and reasonable conditions. This will ensure future exploitability, especially for those partners pursuing market opportunities arising from the project results

The consortium will review this strategy and elaborate on critical background in the initial Consortium Agreement (based on DESCA model), which will provide further details on topics of ownerships, access rights, communication of knowledge, and confidentiality among others. Ownership and conditions of access rights to the foreground, in particular for all those results which are joint ownerships will be further specified and, when applicable quantified, in the project's final Exploitation Agreement.

Interoperability; Standards and Metadata: We will use a standardized approach to data curation and storage based on Open and Linked Data standards. All the data within the project will be available using well known formats or documented accordingly. Data will be always published including extensive metadata that will refer to the data format. The main formats used in the shared files will be JSON, geoJSON, Shapefiles, XML, CSV or OGC standards (e.g. WMS).

2.2.2 Dissemination of results

VITIGEOSS dissemination strategy covers all WPs, but is specifically addressed by WP6. Dissemination activities will be undertaken as part of an overall strategy defined in the preliminary **Communication and Dissemination Plan** (CDP, D6.4) that will be delivered in the early stages of the project (M6) and updated later on (M18). The dissemination plan will have the following objectives:

- Ensure that the project objectives and outcomes reach the relevant target groups, especially end users from the wine sector (farmers and wine producers)
- Spread the use of Earth Observation services among the wine industry as well as other agricultural crops and food systems
- Build capacity among current and potential users of commercial products within the wine sector and beyond
- Showcase new European capabilities combining smart services and ease the uptake of these technologies by the European wine industry and global markets

Dissemination aims at maximizing knowledge transfer to stakeholders that can best make use of them (Table 5), therefore, enhancing stakeholder engagement. This will maximise the impact of research and enable an adequate use and uptake of results.

Table 5. Dissemination materials: target stakeholders and expected impacts

Channels	Target audience	Number	Expected impacts
VITIGEOSS website	- European wine industry - Farmers - Downstream operators (wine producers and distributors) - Upstream operators (e.g., fertilizer producers) - Rural communities - Policy makers - Other stakeholders (retailers, environmental organizations, scientific community) - Earth Observations community - Climate services community - Society as a whole	1	Raise awareness about the project results to all possible audiences

Technical webinars	- European wine industry - Farmers - Downstream operators (wine producers and distributors) - Upstream operators (e.g., fertilizer producers) - Other stakeholders (retailers, environmental organizations, scientific community) - Earth Observations community - Climate services community	3	Foster the possibility of exploitation of some particular components of the platform developed in VITIGEOSS across the value chain of wine
Participatory workshops	- European wine industry - Farmers - Downstream operators (wine producers and distributors) - Upstream operators (e.g., fertilizer producers) - Earth Observations community	2	Present the platform to the wine community to spread the use of EO services
Demo video	- European wine industry - Farmers - Downstream operators (wine producers and distributors) - Upstream operators (e.g., fertilizer producers) - Rural communities - Policy makers - Other stakeholders (retailers, environmental organizations, scientific community) - Earth Observations community - Climate services community	1	Enhance communication about the possibilities offered by the products developed in VITIGEOSS (contextualizing challenges, motivations and outcomes)
Info sheets	- European wine industry - Farmers - Downstream operators (wine producers and distributors) - Upstream operators (e.g., fertilizer producers) - Other stakeholders (retailers, environmental organizations, scientific community) - Earth Observations community - Climate services community	6	Facilitate the use of knowledge generated by the project
Local stakeholder sessions	- Farmers - Rural communities	3	Raise awareness on the project results and share experiences to adjust the products to potential users' expectations
Executive summary	- European wine industry - Farmers - Downstream operators (wine producers and distributors) - Upstream operators (e.g., fertilizer producers) - Policy makers	1	Project legacy (highlighting the main obtained results)
Project reports	- Scientific community - Earth Observations community - Climate services community - VITIGEOSS consortium	5	Provide new knowledge and technology useful for the research, EO and CS communities

Papers for peer-reviewed literature	- Scientific community - Earth Observations community - Climate services community	5	Increase the scientific impact of the project
Dissemination in international fora of relevance	- European wine industry - Farmers - Downstream operators (wine producers and distributors) - Upstream operators (e.g., fertilizer producers) - Earth Observations community	10	Raise awareness about the project in general and its results to all possible kinds of audiences

To spread the key messages of the project to the relevant audiences, we propose a comprehensive set of modern dissemination tools for online facilitation that make use of the most effective channels. Additional dissemination tools, including technical webinars and participatory workshops, are also meant to build capacity within the user community. Dissemination tools will ensure a two-way communication approach, and include:

- **VITIGEOSS website:** The VITIGEOSS official website will provide a high-level description of the project and its objectives aimed at end users from the wine sector and the general public. The website will contain detailed project outputs, such as public reports and links to scientific publications, but also general information about the project, news and dissemination material. It will also have a link to VITIGEOSS social media. Maintenance and updates of online content will be outlined in the communication and dissemination plan (D6.4).
- **Technical webinars:** Three technical webinars addressed to potential service providers within the wine sector and beyond will be organised to foster the possibility of exploitation of particular components of the platform.
- **Participatory workshops:** Two workshops will be organised during the second half of the project to share lessons learned, present the platform to the wine industry and disseminate the main project achievements, with the focus on spreading the use of EO services. The workshops will comprise seminars and training courses on data analysis, satellite data acquisition and probabilistic climate forecasts for decision-making, and will be organised as side events of renowned fairs or conferences to take advantage of specialized audiences.
- **Video:** VITIGEOSS will develop a “demo” video to guide users through the different smart services and the platform developed in the project. These types of products are a suitable way to communicate a set of different options that can be explored by users.
- **Dissemination materials:** Dissemination materials will be created to present a selection of project results. Material will be mainly distributed online, although some printed material will be made available at key events. These will include at least 6 info sheets presenting the 5 VITIGEOSS smart services and the Integrated Vineyard Management platform.
- **Local stakeholder sessions:** Three special sessions will be organised during the project general assemblies at each of the 3 users’ premises. Sessions will focus on sustainable practices to improve productivity and will be addressed to local farmers and rural communities.
- **Executive summary:** Towards the end of the project, VITIGEOSS will provide an executive summary highlighting the relevant results obtained in the project, including the work done at the demo sites that belong to users participating in the consortium as well as the smart services and project platform developed. When relevant, potential application for decision and policy making will be described.
- **Project reports:** Public project deliverables will be made openly accessible on the VITIGEOSS website to broadly share useful results and conclusions.
- **Papers for peer-reviewed literature:** Scientific papers created within VITIGEOSS will be published in open access peer-reviewed literature to reach the scientific community. Papers will be advertised through the project website.
- **Promotion and dissemination of results in international fora of relevance:** The VITIGEOSS consortium will participate in dedicated events on wine and smart agriculture, including conferences, exhibitions, workshops and seminars at national, EU and international levels (see below list of conferences

that can be considered). Attention will also be given to the interaction with the Earth Observation communities as well as to the collaboration other projects with agricultural focus. List of potential events:

European Conference on Precision Agriculture, International Congress on Vine and Wine; OENOVITI; VINITALY; GIESCO; VINOBLE; FENAVIN; VINEXPO; PROWEIN; EXPORIVE; FOOD TECH TRADE; ALIMENTARIA; ALIBETOPIAS; FIMA International Fair of Agricultural Machinery; Salon International de l'Agriculture; SITEVI; AVCSA; Annual Workshop of EuroGEOSS; Events of the Food & Nutrition cluster; Events of the INNOVI cluster; Events of the Technological Platform on Wine; Events of the Foundation of Agrofood cooperatives of Catalonia, etc.

Synergies with EU projects, international initiatives and knowledge hubs
Effective coordination with other national, European and international activities will be a key factor for maximising the impact of VITIGEOSS. The project will exploit the connections that the consortium has with other projects and initiatives described in section 2.1.1. Interactions with **EuroGEOSS** will be made by joining 2 actions groups (climate and agriculture), as well as with **NextGEOSS,** by contributing to their data catalogue. VITIGEOSS actions will be aligned with the UN Sustainable Development Goals, in particular SDG 2 (provide food for everyone), SDG 6 (avoid wasting water), SDG 8 (sustainable economic growth) SDG 12 (sustainable production) and 13 (climate action). Last but not least, interactions with Innovation and Agricultural Hubs (e.g., Smart Agri Hubs, Digital Innovation Hubs, Climate-Smart Agriculture Booster, etc.) will be sought.

Management of generated information

Europe's General Data Protection Regulation (GDPR) **-** The management of personal data will be limited to user accounts for the Portal application. Within the portal infrastructure the GDPR is followed by deploying single sign on and hyperledger that uses different levels of data privacy for the data channels, private transactions and zero-knowledge proofs. The latter cryptographic tools for example allow the consortium to proof the validity of a customer's id to gain access to part of the system, without actually revealing the identity of the person. It also allows for easy, authorized access to decentralized data reducing vulnerability of the system and facilitating scaling up. VITIGEOSS will take into account the EU directives related to both users' rights relating to electronic communications networks and services, and to the processing of personal data and the protection of privacy in the electronic communications sector. The EU directives are the 2009/136/EC and the General Data Protection Regulation (GDPR).

Data management **-** The knowledge management within VITIGEOSS will serve the two purposes of (i) enabling massive dissemination activities that will allow continuous sharing of data among partners and safe access by other research groups to take up from data generated; and (ii) creating the portfolio on data and intellectual property that will be the core of the exploitation strategy. The project will define and execute a Data Management Plan (DMP) to ensure the accurate management of the whole data lifecycle in the system. The DMP will define metadata standards for the geo-information and data according to the EU INSPIRE directive, and will pre-define the work flow for the data processing, storage, and access of all data used and products generated within the project (Data set reference and name, Data set description, Standards and metadata, Data sharing i.e. how data will be shared and Archiving and preservation, including storage and backup)

Data publishing - During the project, it will be decided and stated in the Data Management Plan the place and method where the project resulting datasets will be stored. A data repository will be chosen to store the relevant datasets of the project. A metadata file will be assigned to datasets for effective and persistent citation when it is uploaded to the decided repository. This metadata file can be used in any relevant publications to direct readers to the underlying dataset. The metadata file will be stored in the project dataset section in the decided repository.
Making data FAIR - The project resulting sharing data should be deposited in the project repository as soon as possible unless a decision has been taken to protect results. Specifically, research data needed to validate the results in the scientific publications should ideally be deposited in the data repository at the same time as the publication occurs. During embargo/restriction periods, information about the restricted data will be published in the data repository, and details of when the data will become available again will

be included in the metadata. Restricted data will be agreed amongst all partners. Where a restriction on open access to data is necessary, attempts will be made to make data available under controlled conditions to other individual researchers. Data must be made available to partners upon request, including in the context of checks, reviews, audits or investigations. Data will be made accessible and available for re-use and secondary analysis. All the public data of the project will be openly accessible at the repository. Non-public data will be archived at the repository using a non-visible, indexed directory in the repository.

Open accessibility **-** The datasets will be made available for re-use through uploads to the dataset repository for the project. In principle, the data will be stored in the project repository after the conclusion of the Project without additional cost. All the research data will be of the highest quality, have long-term validity and will be well documented in order other researchers to be able to get access and use them after 5 years. If datasets are updated, the partner that possesses the data has the responsibility to manage the different versions and to make sure that the latest version is available in the case of publicly available data. Quality control of the data is the responsibility of the relevant responsible partner generating the data.

Allocation of resources **-** There are no immediate costs anticipated to make the datasets produced in the project. The datasets will be deposited in the project repository for at least 5 years after the conclusion of the project. Each project partner should respect the policies set out in the resulting Data Management Plan. Datasets have to be created, managed and stored appropriately and in line with European Commission and local legislation. Dataset validation and registration of metadata and backing up data for sharing through repositories is the responsibility of the partner that generates the data. The datasets in the repository project will be preserved in line with the European Commission Data Deposit Policy.

Open Research Data **-** The consortium strongly believes in the concepts of open science, and in the benefit that the European innovation ecosystem and economy can draw from allowing reusing data at a larger scale. Therefore, a number of valuable datasets produced by the project can potentially be published with open access – though this objective will obviously need to be balanced with the other principles described below.

As regards to journal publications which will be produced, the partners of the consortium are committed to **ensuring the open access to their publications**, according the "Gold Open Access" model. The "Green Open Access" model will be adopted when possible, given that the scientific papers that the consortium is expected to generate are based on sensitive data, it is considered a less viable option, and the Gold option following acceptance of the papers by a journal is the best solution that the consortium intends to adopt

2.2.4. Communication activities

Communication activities will consist in taking strategic and targeted measures for promoting the project and its results to a multitude of audiences, including the media and the general public. The aim is to show the benefits of research and possibly engaging in a two-way exchange with these various audiences. Communication actions will be described in the CDP (D6.4), providing the framework for the development of communication tasks along the lifetime of the project and detailing target audiences, communication tools and channels, key messages and practical information such as branding project style, logo, guidelines, templates, etc. The project communication activities are divided between the internal communication and external communication.

Internal communication

Internal communication within VITIGEOSS will assist with timely completion of tasks and deliverables, contributing to a better integration across WPs. Face-to-face and online meetings among VITIGEOSS teams as well as annual General Assemblies will help to strengthen the scientific relationship between consortium members. Communication via e-mail, video conferencing and phone will be encouraged to contribute to cost effectiveness and reduce the project environmental footprint.

External communication

VITIGEOSS external communication will make use of online digital methods whenever possible. Printed or physical communication tools will be produced when necessary, including a project brochure, roll-up and posters. VITIGEOSS consortium members rely on widely connected institutions with experienced communication teams, including EUT and BSC. Tools for communication will include:

- **VITIGEOSS website and social media:** The VITIGEOSS website and social media will be used for communicating project results with high impact multimedia communication material, publishing press

releases and compiling different communication materials of relevance for different audiences. By regular updates on the project progress, news, relevant events and information related to the VITIGEOSS topics, online tools will assure a strong visibility of the project.

- **Visual identity materials:** VITIGEOSS will develop a recognisable visual identity that will include the project logo, design elements, colours and fonts. This visual identity will be also applied to other project materials such as letter templates, presentations, reports and newsletters.
- **Communication and PR materials:** Communication materials will be created to increase the visibility of the project among general audiences and will include a project brochure, a roll-up, 4 posters (in English, Spanish, Portuguese and Italian).
- **Press releases:** Press releases will be used for targeted media outreach involving national newspapers and other specialized press. Press releases will include informative texts and visual materials (graphs, pictures, etc.). The communication departments of VITIGEOSS partners will support press releases with national language versions when appropriate. Relevant magazines/publications where VITIGEOSS could be disseminated below:

Fruitnet media international: Eurofruit (Europe); Mon-VITI (France); Wine & Viticulture Journal (Australia and New Zealand); Future Farming; GIS Professional; MDPI, Remote sensing; Geospatial World; IEEE, Advancing Technology for Humanity; Earth. The Science behind the Headlines; http://www.earthobservations.org (blog); DownToEarth; Enoviticultura magazine (Spain).

Participation to international events: Project visibility will also be increased by the participation to in international events targeting communities strongly related to the project objectives (the wine sector industry and the EO community) as well as other stakeholders for which the methodological approach and the results of the project could be of interest (including the climate services community, NGOs, the Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) communities, the forestry sector, etc.)
We will present VITIGEOSS results at conferences, fairs, exhibitions and workshops at national, EU and international levels. We will attend events covering, but not limited, to the topics of smart agriculture, wine, food, and other topics relevant for the project. The project will exploit the connections that the consortium has with other projects and initiatives. Interactions with Innovation and Agricultural Hubs (e.g., Smart Agri Hubs, Digital Innovation Hubs, Climate-Smart Agriculture Booster, etc.) will be seek. VITIGEOSS actions will also be aligned with the UN Sustainable Development Goals, in particular SDG 2 (provide food for everyone), SDG 6 (avoid wasting water), SDG 8 (sustainable economic growth) SDG 12 (sustainable production) 13 (climate action) and 15 (sustainable use of terrestrial ecosystems).

Table 6. Communication materials: target stakeholders and expected impacts

Channels/materials	Target audience	Number	Expected impacts
VITIGEOSS website and social media	- European wine industry (farmers, upstream operators, downstream operators, etc.) - Earth Observations community - Policy makers - Other stakeholders (retailers, environmental organizations, scientific community) - Climate services community - Media - Society as a whole - VITIGEOSS consortium	1 website, linkedin, tweeter, facebook	Raise awareness about the project to all possible audiences
Communication and PR materials	- Policy makers - Other stakeholders (retailers, environmental organizations, scientific community) - Climate services community - Media	1 roll-up, 1 brochure, 4 posters (in 4 languages)	

	- Society as a whole		
Press releases	- Media	At least 1 at the beginning of the project and 1 for General Assembly	
Participation to international events (including EuroGEOSS and Copernicus related events)	- Policy makers - Scientific community and environmental organizations - Climate services community - Media	15	

3. Implementation

3.1 Work plan — Work packages, deliverables

Table 7. List of work packages[39]

WP Nº	WP Title	Lead Participant Nº	LPSN	Person-Months	Start Month	End month
1	Project Management	1	EUT	49	01	42
2	Intelligent (information) services on vineyard management	1	EUT	119	01	32
3	Integrated Vineyard Management Application Portal (DSS)	3	ELEAF	65,5	01	42
4	Demonstration	6	NAP	94	01	42
5	Commercial innovation and market penetration	5	PWC	50,5	12	42
6	Communication & Dissemination	4	BSC	70,5	01	42
				448,5		

The project will last 42 months, allowing at least 3 vegetative seasons for testing and validation in 3 different Mediterranean locations. Technological innovation is going to be carried out in **WP2** and **WP3**, where co-development of services with end users, design and implementation of the DSS is going to be carried out. The information gathered during **WP4** (through the deployment of the tool) by end users will be used to give feedback to refine models (WP2) and improve the technical design (WP3). **WP5** is devoted to market-uptake activities, fed with results and outcomes from WP2, WP3 and WP4. Dissemination and communication activities are covered in **WP6**, with a special interest in capacity building and transfer knowledge. Figure 10 shows the Pert diagram of the project, presenting the information flows between WPs.

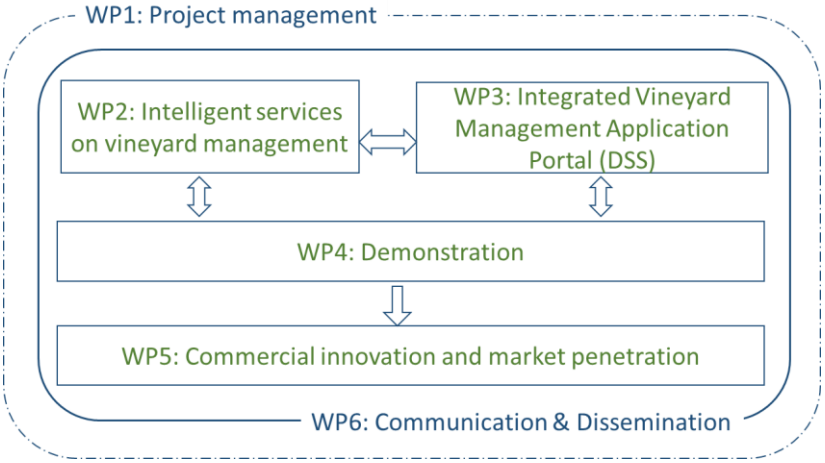


Figure 10. Pert diagram VITIGEOSS

[39] Work Package = WP

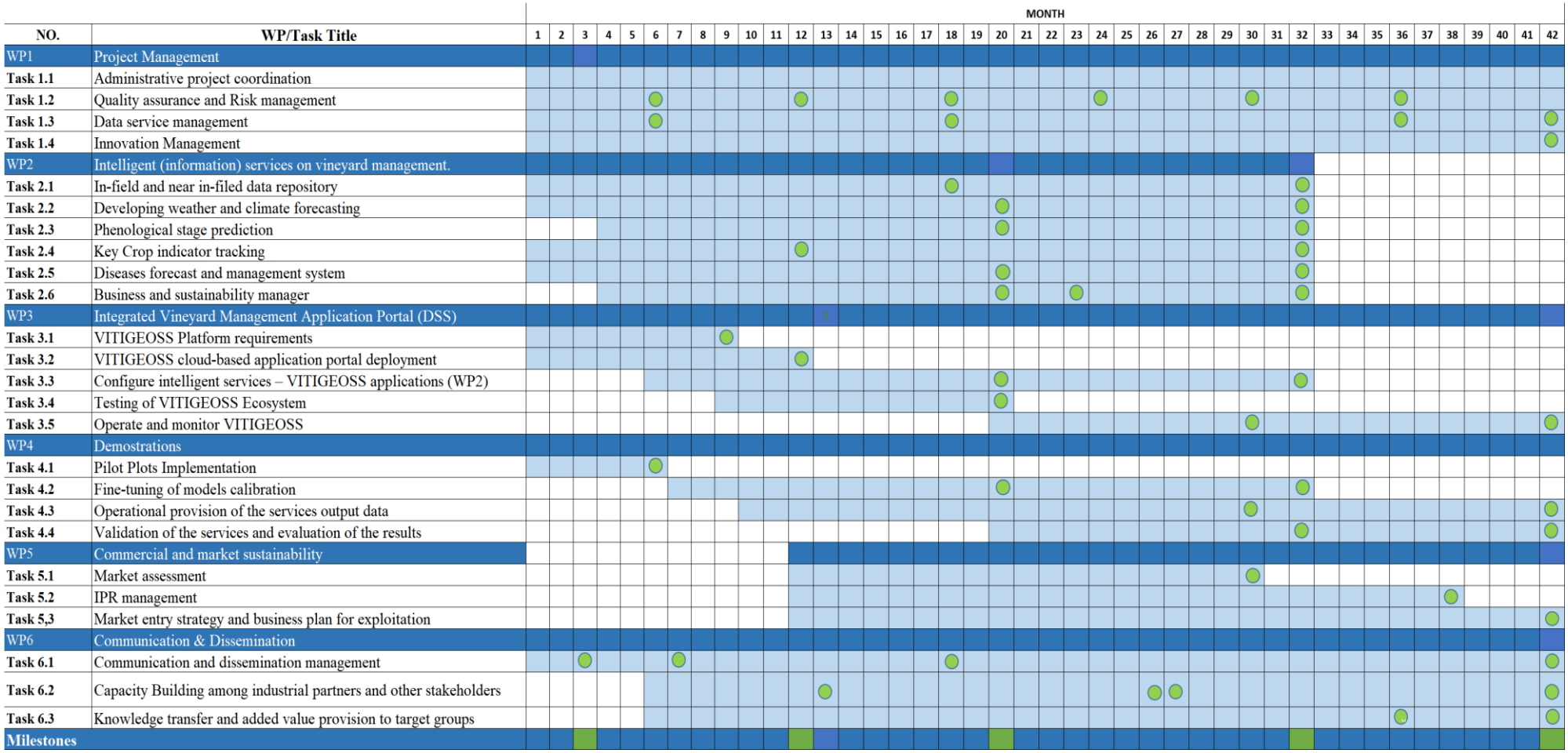


Figure 11. Gannt Chart (Circle = Deliverable; Green cell = Milestone)

3.1.1 Work packages description

WP Nº	1		**Lead beneficiary**					**EUT**	
WP title	Project Management								
Participant Nº	1	2	3	4	5	6	7	8	9
Short name	EUT	LINKS	ELEAF	BSC	PWC	NAP	MBD	TOR	SYM
Person months	**19**	**8,5**	**5,5**	**1**	**8**	**3**	**1**	**1**	**2**
Start month	M01				**End month**		M42		

Objectives:

The scope of this WP is the overall management of the activities to be performed in the project, including:

- Administration and Financial affairs
- Quality assurance
- Risk management
- Data Management
- Innovation management

Description of work

Task 1.1 Administrative project coordination (M01-M42) (**EUT,** All partners**)**

This task will deal with the overall coordination of the project by managing and promoting the interactions among different WPs, ensuring an efficient internal communication, monitoring the progress of the project and the quality of major project outputs. The task also includes the management of legal, contractual, financial and administrative aspects of the project, such as:

- Reports to EC;
- Management of the financial contribution from EC;
- Organization of progress/team meetings;
- Tracking of costs and compliance with Grant Agreement;
- Consolidation of the consortium agreement, (using latest DESCA template);
- Creation and maintenance of the various operational structures (as described in section 3.2)
- Ensure internal dissemination of project information among the consortium members.

General project meetings will be scheduled every six months to check progress against milestones and assess management issues.

Task 1.2: Quality assurance and Risk management (M01-M42) (**LINKS,** EUT, All partners**)**

This task will take up a quality management approach by controlling reported resource usage, review of project documents and results, maintenance of the project work plan and monitoring the progress in all WPs (in terms of project plans and quality measures). Moreover, an initial risk management plan will also be implemented to identify potential mishaps during the entire project execution and prepare action plan that will deal with them should they emerge. Provisions will be taken to minimize potential problems. The management will be punctual and continuous, with the attitude to prevent possible failures or difficulties rather than waiting to solve them when they had already been evident. A preliminary risk management plan will be delivered at M06, and updated regularly with newly detected hazards.

Task 1.3: Data service management (M01-M42) (**ELEAF,** All partners**)**

The project will define and execute a Data Management Plan to ensure the accurate management of the data streams throughout the system. The Data Management Plan will describe the data management life cycle for any datasets to be collected, processed and/or generated by a research project. It will cover:

- The handling of research data during and after the project
- What data will be collected, processed or generated
- What methodology and standards will be applied
- Whether data will be shared/made open and how
- How data will be curated and preserved

Task 1.4: Innovation Management (M01-M42) (PWC, All partners**)**
The aim of this task is to ensure the proper management of innovation during the project and, at the same time, advice companies about implementing successful innovation strategies beyond the project's framework. The project represents a great opportunity for exchanging synergies among participants as well as supporting them to integrate innovation processes into its business model. It will be also a tool to collect and plan all the possible unexpected project outcomes, in terms of novel products, business models, architecture of the value chain, etc. Special attention will be put on identifying shortcuts or fast lanes for small project outcomes to reach the market as early as possible.

Deliverables (Project periodic reporting is not included here as it is a contractual obligation in the GA)
D1.1: Risk management plan (M06-M12-M18-M24-M30-M36) - It will identify potential mishaps during the execution of the project and related recovery actions, setting mitigation actions, including risk prevention measures. It will be issued at an early stage of the project, and then updated continuously.
D1.2: Data Management Plan (M06-M18-M36-M42) - It will describe the data management life cycle for any data to be collected, processed and/or generated by the project. It will be used as a standard data guideline for the project consortium to ensure interoperability and sharing for public data generated by the project.
D1.3: Innovation Management outcomes analysis (M42) - The analysis of all outcomes resulting from the management of innovation during the project will be presented at the end of VITIGEOSS

WP Nº	**2**		**Lead beneficiary**			**EUT**			
WP title	**Intelligent (information) services on vineyard management.**								
Participant Nº	1	2	3	4	5	6	7	8	9
Short name	EUT	LINKS	ELEAF	BSC	PWC	NAP	MBD	TOR	SYM
Person months	**30,5**	**14**	**13,5**	**23,5**	**1**	**5**	**9**	**9,5**	**13**
Start month	01				**End month**		32		

Description of work
WP2 will design and operationally deliver a set of Intelligent Services (ISs) aimed to feed the VITIGEOSS platform to promote a more effective vineyard management and decision support. These ISs will be based on GEOSS data that will be downscaled in some cases to obtain more precise results and recommendation with the help of an in-field and near-in-field data repository (EUT).The list of intelligent services developed include weather/climate forecasting to predict climate anomalies and extreme events (BSC), the prediction of phenological stages of vines (NAP, LINKS), the tracking of key crop indicators and the prediction of yield related KPIs (ELEAF), the prediction of diseases such as Downy mildew and Powdery mildew (EUT), and the monitoring of business and sustainability indicators thanks to the tracking of resources used like (human labour, machinery hours, fuel, plant protection products, fertilizers and water) (EUT). To ease the exploitation of the WP results, each IS will be implemented as a standalone and interoperable service where all data will be delivered through a web-based API. Tasks in this WP will deliver iteratively new versions of the intelligent services in a transparent way to the end user until month 32 when their development will finish and final validation will be carried out in WP4.

Objectives:
- Accurate weather/climate prediction at different lead-times including weather forecast, sub-seasonal and seasonal scale
- Prediction of phenological stages (bud break, blooming, fruit set, veraison, ripening)
- Tracking of key crop indicators (vegetation health status and productivity, evapotranspiration and nitrogen levels)
- Disease management for early warning of diseases (Downy mildew, Powdery mildew) and effective/sustainable treatments
- Tracking of used resources (water, fertilizers, plant protection products, human labour, fuel) giving outputs about Sustainability KPIs

Task 2.1 In-field and near in-filed data repository (M01-M32) (**EUT**, LINKS, SYM, MBD, TOR)
This task will create a supporting data repository for the intelligent services in order to concentrate all in-field data (from end users' IoT infrastructures in the field, from weather stations, from machinery data loggers, from fixed cameras, …) and near in-filed data (from subcontracted drone or aircraft flights) of each pilot plot in a single access point. The task will include the installation of new sensors (fixed cameras, machinery data-loggers and sensors) and subcontracting of specialized companies (drone services). In addition, this tool will act as a bridge to homogenise, following interoperable standards, other in-field measures specific from each use case like weather conditions, manual inspections, irrigation information and operational information from FMIS. This task will assure the monitoring of quality data until the end of it making changes configurations, electronics components and sensors when possible.
Regarding the machinery data-logging, the repository collects data about machinery usage and deliver maps of used resources during their operation in the farms from a data-logger device. The procedure consists on installing a data-logger device connected to tractor and implements (at least in sprayers) communication bus (usually ISOBUS or Canbus) and analyse its data flow. In case sprayers have no sensors to provide information about their usage, new sensors will be installed. The repository will deliver the data from machinery through maps while a farmer uses its tractor. In addition, when details of tasks executed are informed the resources used could be monitored and contextualized. The main resources to be monitored will be human labour, machinery usage, pesticides and fuel. Those outputs will be mainly used in task 2.5 to check effectivity of disease treatments and on task 2.6 to resource management and sustainability KPIs assessment.

Task 2.2 Developing weather and climate forecasting (M01-M32) (**BSC**, SYM, MBD, TOR)
This task will develop the methods to implement short term weather forecast, sub-seasonal and seasonal climate predictions over Europe with a special focus for the three regions of interest: Campania region (MBD), Douro Valley (SYM) and Catalonia (TOR); and assess how the skill changes as a function of the forecast lead time.

***Subtask 2.2.1 Forecasts co-definition with end users (M01-M06) (BSC**, SYM, MBD, TOR)*
The forecasts will be delivered in deterministic (short term forecast) as well as probabilistic formats (sub-seasonal and seasonal predictions). The temporal coverage of the forecasts will cover a large temporal extent, starting from short term (up to 3 days in advance) up to sub-seasonal and seasonal (weekly, monthly and seasonally). To ease the operational management of vineyards, the provision and visualization of this information through the decision support system will be co-defined with the end-users.

Subtask 2.2.2 Modelling and downscaling (M01-M32) (BSC)
The short-term weather forecasts will be provided by the MONARCH model. It will be initialized with data from the Global Forecast System (GFS), a large-scale numerical predictions system. Regarding real-time sub-seasonal and seasonal information, we will use the NCEP coupled forecast system (CFSv2) and the models available in the Copernicus Climate Change Service. Considering that sub-seasonal and seasonal climate predictions are affected by biases, the model outputs will be post-processed to obtain similar statistical properties as found in the observed variables. Additionally, statistical downscaling methods, understood as a form of bias adjustment, will be explored with climate predictions to adapt the different model outputs to the particular climate conditions of the regions of interest (using historical data from weather stations).

Task 2.3 Phenological stage prediction and monitoring *(M04-M32)* (**LINKS**, NAP, SYM, MBD, TOR)
This task will deliver the intelligent services aimed to estimate the phenological stages.

Subtask 2.3.1. Phenology stages prediction (M04-MX) (**NAP**, LINKS, SYM, MBD, TOR)
Specifically, NAP will contribute with a model able to simulate the entire annual cycle of the vines, and therefore to predict all phenological stages. Such model will be calibrated with historical data provided by the end-users (MBD, SYM, TORRES) and it will be validated and fine-tuned with

satellite data and in-field observations acquired either through fixed cameras and drones (LINKS). The services implemented will forecast the following phenological stages: bud break, flowering, fruit set, veraison (red variety), maturity (red variety) and leaf fall. In addition, the Leaf Area Index (LAI) will be calculated.

Subtask 2.3.2 Phenological stage detection* (*M04-M32)* (*LINKS**, NAP, SYM, MBD, TOR)
LINKS will develop artificial intelligence models able to extract valuable features concerning the soil of the observed field, like the vegetation (NDVI) and water (NDWI) indices and detect phenological phases from satellite data. The data processed by the models will be extracted from Copernicus services (exploiting multispectral bands and indices from Sentinel satellites) and GEOSS services. The models will be developed assessing a combination of state-of the art image processing techniques, machine learning algorithms and deep learning approaches, such as Convolutional Neural Networks (CNNs). As a result, the models will provide mappings of the phenological phases for each section of the vineyard.

Subtask 2.3.3 In-field data integration (M04-M32)* (*LINKS**, NAP, SYM, MBD, TOR)
LINKS will develop artificial intelligence models able to process information gathered from: (i) in-field cameras and (ii) drones with on-board cameras. The data will be combined to detect the current phenological phases of the observed vines and as input for the phenological prediction model, in order to improve the subsequent predictions. The quality of the in-field cameras and the drone cameras will be assessed to determine the effectiveness in using pictures acquired at different spectral bands (e.g. near-IR). The high quality, but with limited field of view imagery provided by fixed-position cameras (installed at selected spots in the vineyards) will be complemented with more comprehensive pictures of the vineyards acquired by the drones. The new models will leverage on state-of-the-art techniques in image processing, machine learning and deep learning.
Furthermore, with the addition of information gathered from (i) locally installed weather stations and (ii) historical data provided by the end-users (MBD, SYM, TORRES), the modules applied in subtask 2.3.1 will be extended with the ones developed in this subtask. The final models will process a wide and complete set of data, merging observations at very different scales, improving the phenological phases detection and prediction ability. From the 2nd year onward, the collected data will be used for inference, allowing the models evaluation and refinement.

Task 2.4 Key Crop indicators tracking (M01-M32) (**ELEAF**, LINKS, NAP, SYM, MBD, TOR)
This task will set-up the services aimed to monitor the crop status on a weekly basis during the growth season in order to assess the vegetation health status, crop productivity, crop water use and crop nitrogen content. An operational data production structure is established based on the ETLook model. This is done on field level for the complete farm. The models use both satellite data (Copernicus) and meteorological information from EUMETSAT, complemented with measurements from local weather stations. Additional calibration is achieved based on inputs from manual monitoring done by end-users. ELEAF is responsible of the delivery, while LINKS will support in the data fusion of satellite data. NAP, together with the end-users SYM, MBD and TOR will define the key parameters to be monitored and will deliver the in-field measurements. The satellite-based data products are additionally used to 1) identify vineyard management zones via image segmentation techniques, 2) detect in-season production issues via weekly statistical analysis of crop growth, 3) inform crop water demand forecasts by combination with weather forecasts and 4) investigate forecasting of harvest date and amount of yield

Task 2.5 Disease forecast and management system (M01-M32) (**EUT**, BSC, SYM, MBD, TOR)
Several diseases affect the vineyards during their growing period. This task will build services to predict the appearance of diseases (Downy mildew and powdery mildew, the ones with more impact in the vineyards productions according to end users) and to manage the best disease control plans to decrease their effects. In this way, two main disease-oriented services will be adapted to the particularities of each region, according to the field and climate characteristics. Those services will be based on the analysis of data from a combination of data sources (from the previous intelligent services): meteorological forecasts, phenological forecasts, crop health status, and in-field measures

from weather stations, manual inspections and the machinery monitoring. Both models will be trained to deal with powdery mildew and downy mildew diseases considering the different environmental conditions and possible different variants of the diseases of each pilot plot considering historical data provided by end users. The models will be based on current detection methods available in the literature improved with forecasting data and farmer's knowledge.

***Subtask 2.5.1 Disease early warning service (M01-M32) (EUT**, BSC, SYM, MBD, TOR)*
This task aims to create a precise alarming service for farmers, firing alarms when situations with high probability of disease appearance happens. The alarming service will be iteratively improved to avoid false alarms and obtain a high confidence service. This service will be based on deep and machine learning techniques predicting the infection episodes of the diseases based on data like the weather forecasts, in-field weather data, thermal and topological maps and knowledge from end users.

***Subtask 2.5.2 Disease sustainable management recipes (M14-M32) (EUT**, SYM, MBD, TORRES)*
This task will deal with a service to schedule the best range of dates and recipe (the dose to apply on the spraying treatments on each field) optimizing the number of treatments and the resources used and assuring its effectivity when spraying, avoiding irreversible situations. This second model will use more precise outputs from the early warning model, the crop status maps like vegetation health and zonal delineation, the weather forecasts to avoid rains after spraying that could wash the vines weakening the treatment effects and of course knowledge and data from end-users regarding the plant protection products used.

Task 2.6 Business & Sustainability manager (M04-M32) (EUT, All partners**)**
This application will aggregate all data from the in-field repository, data from management tools of end users, and outputs from the other intelligent services into the VITIGEOSS platform to implement a set of new services that will deal with improvements and monitoring of business and sustainability results.

***Subtask 2.6.1 Optimized resource manager (M04-M32) (EUT**, ELEAF, SYM, MBD, TOR)*
The schedule of all field operations taking into account its order and importance, together with their cost and the needed resources (according the ones available or temporary required) from personnel to machinery or fertilizer products, is a complicated and frequent task in farms. This problem will be solved creating a model for each end user (SYM, MBD, TOR) and searching for the best solver that could propose optimal schedules. The optimizer will offer several results: (i) plan best timing for field operations e.g. summer pruning, harvesting, etc; (ii) calculate personnel resources needed (critical for the harvesting period); (iii) guarantee a better planning of resources and (iv) reduce usage of raw materials (pesticides, fertilizers, fossil fuels, water and fertilizer)
In addition, task 2.4 will bring data to implement two main features: (v) improve predictability of production and (vi) automate "zonal delineation" for selective harvesting and specific management to predict ideal production zones for different wine cultivars (based on slope, heat units, cold units, solar radiation, type of soils, etc).

***Subtask 2.6.2 Sustainability indicators (M04-M32) (EUT**, All partners)*
This task will calculate a set of indicators presented afterwards in a dashboard in the application Portal of WP3 to monitor end-users sustainability production. Most of this indicators are calculated with results from the previous services, based on GEOSS data or in-field repository data. It will evaluate production standards based on the analysis of sustainability indicators on the following aspects:
<u>Productivity</u> (crop biomass production, crop evapotranspiration (=water use), water use per kg of product, total water use and yield, pesticides used/ha). Combining knowledge of the crop stages (task 2.3), climate (task 2.2), pesticides usage (tasks2.5) and industry requirements from WP5 the productivity and water use of the crop can be optimised to attain sustainable and commercially viable yields without depleting soil and water efficiency.

Environment (PCF, GHGI), based on improved calculations, with a homogenised methodology used by end users in the different initiatives deployed at their sites or frameworks used (VIVA by MBD, OIV protocol by SYM, Torres&Earth by TOR – see section 4 for more information)
Protection (percentile 10 and 90 of wind and precipitation to predict erosion & flooding hazards) These percentiles will be computed considering the past database of forecasts (hindcast) and the reanalysis
Economic viability (benefit–cost ratio, availability of farm labour) from the analysis of available data in the in-field data repository together with data from end users management tools and market data provided by PWC.

Deliverables (brief description and month of delivery)
D2.1: In-field and near in-field data repository (M18, updated at M32) - This deliverable describes all in-field data sources connected to the repository and how they are filling it. It also describes the repository design and technical deployment.
D2.2: Weather forecast and climate predictions methodologies and skill assessment (**M20** – updated at **M32**) **-** This deliverable will describe the models that will be implemented for the weather/climate predictions. The first release will contain the design description, while the update will include the ISs evaluation and the release notes of the software.
D2.3: Estimation of phenological phases (**M20** – updated at **M32**) **-** This deliverable will describe the models that will be implemented for the estimation of the phenological phases. The first release will contain the design description, while the update will include the ISs evaluation and the release notes of the software.
D2.4: Crop indicator tracking (**M12** – updated at **M32**) **-** This deliverable describes the parameters that are tracked by the service and all techniques used in order to implement such tracking. The first release will contain the design description, while the update will include the ISs evaluation and the release notes of the software.
D2.5: Disease management (early warnings and sustainable recipes) (M20 – updated at **M32**) **-** This deliverable will describe the models implemented for the disease predictions. The first release will contain the design description of both features, while the update will include the ISs evaluation and the release notes of the software.
D2.6: Resource optimizer (**M20** – updated at **M32**) **-** This deliverable describes the model used and technical solution used to build the resources planner and optimizer. The first release will contain the design description of it, while the update will include the ISs evaluation and the release notes of the software.
D2.7: Sustainability Manager (**M23** – updated at **M32**) **-** This deliverable describes how the sustainability indicators are calculated, an evaluation of them according to end-users and the parameters influencing sustainable winegrowing in the technical, policy and financial domains.

WP Nº	**3**		**Lead beneficiary**				**ELEAF**		
WP title	**Integrated Vineyard Management Application Portal (DSS)**								
Participant Nº	1	2	3	4	5	6	7	8	9
Short name	EUT	LINKS	ELEAF	BSC	PWC	NAP	MBD	TOR	SYM
Person months	**13,5**	**11**	**20**	**4**	**1**	**4**	**3**	**7**	**2**
Start month	01				**End month**		42		

Description of work
WP3 deploys the VITIGEOSS cloud-based application portal. The portal provides a one-stop-shop for viticultural applications to the end-users. It will enable sustainable and transparent engagement and cooperation of application providers. Development will be based on existing FruitLook and VISCA technologies following Agile development methods. A Platform test and validation will be performed based on the use cases supported by the applications obtained from the intelligent services (WP2). Configuration of the system will be done during the first year of the project. This implies the specification of all data formats and protocols for the information exchanges between the Intelligent Services and the VITIGEOSS platform needs to be defined. **From the M21 onward VITIGEOSS will be fully operational.**

Objectives:

- Understand system requirements
- Cloud platform operational
- Host applications based on the Intelligent Services defined in WP2
- Deliver tested Vineyard Management application portal VITIGEOSS
- Service provision and helpdesk operational

Task 3.1 VITIGEOSS platform requirements (M01-M09) (**EUT**, all)
During this task EUT will identify with the partners the properties of the data service stream for the services established under WP2. This is done in the form of user roles ("providers and users") and use cases ("connectivity"). These properties are used to dimension the cloud-based application portal.

***Subtask 3.1.1 Explore end-user requirements (M01-M06) (EUT**, all)*
This tasks aims to collect the expectations from end users about the VITIGEOSS Platform and to better define specific desires they could arise aligned with project goals. A set of interviews and meetings will be done among end users (MBD, SYG, TOR), technological partners (ELEAF, LINKS, NAP, EUT) and the business partner (PWC) to discuss about who, when, where and how VITIGEOSS will be used; the needs and requirements of the final user interface (application portal), its performance, ease of use and accessibility, and finally to agree the VITGEOSS minimal requirements to be a valuable product in the market.

***Subtask 3.1.2 Definition of system users, roles and use-cases (M01-M06) (ELEAF**, EUT, LINKS, BSC, PWC, NAP)*
To set-up a practical application portal to know who the user is, where he/she logs in and when. What information is needed from the portal in which situation etc. After a good definition of the users and use-cases the portal can be better suited to the end-users' needs and adoption of the portal is more likely.

***Subtask 3.1.3 Semantic interoperability standards implementation plan (M01-M09) (EUT**, ELEAF, LINKS, BSC)*
Despite using the INSPIRE directive to share project spatial data among European partners, other related standards could be selected during the project to work with semantics and better explain/understand through metadata the relations between the data source concepts. For example, other standards like Saref4Agri could help in the semantic interoperability of data from in field measurements as well as OGC standards could help in data sharing about environment and sustainability, forecasts and earth observations. This task will analyse possible semantic interoperability standards to be used and introduced in the project scope as pilot semantics tests and write some guidelines to implement them when possible.

Task 3.2 VITIGEOSS cloud-based application portal deployment (M01-M12) (**eLEAF**, LINKS, BSC, EUT)
During this task the VITIGEOSS cloud-based application portal will be configured and deployed by eLEAF and validated by the data and the application providers in the consortium. The application portal is an instantiation of eLEAFs cloud-based FruitLook infrastructure that consists of a development, test and deployment facility. The infrastructure has two distinctive components, the API service store and the Application dashboard. The API service store forms a repository of consortium data-services and enables the connection of these data-services to the applications available to the end-user. The Application dashboard represents the user interface from which different applications can be attained and used via a single point of entry. For future roll-out the portal needs to facilitate both access from the user to the different applications as well as an accounting protocol for these applications. Traditionally this is done via Single Sign On methods (for example using SAML): this will be the initial setup of the VITIGEOSS platform for the pilot.

***Subtask 3.2.1 Configure API service store (M01-M12) (eLEAF**, LINKS, BSC, EUT)*
Set up the API service store to establish connections with the individual service providers. Negotiate standards between partners. This task finishes when project partners communicate with the services in the API service store, sharing data and services between them and adhering to the standards used in the VITIGEOSS portal.

***Subtask 3.2.2 Setup Application dashboard front-end (M01-M12) (eLEAF**, LINKS, BSC, EUT)*
A domain is set-up for wine producers in the project to access the VITIGEOSS portal. The existing FruitLook crop monitoring application, VISCA climate application and VISCA phenological application can be presented as standalone applications on the VITIGEOSS platform. Individual and combined intelligent services developed in WP2 are added as application when they are completed (Task 3.3.1) and come available to the users as separate tiles on the platform. The platform will offer a simple Single Sign On authentication system for end-users until advanced authentication options for data security and scalability are explored in Task 3.3.3.

Task 3.3 Configure intelligent services – VITIGEOSS applications (M06-M32) (**eLEAF**, LINKS, BSC, EUT)
During this task the intelligent services developed under WP2 will be deployed in the application portal as specific wine producer applications with their respective views and layout. Pending the outcome of the commercial analyses and consortium partner preferences, initial standalone applications may be migrated into a full configuration within the portal itself during or after the project. The advantages of this approach are a one access – one login application portal for the users and a flexible infrastructure that can easily scale-up and add applications from consortium partners and third parties during and beyond the project duration.
We intend to implement a trial implementation of an open source blockchain platform (Hyperledger) in subtask 3.3.3 for transactional transparency between partners and partner services and safe and secure end-user experience. A special (not WP2 related) use case will be developed by eLEAF and PwC for the accounting protocol for service delivery, service fees and transaction ledger ("security").

***Subtask 3.3.1 Populate VITIGEOSS application portal tiles (M06-M32) (eLEAF**, LINKS, BSC, EUT)*
The deployment will be a phased approach; in the application portal a tile will be made for partner standalone applications initially and then for every finalised application based on the intelligent services in WP2 another tile will be made. This means existing applications can be added decentralised.

***Subtask 3.3.2 Configure composite applications (M06-M32) (eLEAF**, LINKS, BSC, EUT)*
The aim of this task is to fully configure composite data services from WP2 within the portal to enable possible re-use of them in various applications and improve security. The composite applications will offer new powerful capabilities to end users by combining the intelligent services outputs.

Subtask 3.3.3 Configure authorization and study hyperledger system (M19-M32) (eLEAF)
This task ensures end-users can authorize the partners in our consortium to access their data and makes it possible to share user data between partners when needed and when authorized by the end-user. Hyperledger would make it possible to keep a close track of the path user data takes and to ensure trust in the platform by end-users and service providers.

Task 3.4 Testing of VITIGEOSS Ecosystem (M09-M20) (**TOR**, EUT, eLEAF, LINKS, BSC, SYM, MBD, NAP)
During this task the integration and load testing of the finalised VITIGEOSS cloud-based application portal is done by eLEAF. Use case acceptance testing is done by TORRES to validate that the portal delivers what was requested. Subtasks are:

***Subtask 3.4.1 Load testing to ensure the integrity of the infrastructure under load (M09-M20) (ELEAF**, TOR, EUT, LINKS, BSC, SYM, MBD)*

It is essential to test the system when users make use of the portal, request a lot of data and access different applications while service providers put the services to work to fulfil all the requests. End-users will also validate the responsiveness of the customer facing VITIGEOSS platform while service providers will validate the responsiveness of the API web store.

***Subtask 3.4.2 Use case acceptation to validate the infrastructure against the user requirements (M09-M20) (TOR**, EUT, eLEAF, LINKS, BSC, SYM, MBD)*

Finally, it is tested if the use-cases defined in task 3.1 are well implemented and can be performed the way envisaged by end-users. This will resemble a real-life scenario to ensure all requests or situations in that scenario are working and performing according to expectations.

Task 3.5 Operate and monitor VITIGEOSS (M20-M42) (**eLEAF**, LINKS, BSC, EUT)

This task entails the operation and monitoring of the API service store, application portal and applications. The infrastructure is monitored and maintained, and a helpdesk is being operated that provides users access to the VITIGEOSS applications and accepts and handles support tickets. eLEAF will be the first point of contact of the Helpdesk. Main objectives in this task:

- Guarantee Cloud platform operation:
  - EO Data processing for services
  - Cloud application platform operation and servicing (i.e. updates)
  - Managed service operation and servicing (i.e. updates)
  - Hardware monitoring and servicing
- Give support/helpdesk to end users*:*
  - Provision and management of end-user accounts
- Support ticket receipt and processing

Deliverables

D3.1: Report on use case scenarios descriptions (M09) - A report containing consolidated use case description, describing the functional and technical configuration of the different use cases of the intelligent applications including roles and data streams used as blueprint for the configuration tasks 3.2 and 3.3. This report will also contain guidelines to use semantic interoperability standards

D3.2: Deployment of the VITIGEOSS cloud-based application portal (M12)- Deployment of the operational cloud-based application portal to the end-users.

D3.3: Report on services configuration (M20, updated at M32) - We will report on the service adjustments and final settings for the intelligent services that affect the end users.

D3.4: Report on authorisations with hyperledger results (M32) - We will elaborate on the viability of using cutting edge technology like hyperledger, the benefits and implementation possibilities compared to the implemented Single Sign On authentication.

D3.5: Report on Operational application portal testing (M20) - Report on the integration, load and use case acceptance testing used to finalise the 3.2 and 3.3 tasks.

D3.6: Report on statistics and evolution of VITIGEOSS platform (M30, updated at M42) - During the operational phase of the portal the production partners' number of logins and use of the portal is monitored to evaluate the uptake during the project.

WP Nº	**4**		**Lead beneficiary**				**NAP**		
WP title	Demonstration								
Participant Nº	1	2	3	4	5	6	7	8	9
Short name	EUT	LINKS	ELEAF	BSC	PWC	NAP	MBD	TOR	SYM
Person months	**12**	**10,5**	**15**	**11**	**0**	**17**	**7**	**10,5**	**11**
Start month	01				**End month**	42			

Objectives:

The main objective is to validate the in-field performances of VITIGEOSS in supporting viticulturists to manage the vineyard based on sustainability indicators. This will be done at three different demo-sites. Specific objectives:

- Select and implement pilot plots suitable for a correct calibration/validation of the services included in VITIGEOSS.

- Provide the dataset required for the fine-tuning of models calibration.
- Testing the robustness of the VITIGEOSS services.
- Using the pilot plots as a platform for extension activities.
- Validation of business and sustainability dashboard demonstrating its capacity to help in the improvement on productivity, environment, protection and economic indicators.

The work will be carried out simultaneously at three pilot plots located in important European viticultural regions (Douro, Portugal; Irpinia, Italy; Catalunya, Spain) within commercial vineyards owned by the end-user wine companies (SYM, MBD, TORRES, respectively). Each pilot plot will be of a minimum size of 1 ha and will be managed according to the specific protocols adopted commercially by the end-users for wine making. This approach will allow to validate VITIGEOSS in different climate conditions, different cultivars, and viticultural strategies (different vineyard management protocols and different wine style goals)

Task 4.1 Pilot Plots Implementation (M01-M06) (**NAP**, MBD, SYM, TORRES, LINKS)
This task aims to select, at the three demo sites, suitable pilot plots to be used for validation purposes. The main selection criteria will be: vineyard exposition and slope; the cultivar; the intra-vineyard homogeneity (vines with similar age, vigour, rootstock and training system; homogeneous soil; etc.); availability of a nearby weather station; availability of phenology data on the specific cultivars and availability on historical management data. Once the pilot plots are identified, the setup of the pilot plots will finish when the installation of the fixed cameras in the field; irrigation system adaptation if needed, installation of machinery data-loggers, acquisition of specific field equipment, etc; and the necessary vineyard modifications will be implemented

Task 4.2 Fine-tuning of models calibration (M07-M32) (**NAP**, LINKS, ELEAF, EUT, BSC, SYM, MBD, TOR, BSC)
The activities of the second task aim to fine-tune the calibration of the models included in VITIGEOSS. During the first vegetative season of the project, a high quality dataset collected in the three selected vineyards will be used to tune the calibration of (i) the downscaled weather forecast models (ii) the phenological stage prediction models, (iii) the key crop indicators tracking models, (iv) the vine disease early warning system forecast, and (v) the business and sustainability manager. An additional fine-tuning of the models will be realised between the vegetative seasons two and three.

Task 4.3 Operational provision of the services output data (M10-M42) (**ELEAF,** LINKS, EUT, BSC, NAP, SYM, MBD, TOR)
The quantitative data resulted from all services will be provided in-season for operational use by end users via the VITIGEOSS portal in an automated way with the right frequency according to nature of the different services:

- Weather: daily, weekly and monthly
- Phenological: daily and monthly (field-based)
- Crop status: weekly, (field-based)
- Disease: weekly & daily on critical episodes (field-based)
- Sustainability: weekly/ (on demand) for optimization and plan of task and resources, monthly for sustainability indicators. (by using the appropriate parameters from the services)

End users will be able to access, visualize, monitor, check values and give feedback through the VITIGEOSS portal

Task 4.4 Validation of the services and evaluation of the results (M20-M42) (**LINKS**, NAP, ELEAF, SYM, MBD, TORRES, ELEAF, EUT, BSC)
The second and the third vegetative seasons of the project will be dedicated to fully validate the Intelligent Services that will run operationally, using data collected at the three demo sites. The performance of the VITIGEOSS services will monitored, making special emphasis on the validation of the business and sustainability services as well as the related dashboard (as final application integrating several intelligent services outputs) to confirm they could help the winemaking

community to improve their current strategies in order to be more sustainable. Data collected during second year will be used to calculate intermediate performance of intelligent services and proposing improvements to be implemented in the third year. Data from the third year will be used to calculate final performance of the intelligent services This will be done by evaluating the capacity of the tool in:

- forecasting the vine phenology
- monitoring the key crop indicators
- forecasting the occurrence of vine diseases
- delivering precise disease treatment recipes
- optimizing the use of resources and tasks
- evaluating sustainable indicators and implementing sustainability practices

Deliverables (brief description and month of delivery)

D4.1: Pilot Plots Implementation (M06) - Once the experimental plots are selected, the trial setup is finalized, and the necessary vineyard modifications are implemented, a report with detailed information of the location of the vineyards and their characteristics will be made public for all the consortium. This report will be use as a link with further results of the project.

D4.2: Dataset for fine-tuning model calibration (M20, M32) - This report will consist in the description of all the field measurements that will be necessary to calibrate the models included in the VITIGEOSS.

D4.3: Report on the application of VITIGEOSS services (M30, updated in M42) - Once the VITIGEOSS services has been tested for the first time in the field (in the second vegetative season), a report with the main results, derived from the predictions will be available to share with all the members of the consortium.

D4.4: Validation and Evaluation report (M32, update in M42) – It will include the validation of the VITIGEOSS services and the evaluation of their performance obtained along 2nd and 3rd vegetative seasons

WP Nº	**5**		**Lead beneficiary**				**PwC**		
WP title	**Commercial innovation and market penetration**								
Participant Nº	1	2	3	4	5	6	7	8	9
Short name	EUT	LINKS	ELEAF	BSC	PWC	NAP	MBD	TOR	SYM
Person months	**12,5**	**4**	**9**	**4**	**10**	**1,5**	**1,5**	**5**	**3**
Start month	12				**End month**		42		

This WP evaluates the future sustainability of VITIGEOSS and analyses market critical policies and financial constraints required to promote the sustainable wine growing approach using the sustainability checker application provided in WP2. The WP will support research and commercial exploitation of the project results on an international scale and the preparation of a realistic exploitation strategy and business plan. Specific objectives:

- Raise the awareness of the target groups and potential users about Vitigeoss: understand what it can deliver and how it relates to their needs
- Define a successful market entry strategy
- Creation of a financial model and revenue estimation for the partners

Task 5.1 Market assessment (M12-M30) (PWC, all partners)

***Subtask 5.1.1 "Portraying the project" (M12-M15) (PWC**, all partners)*

Main objective of this task is to understand current strategic guidelines and goals. There will be high level discussion with partners in order to obtain a good understanding of the strategic objective and the key elements of the value proposition and business model including:

- Business model
- Technical aspects of VITIGEOSS
- OPEX and CAPEX inputs to business plan / feasibility model

***Subtask 5.1.2 "Market analysis and competitive assessment" (M15-M30) (PWC**, all partners)*
The main objectives of this task are to understand the market drivers for the market, characterise the market size and trends for the main markets and characterise the main competitors. We will use public information and third party data and reports on the market that PwC has access to (such as GlobalData, Euromonitor, BMI, Reuters), as well as our databases and network, in order to assess the market. Overview of the wine sector in Europe in terms of:

- Production dynamics
- Exports and imports
- Consumption dynamics and trends
- Market drivers
- Main wine producing players

Conduct a desk/secondary research on competitors in order to perform a competitors' assessment:

- value proposition,
- positioning,
- services provided,
- target segments,
- distribution channel and
- pricing

***Subtask 5.1.3 "Stakeholders consultation" (M12-M30) (PWC**, ELEAF, MBD, SYM, TOR)*
We intend to validate market trends, critical success factors and collect market and competitors' information through the market survey to end-users. The market assessment phase will be finalised with a robust SWOT analysis. We will assess VITIGEOSS potential market acceptance through interviews with wine producing players:

- Using VITIGEOSS participants network, interview relevant producers in the top 3 producing countries in Europe (Italy, France and Spain) and Portugal to assess sustainable production indicators related to policy and finance
- Perform a market survey during the two workshops already planned

Task 5.2 IPR management (M12-M38) (EUT, all partners)
This task will oversee the management of all intellectual property that will arise from the project and will take the necessary steps to ensure that it can be appropriately protected. IP experts from EUT will support partners in:

- Identification of Exploitable results - a project results table will be developed to identify, synchronise, and conduct efficient IP planning and management, including ownership rights. Exploitation managers will be assigned to each result and the management of the collective project foreground will be a part of periodic reporting and project meetings.

IP strategies – Regular patent surveillance will be undertaken in relation to relevant exploitable results. This will allow a correct management of future patentability processes (e.g. confirm novelty, inventive step, industrial application) and ensure "Freedom to Operate" for future commercial products/services.

Task 5.3 Market entry strategy and business plan for exploitation (M12-M42) (PWC, all partners)
This task will start reviewing all insights from Market and competitive assessment and stakeholders' consultation, and establish the VITIGEOSS value proposition, together with participants.

***Subtask 5.3.1 "Market entry strategy" (M12-M38) (PWC**, ELEAF, LINKS, EUT, BSC)*
This task will start reviewing all insights from Market and competitive assessment and stakeholders' consultation, and establish the VITIGEOSS value proposition, together with participants. During this task the main objective is to define the future "way to play" of Vitigeoss identifying its future main distinctive capabilities and business model using the Canvas Model. We will use as main source of information the results of the market assessment and a workshop approach with relevant partners involved.

***Subtask 5.3.2 Business plan and feasibility study (M12-M38) (PWC**, ELEAF, LINKS, EUT, BSC)*
The main objective of this task is to create a comprehensive strategic financial model based on Vitigeoss's strategy using PwC templates and assess its feasibility conducting a proper sensitivity analysis exercise to detect key inflation points and stability of the suggested business strategy and model. It will embrace the creation of a financial model in order to estimate potential revenue and operational costs over 10 years understanding the expected revenue together with the partners based on the previous market research. Calculation of the project's return: net present value, internal rate of return. Compilation of the financial projections and estimated financial statements (base case and possible alternative scenarios)

***Subtask 5.3.3 Implementation roadmap (M36-M42) (PWC**, all partners)*
The main objective of this task is to create an implementation road map and activity charters and a overall responsibility assignment and milestone plan, using PwC templates.

- Define an implementation roadmap for the business plan
- Define key activities required for implementation of each element of the business plan
- Based on the activity plan, develop a milestone plan (when to achieve what?) and assign responsibilities

Deliverables (brief description and month of delivery)
D5.1 Market assessment (M30) – report that includes a comprehensive analysis of environment forces, market trends, entry barriers, competition, risks, opportunities and the consortium's resources and constraints in order to go after markets and opportunities
D5.2 IPR management report (M38) - deliverable will analyse all the IPRs involved in the project. This analysis will cover the list of all background IPRs, sideground IPRs, and foreground IPRs, together with a description of policies and practises. This results gathered during the elaboration of this report will feed the business plan and feasibility study.
D5.3 Business Plan for exploitation (M42) - report that summarizes the operational and financial objectives for the commercialization of VITIGEOSS, containing the detailed plans and budgets showing how the objectives are to be realized. It is the road map to the success of your business

WP Nº	**6**		**Lead beneficiary**				**BSC**		
WP title	**Communication & Dissemination**								
Participant Nº	1	2	3	4	5	6	7	8	9
Short name	EUT	LINKS	ELEAF	BSC	PWC	NAP	MBD	TOR	SYM
Person months	**20**	**3**	**6,5**	**22,5**	**2**	**5**	**3,5**	**3**	**5**
Start month	01				**End month**		42		

Objectives

- Increase the global visibility of the VITIGEOSS project and its outcomes in Europe and beyond
- Develop novel communication and dissemination activities to facilitate knowledge transfer to end users
- Spread the use of Earth Observation services and climate services among the agriculture sector
- Build capacity among current and potential developers and users of commercial products within the wine sector and beyond
- Showcase new European capabilities combining smart services and make them available for uptake of the European wine industry and global markets

Task 6.1. Communication and dissemination management (M1-M42) (**EUT**, BSC, all partners)
The communication and dissemination of the project will be a continuous process supported by all project partners and stakeholders to ensure integration, continuity, and maximise impact and reach. This task will manage general communication actions such as the creation and periodic review of a communication and dissemination plan, the creation of a recognizable visual identity for all project materials, the design of a website and set up of social media, the production of online and printed

PR materials and support media liaison for the project. *As a general rule, the project will prioritize the use of online material and try to minimize the use of paper.*

SubTask 6.1.1. Visual identity and Website (M01-M03) (EUT)
A coherent and recognizable visual identity will be designed to be used in all project materials. This task will encompass the design of visual identity (including design elements, logo, colours and fonts), design of templates for letters, presentations, reports and newsletters. A website will be developed, containing a high-level description of the project and its objectives aimed at end users from the wine sector and to the general public. The website will contain detailed project outputs, such as public reports and links to scientific publications, but also general information about the project, news and dissemination material. It will also have a link to VITIGEOSS social media.

***SubTask 6.1.2. Communication and dissemination plan (M01-M42) (EUT**, BSC)*
An outline of the communication and dissemination plan will be developed at the beginning of the project (M07) and will be updated later on (M18). The document will provide detailed information about the activities planned along the lifetime of the project. It will define the following key points: dissemination objectives, key messages, target audiences, dissemination channels and tools including the official website and social media, participation to events, workshops, magazines and platforms, planning of promotional materials, timing of activities, as well as practical information such as project branding, logo, templates, etc. (compliant with the EC visibility rules).
Key performance indicators for each communication and dissemination activity will be defined and reported, ensuring the traceability of the WP activities that are not listed under a particular deliverable or milestone.

***SubTask 6.1.3. Communication and PR materials (M01-M42) (EUT**, BSC)*
We will produce a roll-up, 4 posters (one in English, that will be translated to the languages of the end users involved in the consortium: Spanish, Portuguese and Italian), and a project brochure in physical format to increase project visibility following the visual identity defined in Task 6.3.1. When relevant, press releases will be used for targeted media outreach involving national newspapers and other specialized press. The communication departments of VITIGEOSS partners will support press releases with national language versions when appropriate. To facilitate the use of the knowledge generated in the project, we will develop at least 6 info sheets addressed to transfer this knowledge to a wider audience. Info sheets will illustrate the 5 smart services developed by VITIGEOSS and the Integrated Vineyard Management Application Portal (DSS).

Task 6.2. Capacity building among industrial partners and other stakeholders (M06-M42) ***(BSC**, EUT, ELEAF, NAP, LINKS)*
The services developed within the project and lessons learned will be used for building capacity on sustainability among agricultural communities, expected to benefit local economies (e.g., by ensuring productivity in the long term, thus safeguarding the creation of jobs in the region). This approach will strengthen skills, competencies and abilities to advance the development of services and products based on the use of EO systems. It can also be used by policy makers to monitor and map general irrigation and crop cultivation activities within specific management areas, supporting decision making processes on future sustainability strategies. The final conference of VITIGEOSS will gather the main stakeholders belonging to the whole chain of wine and agriculture chain.

***Subtask 6.2.1. Technical webinars (M06-M42) (BSC**, EUT)*
VITIGEOSS will organise 3 technical webinars on the technical aspects of probabilistic climate predictions (BSC), data analysis in agriculture (EUT) and use of satellite data in agriculture (EUT). Webinars will be addressed to potential service providers within the wine sector and beyond, to foster the possibility of exploitation of some particular components of the portal within and outside of the wine producer community. Questionnaires to evaluate the improvement on technical capabilities of the attendants will be sent after each webinar.

***Subtask 6.2.2. Participatory workshops (M12-M42) (ELEAF**, BSC, NAP, LINKS, EUT)*

Two participatory workshops will be delivered during the second half of the project to share lessons learned, present the portal to the wine community and disseminate the main project achievements, with focus on spreading the use of EO services. They will comprise seminars and training courses on topics such as geo/remote sensing in agriculture (eLEAF), application of remote sensing and EO in viticulture (NAP) and probabilistic climate forecasts for decision-making (BSC). The workshops will be organised as side events of renowned fairs or conferences to take advantage of their audiences. They will be addressed to technology developers and commercialization partners, supported with the presence of relevant stakeholders of the wine and the agriculture sector as well as EuroGEOSS and Copernicus members, and relevant partners of other related H2020 projects.

***Subtask 6.2.3. Demo Video (M27-M36) (EUT**, BSC, LINKS, ELEAF, NAP)*
We will develop a high quality video that will guide users through the different smart services developed in WP2 and the portal deployed by WP3, while providing the context to understand the project challenges, motivations and outcomes. Video explanations are a suitable way to communicate a set of different options that can be explored by users.

Task 6.3. Knowledge transfer and added value provision to target groups (M06-M42) (**BSC**, ELEAF, MBD, TOR, SYM, EUT, LINKS, NAP)
This task aims at engaging with the whole European wine industry as well as the Earth Observations and climate services communities and the society as a whole. The engagement of these groups will raise awareness on the benefits that VITIGEOSS can bring to businesses and the society.

***Subtask 6.3.1. Sharing lessons learned with Climate Services (CS) and the Earth Observations (EO) communities (M06-M42) (BSC**, eLEAF)*
The learning process of climate services co-production will be shared with the broader CS and EO communities working in agriculture and other sectors that could benefit from the experience of VITIGEOSS, specially from the knowledge exploitation regarding the co-production approach of creating a commercial service. Lessons learned regarding the use of EO for the optimisation of decision making in the agriculture sector will be shared with the Copernicus and EuroGEOSS communities. Whereas this will provide useful guidance for other projects and initiatives dealing with climate service topics, it will also place the project as a reference and will increase its visibility. Data sets will be shared in the data catalogue of NextGEOSS and the services will be showcased within this initiative as well. Letter of Interests to EuroGEOSS community will be sent to join 2 action groups (climate and agriculture)

***Subtask 6.3.2. Local stakeholder sessions at General Assemblies (M06-M42) (EUT**,* MBD, TOR, SYM, NAP*)*
A total of three special sessions will be organised during the project general assemblies at each of the 3 users' premises. Sessions will be addressed to local farmers and rural communities with the aim to educate on sustainable agricultural practices to improve productivity. These sessions will bring together professionals from the vineyard sector and the data collection sector to present them the capabilities and opportunities of the new sensing methods and train them about how to properly apply these technologies in their own fields. Beyond the outreach purpose of the event, the joint participation of professionals from both disciplines will give them the opportunity to share experiences, aims and requests in order to adapt the offer from providers to the expectations of the vineyard sector practitioners.

***Subtask 6.3.3. Executive summary (M36-M42) (BSC**, EUT, PWC, ELEAF, all partners)*
Based on project publications and public deliverables, we will provide an executive summary (e.g., booklet format) towards the end of the project. This document will highlight the relevant results of the project while translating them to be more easily understood and used by decision and policy makers. If relevant, the document may contain a set of recommendations issued by the project (e.g. regarding topics such as the development of new EO-derived markets or increasing cross-domain exploitation of EO data).

Deliverables
D6.1 Visual identity and project website available (M03) - design of website, logo, colours and fonts, templates for letters, presentations, reports and newsletters.
D6.2 Communication and dissemination plan (M07, M18) - This document will provide detailed information about the activities planned along the lifetime of the project, plus KPIs for each communication and dissemination
D6.3 Summary report on dissemination and communication activities and materials (M42)
D6.4 Summary report on user engagement activities (M12, M27, M42) (**BSC**) – Report that gathers and describes the activities made during the projects regarding engagement of stakeholders (technical webinars, workshops, local sessions.)
D6.5 Demo video (M26) – video-guide addressed to potential user explaining the set of different options that can be explored in the Portal
D6.6 Lessons learned in VITIGEOSS for Climate Services and Earth Observations Communities (M36) - Report summarising the lessons learned in VITIGEOSS to foster the exploitation of the experience gained in the project within the climate services and the Earth Observations communities.
D6.7 Executive summary (M42) – Report that highlights the relevant results of the project, translated to be more easily understood and used by decision and policy makers.

Table 8. List of Deliverables

Deliverable (number)	Deliverable name	WP Nº	Short name of lead participant	Type	Dissemination level	Delivery date
D1.1	Risk management plan	1	EUT	R	CO	M06-M12-M18-M24-M30-M36
D1.2	Data Management Plan	1	ELEAF	R	CO	M06-M18-M36-M42
D1.3	Innovation Management outcomes analysis	1	PWC	R	CO	M42
D2.1	In-field and near in-field data repository	2	EUT	R	CO	M18, M32
D2.2	Weather forecast and climate predictions methodologies and skill assessment	2	BSC	R	PU	M20, M32
D2.3	Estimation of phenological phases	2	LINKS	R	CO	M20, M32
D2.4	Crop indicator tracking	2	ELEAF	R	CO	M12, M32
D2.5	Disease management (early warnings and sustainable recipes)	2	EUT	R	CO	M20, M32
D2.6	Resource optimizer	2	EUT	R	CO	M20, M32
D2.7	Sustainability Manager	2	EUT	R	CO	M23, M32
D3.1	Report on use case scenarios descriptions	3	EUT	R	CO	M09
D3.2	Deployment of the VITIGEOSS cloud-based application portal	3	ELEAF	DEM	PU	M12
D3.3	Report on services configuration	3	ELEAF	R	CO	M20, M32
D3.4	Report on authorisations with hyperledger results	3	ELEAF	R	CO	M32

D3.5	Report on operational application portal testing	3	TOR	R	CO	M20
D3.6	Report on statistics and evolution of VITIGEOSS platform	3	ELEAF	R	CO	M30, M42
D4.1	Pilot Plots Implementation	4	NAP	DEM	PU	M06
D4.2	Dataset for fine-tuning model calibration	4	NAP	OTHER	CO	M20, M32
D4.3	Report on the application of VITIGEOSS services	4	ELEAF	R	CO	M30, M42
D4.4	Validation and Evaluation report	4	LINKS	R	PU	M32, M42
D5.1	Market assessment	5	PWC	R	CO	M30
D5.2	IPR management report	5	EUT	R	CO	M38
D5.3	Business Plan for exploitation	5	PWC	R	CO	M42
D6.1	Visual identity and project website available	6	EUT	DEC	PU	M03
D6.2	Communication and dissemination plan	6	EUT	R	PU	M07, M18
D6.3	Summary report on dissemination and communication activities and materials	6	EUT	R	PU	M42
D6.4	Summary report on user engagement activities	6	BSC	R	PU	M12, M27, M42
D6.5	Demo video	5	EUT	DEC	PU	M26
D6.6	Lessons learned in VITIGEOSS for Climate Services and Earth Observations Communities	6	BSC	R	PU	M36
D6.7	Executive summary	6	BSC	R	PU	M42

3.2 Management structure, milestones and procedures

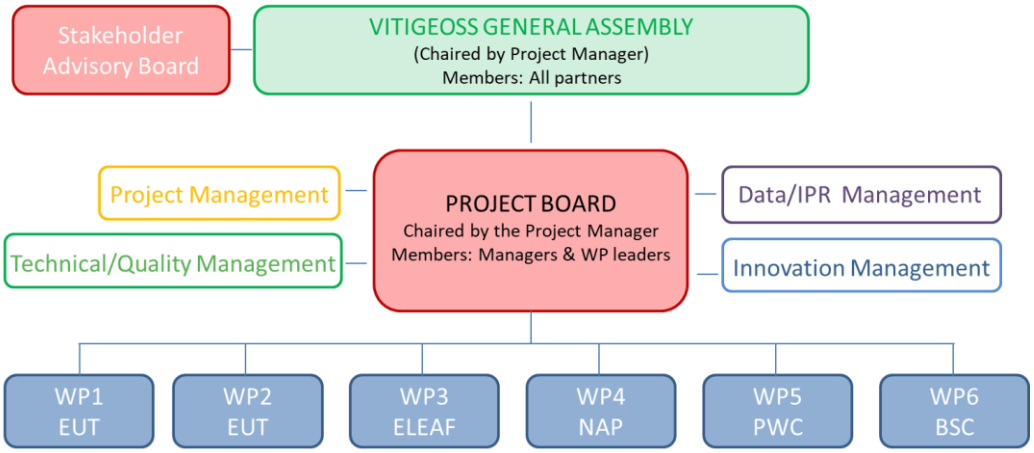


Figure 12. Project Management Structure

Multidisciplinary is a key feature of the project, and therefore coordination needs a team approach. The project management structure is presented in Figure 12, and it is designed to promote the strategic as well as the operational tasks of the project, i.e. decisions, technical execution, dissemination, data, IPR, innovation and administrative/financial tasks.

The management structure will have a strong focus on objectives and milestones, risk and innovation. The management structure consists basically of the General Assembly (GA)as the strategic body, and the Project Board (PB) as the operational/execution body. A Project Advisory Board designated within at M03 of the project to give advice and recommendations on the project progress, as well as favouring the replicability of VITIGEOSS among other sectors.

3.2.1. Robustness and Appropriateness of the Management Team

Responsibilities and constituents of the management structure as well as the basic tools and procedures to be used in the decision process are explained below for the main agents involved in VITIGEOSS. The decision-making process has been planned to reduce delays and uncertainties and it is expected to function in an efficient way. The decisions are to be the result of the inputs received from the different agents involved, from the upper to the lower-decision agents of the project, where the troubleshooting is envisaged to be escalated and transversal, in order to stimulate communication among the different levels of the management structure. The project coordinator (EUT) will carry out management activities, which consists of the GA along with the PB, composed by several strategical managers. The GA will be responsible for the strategical decisions and for the engagement with the Advisory Board, while the PB will be in charge of the operational project management.
The PB is composed of several managers, each one with a specific focus and responsibility, as detailed in Table 9 plus WP leaders. Both the GA and the PB will be chaired by the Project Manager (PM), who is likewise responsible for liaison with the European Commission, coordinating the project activities of the Consortium members and for the production of deliverables respecting time, quality and budget constraints. The PM, supported by the PB, will ensure day-to-day operational project control. The WP leaders will work very closely with the Project Board on all project's matters, and will be responsible for the work and the resource allocation at the partner level for the relevant management support activities.

Table 9. Main Management actors in VITIGEOSS

General Assembly (GA)	**One representative per partner, chaired by PM**
The main tasks of this committee are the management of the strategic aspects. The Consortium Agreement (CA) is the basic document that will regulate the responsibilities and the basic procedures to be followed at all stages of the project, and describes in detail the decision making structure. Major change decisions relating working plan, budget or consortium´s situation are to be taken unanimously, and subsequently sent to the European Commission for approval. Other (lower importance) decisions are to be taken by consensus, and when this is not feasible, the principle of majority voting will be applied, and all partners shall have an equal vote. The implementation of the decisions determined by the committee will be managed by the PM. Frequency of meetings: they shall meet whenever it is necessary due to extraordinary situations that might take place, and minimum in every general meeting (approx.: M09, M18, M30 and M42).	
Project Board (PB)	**WP leaders, chaired by the PM**
The Executive Committee is chaired by the Project Manager and is composed by the WP leaders, and the Technical/Quality Manager, Data/IPR Manager, and the Innovation Manager. This team has to ensure that the project follows the expected planning, timing and budget at all levels. They are in charge of reporting the technical and financial progress both to European Commission and to the Consortium. In parallel, they are responsible for the implementation of the decisions made by the GA. They will meet on a 6-months basis, and whenever it is considered necessary due to extraordinary situations that might take place during the course of the project. These meetings will be held either in-person or through telephone/videoconferences meetings, to monitor the progression of the WPs –according to the agreed timing and budget-, the course of deliverables and milestones, and the use of the allocated resources. This Board is likewise in charge of the preparation of internal reports, indication of delays or potential risks or deviations –and the suggestion of ideas or solutions	

to these-, and, at administrative level, they are responsible for the circulation of the agenda and the consolidation of the minutes.

Project Manager (PM)	**María Navarro (**EUT**)**

The Project Manager shall ensure the smooth running of the project, avoiding bottlenecks, promoting a close collaboration between the strategic and operational levels, and ensuring that deadlines are accomplished, and work carried out with maximum quality. She will review all documents referring project status, progress, planning, contents for relevant publications, deliverables and reports, etc. before their circulation within the consortium frames and their further submission to the European Commission. The main interfaces of the project manager are: (i) EC (Project Officer), extensively working by mail and audio/video conference calls, physical meeting in case of planned events; (ii) Innovation manager, Technical manager, Data Manager and WP Leaders, extensively working by mail and audio/video conference calls (both on a periodic basis, e.g. monthly, and in case of need), physical meeting in case of planned events; (iii) the Steering Committee, with meetings held by audio/video conference call.

In parallel, the PM will be responsible for the administration of the internal Consortium structure and the financial administration of the project, including ensuring the proper completion and consolidation of the cost claims for partners.

Maria Navarro is European Program Manager at EURECAT, with more than 10 years' experience in project management. She holds a PhD in Chemical Engineering and has a broad experience as project researcher and coordinator in several fields such as waste water treatment, agriculture, recovery of residues, disasters resilience and management, among others. She has participated in several national and European projects (FP7 and H2020)

Technical and Quality Manager	**Claudio Rossi (LINKS)**

The Technical Manager (TM) will have the responsibility of the overall coordination of the project's technical progress. The main tasks of the TM will be to secure the continuous alignment of commonly understood and agreed project results with the projects vision and the overall technical objectives. The TM will report to the Project Manager, supported by the WP Leaders. In parallel, the TM will lead the quality assurance procedures for the whole project, collecting and considering the recommendations and the advises of the Advisory Board. As quality manager, he will be likewise in charge of monthly monitoring and support telcos with partners to periodically update the quality assessment.

Claudio Rossi graduated at INPG - Institute National Polytechnique de Grenoble and at Politecnico di Torino with a double bachelor's degree in information and Communication Technology. From September 2012 to March 2013 he was an intern at Telefonica I+D working on bandwidth aggregation techniques between wired and cellular networks. In Dec 2013 he obtained from Politecnico di Torino his PhD with the thesis titled "Cooperation Strategies for Enhanced Connectivity at Home". He is now a researcher and project manager in the Microsoft Innovation Centre at LINKS, focusing on mobile sensing, cloud-based web applications, wireless networks, and data analysis and has coordinated successfully H2020 projects such as I-REACT, and VISCA, where he is technical manager.

Innovation and IPR Manager	**Claudia da Silva (PWC)**

The Innovation Manager (IM) will have the responsibility of governing the innovation management process that will be implemented by adopting a hybrid research and innovation methodology. He will iteratively consider the evolution of products and market demands in the emergency sector, the business strategies of the large, small and medium enterprises present in the consortium, and the results achieved in order to adjust project objectives and requirements, specifying the innovations on which VITIGEOSS should focus more and identifying exploitation potentials. As IPR manager, he will also handle the issues related to IPR affairs: IP identification, IP protection, IP management and IP conflicts handling

Cláudia da Silva e Sousa da Costa Rocha is currently the Strategy Advisory leader in PwC Portugal, Angola and Cape Verde. She has been responsible for the coordination of multidisciplinary teams in projects related to the elaboration of business plans, companies and businesses valuations, financial structuring of capital projects, model reviews, economic and financial feasibility studies, analysis of

strategic options including financial restructurings, fundraising and identification of strategic partners in the development of new projects, market analysis and business plan frameworks, economic impact analyses and other specialized interventions.	
Data Service Manager	**Karel van der Lande (ELEAF)**
As Data Service Manager, he will be in charge of: Information Model, Data Access and Distribution, Data Protocols, Quality Definitions, Data Collection, Access Protocols, Infrastructure and Requirement and Data Security. Karel van der Lande: With over 15 years of (international) experience with Business Process Management (BPM) and Service Oriented Architecture (SOA), Karel does not solely focus on the technical integration of systems but also on business IT integration and is first and foremost people oriented. Karel joined eLEAF in 2014 and is responsible for IT infrastructure, service development, service integration and service delivery. He has virtualized hardware infrastructure and implemented an Enterprise Service Bus (ESB) in order to reuse software components for different projects and technologies. Karel is fluent in Dutch, English and Spanish, has a good comprehension of German and a basic understanding of French.	
Work Package Leaders	**(EUT, ELEAF, NAP, PWC, BSC)**
The WP leader will be selected internally by the members of the consortium, based on their technical knowledge and expertise. They are responsible of the execution of their assigned work packages and related tasks, deliverables and milestones. They shall report the Project and the Technical Managers about any extraordinary events that may affect the quality or the timing of the projects. More specifically, they will be responsible for: • The internal coordination of their respective work packages (monitoring, planning, review and reporting). • Assure that the WP tasks are being executed according to the agreed timing and budget. • Report on a regular basis to the project coordinator, and maintain contact with the rest of WP leader. • Designation of the task leaders and their coordination. The WP Leader follows the guidelines established in the description of the Work Packages of the project, and the technical decisions taken by the PB. Any relevant resolution taken by the GA will be communicated by the Project Manager during the course of the Executive meetings. Additionally, they will report to the Technical Manager any deviation or potential risk encountered during the execution of their work packages.	

3.2.2. Project internal reporting and planning

Executive management. For operational control, the WP Leaders report in each Project Board meeting their team's progress on work/objectives, innovation/IPR aspects, risk issues, possible ethical concerns and proposal for planning next steps/next period. To ensure quality input, revision and adequate time for handling issues, such report shall be made available in due time prior to the meeting. The individual reports of the WP Leaders, agenda and records of the meetings will be made accessible for all team members in the shared workspace. Hence, in all this reporting and management it is fundamental that progress is evaluated against objectives and judgement is based on factual and verifiable milestones:

Administrative management. For administrative issues, in particular the use of resources, an interim reporting about the use of budget/funding and effort/person-month from M1 to M6 of each reporting period is asked from each partner to be discussed in the General Assembly. It serves to detect methodical deficits, help less experienced partners and identify mismatch of resources/work/effort. Further similar internal reports can be conducted on a need basis and the delivery date shall respect distorting events such as holiday or deadlines for deliverables.

3.2.2.1. Documentation and communication

The Coordinator shall assist the consortium in implementing transparent, documented and meaningful communication and documentation of work. The project will use a shared workspace online as document repository and corporate tool for sharing and publishing minutes, deliverables, reports, code, contact data, certificates and any other type of information circulating among the partners. The

Coordinator must enable copy and access beyond project lifetime to relevant documents from this platform. The guidelines and templates for communication and documentation will be detailed in the Project Handbook (internal document), which will also include the manuals for these communication tools and shared workspace. Special emphasis lies on the exchange of data and archiving of information of intern, restricted or public circulation. Provisions for confidentiality and dissemination of any documentation will be settled in the Consortium Agreement and also applied to the shared workspace. Three elements of documentation shall be highlighted because of their universal importance for the project and because each individual team member contributes to these central registers: the IPR log, the outcome register, and the risk register. All partners are responsible of keeping these registries up to date during project implementation.

3.2.2.2.Innovation management

VITIGEOSS has already identified its outputs and will explore in WP5 the mid and long-term exploitation possibilities. VITIGEOSS will validate in WP4 the solutions as a whole and, at the same time, will set the benchmarks for innovation planning and management. This includes the baselines for assessing end-user's perceived quality of the experience and to what extent they consider it satisfactory. To this end, VITIGEOSS understands that innovation management techniques will be needed to propose a strategy for eventually porting outputs to markets. The role of the Exploitation manager will be key in this regard. The tools to be used include creativity in the loop, as detailed in what follows:

- **Periodic brainstorming**: quarterly remote meetings will be arranged to evaluate the advancements of the project against current market and policy trends, and to come up with new ideas and approaches in a collaborative and open way.
- **Idea management:** ideas proposed in the brainstorming meetings will be further evaluated and analysed offline based on a set of strategic criteria. Selected ideas will be further developed by the Exploitation manager and implemented through the project coordinator.
- **Phase-Gate management actions**: the project management will periodically trigger management decisions based on (i) the state of investigation activities, (ii) the requirements identified during the project for business cases, and (iii) market and policy opportunities identified through the brainstorming sessions. Milestones will play a fundamental role in this process, since they identify the timeline for the achievement of project goals, and therefore steering decision might be needed in correspondence to project milestones.

3.2.2.3.Engagement with stakeholders: Project Advisory Board

A Project Advisory Board will be set up during the first month of the project, and it will link the VITIGEOSS consortium with its broad network of members. The PAB will provide the consortium with advice on market opportunities and barriers, directives and regulations, standardization, and on international investment programmes related with agriculture adaptation strategies. User needs and decision making processes that can benefit from project results will be defined through analysis of knowledge gathered in previous projects and interaction with other initiatives on similar topics, including EO services and smart agriculture. Results from previous works on the needs of users from the wine sector will be considered as departing point. These results include outputs from projects and initiatives focused on wine and agriculture in general that count with involvement from the VITIGEOSS consortium, like VISCA, MED-GOLD, FruitLook, GRAPE, Agrobofood, IoEcrops, SECTEUR and IMPREX. The knowledge gained in these previous projects will be discussed with end-users represented in the VITIGEOSS consortium, defining several challenges faced by the wine industry in Europe. To collect Advisory Board recommendations and advises, three stakeholders meetings (M06, M18 and M30) will be organized throughout the duration of the project. A number of relevant experts have already committed to join the VITIGEOSS Advisory Board, and many of them have provided letters of intent, which are attached in an appendix[40] of this proposal.

Table 10. VITIGEOSS Project Advisory Board

[40] Annex I in Part 4&5 of the proposal

Member	Sector	Representative	Scope
INNOVI (Catalan Wine Cluster)	Wine	Clara Santa María	Catalonia
PTV (Plataforma Tecnológica del Vino)	Wine	Mario de la Fuente	Spain
Assoenologi Campania	Wine	Dr. Roberto di Meo	Italy
Copernicus Climate Change Service	Climate	Carlo Buontempo	Europe
HCP International	Earth Observation & Agriculture	Mark Noort	International
Department of Agriculture, Generalitat Catalunya	Agriculture & Food	Jaume Sió Torres	Catalonia
Coldiretti Avellino	Wine	Francesco Acampora	Italy

3.2.2.4.Quality Management

VITIGEOSS will implement strict and sincere reviewing process on the project's output, in particular deliverables. The process must follow objective criteria on scientific and technical excellence, expected objectives, coherence with prior/following work, technical viability and value for exploitation. Aspects such as comprehension for non-experts shall be further taken into account since outcomes and most deliverables will be public. The cautious selection of critical reviewers is needed for integration, coherence and viability of the output delivered in respect to the alignment with industry interests, user acceptance and project objectives. Every deliverable is to be revised by at least one partner not authoring the document or otherwise directly involved in its production and shall be of the following: (i) the Project Coordinator; (ii) a team member that needs the content, e.g. as he continues the work/takes up the results or for exploitation; (iii) an agreed external expert because of the technical value he can introduce through revision or because of his valuable opinion and critical user-sight. Reviewers give their feedback in a structured format, following common rules and agreed scientific and technical criteria discussed by the Project Board. They shall provide constructive recommendations for improvement which the deliverable owner integrates for improvement. A list of milestones has been outlined, which serves as a tool to ensure the project quality. The monitoring of these milestones is an invaluable tool to identify potential deviations and apply corrective actions in order to achieve the expected results.

Table 11. List of milestones

Milestone number	Milestone name	Related WP(s)	Due date	Means of verification
MS1	Completion of Advisory Board	WP1	M03	Letters of commitments signed by all members
MS2	Delivery of Front-end for Vitigeoss portal	WP2 WP3 WP4	M12	Domain is registered, standalone apps are exposed, login for partners
MS3	API webstore published	WP2 WP3	M12	Service providers can upload and download data with VITIGEOSS services, demo services available, communication about desired standards
MS4	First release of all intelligent services	WP2 WP3	M20	First operational and verified versions of intelligent services ready to be tested during 2nd vegetative season. Services deployed and connected to Application portal and respective tiles.
MS5	Second release of all intelligent services	WP2 WP3	M32	Final versions of intelligent services ready to be tested during 3rd vegetative season. Services deployed and connected to

				Application portal and respective tiles.
MS6	Commercial release candidate of VITIGEOSS platform ready	WP3	M42	Authorizations are implemented, service providers handle authorization successfully, (user) data is exchanged between partners based on user authorisations. New users and service providers can be registered on the portal.
MS7	First successful customer addition	WP5	M42	A new customer is registered and able to use VITIGEOSS services
MS9	Final Conference	WP1	M42	Minutes of the event, list of attendants with signatures

3.2.2.5.Risk Management

The identification of the critical (or non-critical) risks acts as a part of the risk assessment of VITIGEOSS, due to the fact that it helps to set up appropriate mitigation measures. The identified risks will be monitored throughout the project and discussed during the meetings. Each identified risk will be assigned to a responsible, and mitigation and contingency plans will be defined. This process entails the identification and prioritization of risks and the application of the necessary resources to mitigate the impact of unfortunate consequences. Risks include project failures (at any phase in design, optimization, etc.), organizational issues or events of uncertain or unpredictable root-cause, etc. Table 12 reports a preliminary (non-exhaustive) list of potential risks affecting the achievement of VITIGEOSS objectives. The content of this table is intended to be the starting point for the preliminary risk management plan to be carried out in M06.

Table 12. Critical risks for implementation

Description of risk (level of likelihood)	WP(s) involved	Proposed risk-mitigation measures
Availability of sub-seasonal and seasonal predictions on time for the operational real-time operational forecast and disruption in data procurement (LOW)	**WP2** **WP3** **WP4**	A data availability schedule will be established to identify the due date and data needed along the project
End-user are not able to supply the necessary input data to establish the services listed (LOW)	**WP2**	The end-users are involved in the definition of the services and the data needs related to the to-be-developed services. This makes it unlikely services cannot be developed (optimally) within the project.
Innovative composite services developed will not comply with quality standards and overall expectations of the end-user (MEDIUM)	**WP2**	Innovative composite services are created in this project in collaboration with end-users. This means mitigation measures can be taken in consultation with end-users if it becomes clear later in the project that the assumed level of quality and usability cannot be reached. This means we can steer the development of these services effectively ensuring a minimum viable product can still be reached.
Technical failure of the VITIGEOSS infrastructure (LOW)	**WP3**	The platform is based on proven FruitLook technology. The VITIGEOSS portal has a redundant backup system in different data centres.
Performance of the system (LOW)	**WP3**	As we will base VITIGEOSS on existing technologies there is large experience with handling large amounts of data. We have developed smart “big data” solutions to optimize the performance of our services. For example we use smart compressed data formats to minimize the storage in our databases.
Clouds limit acquisition of satellite imagery (LOW)	**WP4**	The system is designed to work with multiple data sources, decreasing risk of lack of data. If one data source is not available it can easily be replaced with another one.

		Additionally, the focus lies on Mediterranean areas in which cloud cover is low during the grape production season.
The platform does not gain the necessary trust or reputation with its intended end-users (LOW)	**WP5**	Users will be well informed and the platform will offer a transparent view on how user-data is used throughout the system next to having a safe and trusted system for handling user data. Additionally, the end-users are involved in determination of system requirements.
Application service providers do not see the benefit of making their services available via the VITIGEOSS portal (MEDIUM)	**WP5**	Service providers are involved in the setting of requirements and development of the VITIGEOSS portal (API Service Store), ensuring VITIGEOSS matches their needs. This also supports the realization of a suitable value proposition and overall business case for service providers in the European wine sector to deliver their services via VITIGEOSS.
User willingness to attain VITIGEOSS services after project finalization (MEDIUM)	**WP5**	End-users are involved in the development of both service offering and the setting of requirements to the VITIGEOSS portal, ensuring VITIGEOSS matches user needs. This also supports the realization of a suitable value proposition and overall business case. Regarding the capacity to pay for it, VITIGEOSS is modular, meaning that users can choose the service of their interest (they might have other running, e.g. irrigation planner), and pay only for the IS they need, instead of paying for the whole package
Market readiness of technological solutions need more time after VITIGEOSS completion (LOW)	**WP5**	All ISs included in the platform are based on existing tools or products. During VITIGEOSS we will have 42 months to improve the existing models with EO data, and validate them during 3 vegetative seasons demonstration in end users plot. Nevertheless, special agreements may be done with end users (SYM, MBD and TOR) for a longer fine-tuning of the platform, in exchange of being able to use the outcomes during 1 more year (free-of-charge).
Not enough customers can be reached to provide a sustainable operation of the VITIGEOSS portal and services. (MEDIUM)	**WP5** **WP6**	The business analysis shows that even with a very conservative estimation of the target market we can maintain a sustainable service. However, due to the generic set of the services we expect to be able to reach a much larger market potential. Via WP 5 and WP 6 VITIGEOSS market entry stategy and dedicated communication/marketing of VITIGEOSS need to ensure a sufficient userbase can be reached.
The cooperation between the partners after the projects end-date stops or partners leave the project. (LOW)	**WP5** **WP6**	A viable business plan is developed in WP5 and momentum for the uptake of the services is generated in WP6
Competition from other service providers to the European wine sector (LOW)	**WP5**	We will mitigate this risk by making the design of the services as flexible and modular as possible. VITIGEOSS aims to be the single point of entry for viticultural data services for the Southern European wine sector. The infrastructure will enable linkage and integration with third party systems. As such we will be able to cooperate with any service available.
Low engagement of stakeholders in technical webinars, workshops and local sessions (MEDIUM)	**WP6**	Intense communication campaigns promoting the events in relevant channels min. 2 months in advance

3.3 Consortium as a whole

VITIGEOSS consortium is composed of 9 partners from 4 European countries (Spain, Italy, Portugal, and Netherlands), being 3 of these countries included in the list of most important wine producers in the world (Spain, Italy and Portugal, occupying the 1st, 3rd and 7th position respectively). All partners together provide the necessary range of expertise, competence and operational capacity to deliver the innovative project objectives. The high number of industrial partners (ELEAF, MBD, SYM, TOR) ensures a real orientation towards the business exploitation of the project results, and the high number of spezialized technical partners (EUT, BSC, LINKS, NAP) ensures a high innovation capacity of technologies included.

VITIGEOSS consortium was designed from the very first beginning to bring the partners necessary for the innovations we want to advance on, and make sure of the comnmercial development the topic wants to address. **ELEAF**, is especialized in services for agriculture based on satellite data, and who has already products on crop monitoring and crop status, being present already in markets all around the worls. They will bring the service on crop status and will design the platform for a later commercialization with agreements with the rest of technical partners (owners of the other services). **LINKS** is the technical coordinator in VISCA and they have developed a module for phenological prediction, using modelling and high resolution weather information. The phenological model is owned by **NAP** and needed for the phenological service owned by LINKS. They have a great experience in pilot implementation for wine companies, as well as knowedge of all field works in this business. **BSC**, also partner in VISCA and owner there of the high resolution weather and climate module, is going to advance here adding subseasonal forecasting, which is an innovative aspect in weather agriculture services. This forecasting will feed the other services for a better estimation and planning. **EUT** is the coordinator of the project with a vast experience in applying artificial intelligence to resource management optimization in companies belonging to different sectors. Here in VITIGEOSS they will improve this tool with a machinery data-logging, which will use also EO data for business planning and sustainability monitoring. **SYM**, **MBD** and **TOR** are 3 wineries whith a vast track-record in R+D and innovation activities , who will co-design the services and platofrm according to their needs, and will test it for improvement and refining. Las, but not least, **PWC** is the second largest professional services firm in the world, who will lead the commercial development activities for a succesful market penetration.

3.4 Resources to be committed

Table 13. Summary of staff effort

		WP1	WP2	WP3	WP4	WP5	WP6	Total
1	EUT	19	30,5	13,5	12	12,5	20	107,5
2	LINKS	8,5	14	11	10,5	4	3	51
3	eLEAF	2	13	2	11	3	5	36
4	BSC	5,5	13,5	20	15	9	6,5	69,5
5	PWC	1	23,5	4	11	4	22,5	66
6	NAP	8	1	1	0	10	2	22
7	MBD	3	5	4	17	1,5	5	35,5
8	TOR	1	9	3	7	1,5	3,5	25
9	SYM	1	9,5	7	10,5	5	3	36
	Total Person Months	49	119	65,5	94	50,5	70,5	448,5

Figure 13 shows the share of efforts in the different WPs. As it can be observed, the weight of WP2 is the highest since 5 ISs will be co-developed there, which will need intensive work and also strong cooperation and feedback with the end users and other WPs. The rest of WPs owns a reasonable amount of efforts, according to their nature (e.g. WP4 demonstration is always effort-demanding, here is the second in importance).
Figure 14 shows a well-balanced and logical share of efforts between the partners of the consortium, according to the amount of technical tasks they lead, and relevance of their role in both innovation and commercialization activities within the project.

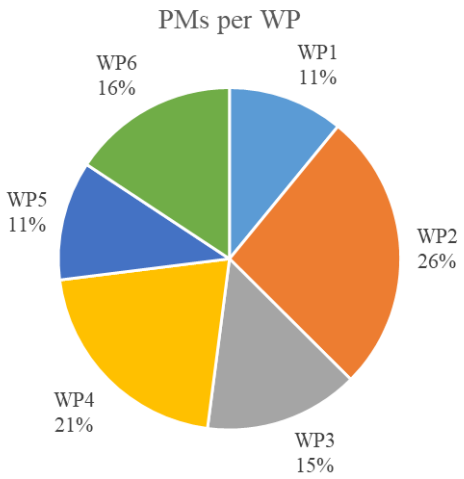


Figure 13. Distribution of efforts per WP

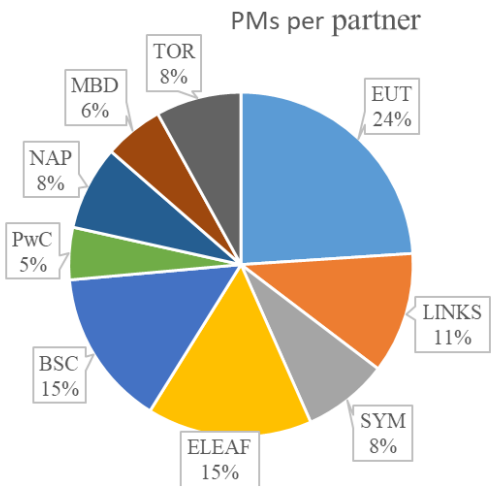


Figure 14. Distribution of efforts per partner

Table 14. 'Other direct cost' items (travel, equipment, other goods and services)

SYM	**Cost (€)**	**Justification**
Travel	11.250	Costs for attending Consortium and Review meetings (2 persons*2days)
Other goods and services	20.000	Machinery data-logging equipment (5000€) - Data-logger, and sensors to monitor operational data from tractors and accessories (e.g. sprayers). Connectivity to the cloud (with a 4G data plan). Fixed cameras (10.000€) - Remotely controllable cameras with high resolution sensors, variable focus, and Infra-Red (IR) sensors. Network connectivity infrastructure such as 4G modem and/or WiFi Drones (5.000€) - Service for flights of drones (with their current subcontracted drone company). Drones with high resolution camera and GPS, suitable for outdoor flight and for shooting pictures and videos of the vineyard.
Total	**31.250€**	

MBD	**Cost (€)**	**Justification**
Travel	11.250	Costs for attending Consortium and Review meetings (2 persons*2days)
Other goods and services	20.000	Machinery data-logging equipment (5000€) - Data-logger, and sensors to monitor operational data from tractors and accessories (e.g. sprayers). Connectivity to the cloud (with a 4G data plan). Fixed cameras (10.000€) - Remotely controllable cameras with high resolution sensors, variable focus, and Infra-Red (IR) sensors. Network connectivity infrastructure such as 4G modem and/or WiFi Drones (5.000€) - Service for flights of drones (with their current subcontracted drone company). Drones with high resolution camera and GPS, suitable for outdoor flight and for shooting pictures and videos of the vineyard.
Total	**31.250€**	

TOR	**Cost (€)**	**Justification**
Travel	11.250	Costs for attending Consortium and Review meetings (2 persons*2days)
Other goods and services	20.000	Machinery data-logging equipment (5000€) - Data-logger, and sensors to monitor operational data from tractors and accessories (e.g. sprayers). Connectivity to the cloud (with a 4G data plan). Fixed cameras (10.000€) - Remotely controllable cameras with high resolution sensors, variable focus, and Infra-Red (IR) sensors. Network connectivity infrastructure such as 4G modem and/or WiFi Drones (5.000€) - Service for flights of drones (with their current subcontracted drone company). Drones with high resolution camera and GPS, suitable for outdoor flight and for shooting pictures and videos of the vineyard.
Total	**31.250€**	

Innovation action
Horizon 2020
Call: H2020-SC5-16-2019
Topic: Developmen6tt of commercial activities and services through the use of GEOSS and Copernicus data
Type of action: IA
Proposal number: SEP-210597733
Proposal acronym: VITIGEOSS

Vineyard Innovative Tool based on the InteGration of Earth Observation Services and in-field Sensors

List of participants

Participant No	Participant organisation name	Country
1 (Coordinator)	FUNDACIO EURECAT	Spain
2	LINKS FOUNDATION	Italy
3	Symington	Portugal
4	ELEAF	Netherland
5	BARCELONA SUPERCOMPUTING CENTER-CENTRO NACIONAL DE SUPERCOMPUTACIÓN	Spain
6	PriceWaterhouseCoopers	Portugal
7	UNIVERSITA DEGLI STUDI DI NAPOLI FEDERICO II	Italy
8	AZIENDA VINICOLA MICHELE MASTROBERARDINO SPA	Italy
9	MIGUEL TORRES SA	Spain

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Section 4: Members of the consortium

4.1. Participants (applicants)

4.1.1. FUNDACIÓ EURECAT

Partner No 1	PARTICIPANT NAME: Fundació Eurecat	Country: Spain	
www.eurecat.org			

General description of the organisation:

Eurecat is the leading Technology Centre in Catalonia, and the second largest private research organization in Southern Europe. In figures corresponding to 2018, Eurecat turnover was 50 M€ and accounted 650 professionals. With HQ in Barcelona, Eurecat has 11 operational sites across Catalonia. Eurecat is currently participating in more than 70 EU funded collaborative projects (where 30 are also coordinated by Eurecat). In addition, Eurecat is also a strong player in the various public R&D programmes sponsored by the Spanish and Catalan administrations, so that, in all, Eurecat is currently participating in +200 R&D projects. Working in support of the business and enterprise ecosystem and Technology Transfer are also essential activities in Eurecat. Thus, Eurecat holds a private customer portfolio of over 1.600 companies, with 36 international patents and 7 technology-based companies started-up from the centre.

Eurecat R&D, innovation and training activities span from Industrial Technologies (metallic, plastic and composite materials, manufacturing processes, autonomous and professional robotics, functional printing and fabrics, simulations and sustainability) to Digital Technologies (Data Science and Big Data, Artificial Intelligence, IT Security, e-Health, Multimedia technologies) and Biotech (Omics science and Nutrition & health).

Name and Description of the Department(s) contributing to the execution of the Project

Eurecat's technical contribution to the project would be made through three units:

The **Smart management Systems** unit which focuses in the application of new technologies to the development of early warning systems and decision support system for reducing environmental impacts; modelling and development of distributed environmental/water governance and management systems across different actors of the urban, industrial and rural stakeholders; elaboration of smart objects and IoT platforms to enable collaborative and context-aware intelligence; and user-friendly expert simulation tools integrated to governance, management and decision support systems and gaming tools for rural, urban and industrial areas. Then, main role of SMS in the project is focused on the application of semantic technology and big data analytics to provide a semantic data broker that permit to generate newer participatory services for the cities and the urban symbiosis paradigm.

The Research Communications Office (RCO) is a specific unit within Eurecat's Corporate Communications Department. It is comprised of four professionals who specialize in the field of Corporate Communications and Digital Marketing, and who boast more than 10 years of experience in projects' dissemination in both the industrial and digital field. The RCO arose from the need and desire to professionalize the planning and execution of Dissemination and Communication activities, and was set up in order to maximize the impact of R&D projects and their results. EURECAT places particular emphasis on communicating the results of the projects it coordinates or in which it takes part, in order to make sure that the targeted stakeholders, companies and society in general are aware of its contributions. Communication takes place on a fully integrated, 360º basis, to ensure that all activities remain coherent and consistent with the specific strategy employed for each project. Moreover, the RCO keeps abreast of the emergence of creative and innovative channels, trends and tools and integrates them into its communication plans. Additionally, the recommendations of different international organizations (such as the European Commission) regarding communication and open data access are taken on board and implanted at a deep-rooted level.

Technology Consultancy Department
This department is composed of a multidisciplinary team oriented to increase the competitiveness of our customers by accelerating their innovation process through the inclusion of innovative technology within their business strategies. Their expertise includes: innovation strategies at territorial and company level; competitive intelligence; Systematization of innovation process; R&D, financing strategies; Industrial systems (ISO, UNE).
One of the most important activities of this department is the offering of innovation and strategy services to companies. This service consists of the development of a detailed action plan that define the strategy for innovation and technology development in the company, in line with its internal R&D procedures. Due to the existing Spanish and European industry, mainly composed of SMEs, EURECAT has developed an Innovation Management Methodology tailored for SMEs in order to better tackle their needs. The main phases of the methodology are:

- Analysis of existing innovation process
- Creation of innovation structures
- Mapping of opportunities and definition of the strategy
- Definition of the innovation methodology
- Awareness-raising within the company (training of key personnel and definition of the KPIs)
- Remote monitoring of the implementation results.

The **Public Programmes department** will be involved to assist the principal investigator in the general management procedures and coordination in WP1. Members of this team are responsible for ensuring project prospecting, efficient and professional project management, coordination, execution and justification of public funded R & D projects.

Role:

Eurecat as coordinator will manage the correct execution of the project in order to achieve the objectives and KPI's defined in the proposal. Technically it will ensure the appropriate implementation of all intelligent services, being the responsible of the development of two of them: the disease management and business and sustainability services plus the in-field data repository to be deployed and connected to the VITIGEOSS application portal. In addition, Eurecat will be involved form the beginning in the requirements definition of the future VITIGEOSS platform to assure the needs of the winery community are solved in an easy way and working hard to obtain a final marketable product thanks also to the dissemination done during the project.

The Unit of communication will be in charge of task 6.1 "Communication and dissemination management", where dissemination and communication activities are continuously monitored and

registered during the project. They are in charge of designing the web site and visual identity, as well as producing communication materials (roll ups, posters, info sheet, etc.)

The Unit of consultancy will be in charge of task 5.3 “IPR management”, dealing with all intellectual property that will arise from the project so as to ensure that it can be appropriately protected, partner’s agreements made (when applicable) in order to achieve a successful commercialization of VITIGEOSS. This activity is essential also for the business plan, so they will be giving support to PWC on this aspect (IPR).

Relevant Experience:

The Smart Management Systems research unit of Eurecat research will take part of the proposal. This unit has proven experience in data value chain management (Collection-Information-Knowledge-Intelligence) by means of research, design and development of solutions (algorithms, methodologies, modules, mobile apps, platforms) based on the combination of different technologies such as AI, Machine Learning, data analytics, optimization, and information and knowledge management, applied especially to water, advanced manufacturing, agri-food, energy and sustainability domains.

SMS has a wide expertise in the application of intelligent resource management and decision support tools; the development of interoperable and real-time platforms to fuse and integrate heterogeneous sources of information; the promotion of open, streaming and linked data environments inside knowledge management solutions capable of sharing and combining information between multi-level stakeholders and domains.

SMS’s portfolio includes technologies susceptible of being exploited and promoted in the smart farming future integrating IoT technologies and capabilities for the development of services and software that enables managing heterogeneous information. These technologies include artificial intelligence and Big Data applied to decision support, complex-event processing and context awareness applications.

CV or Profile description of Key staff carrying out the work

Gabriel Anzaldi. Graduated with honours as an Electronic Engineer, MSc Advanced Electronic Technology and MSc in ICT Management. Counts with more than 20 years of experience throughout the entire data value chain holding multiple positions (Developer, Researcher, Director of R&D and CTO). Across his professional history has collaborated with large and small companies, participated in technology transfer activities in the USA and the French Republic and designed and developed an intelligent factory in the People's Republic of China (2006). Currently, as **director of Eurecat’s Smart Management Systems Unit**, leads a research team focused on Artificial Intelligence applied to industry and resource management. He also collaborates as an external expert with the European Commission (Directorate General for Communication Networks, Content and Technology - DG-CONNECT and The Executive Agency for Small and Medium Enterprises - EASME) in the development of digital strategies (AI, Big Data IoT), being the principal author of the "Action Plan for the Digital Single Market for Water Services", DOI: 10.2759 / 724173. He is Director of the DIH Agritech Big Data and a member of different working groups in the following organizations: Big Data Value Association (BDVA), Alliance for internet of things (AIOTI), European Innovation Partnership on Water (EIP Water), Water Europe (former WssTP) and the ICT4Water cluster. Gabriel, collaborates with different standardization bodies, OGC® and ETSI, and delivered keynote speeches at several international conferences. He is co-author of the following patent “A computer implemented method for generating a mold model for production predictive control and computer products thereof”.

Josep Pijuan (M) - Advanced Researcher at Smart Management Systems Unit.

He holds a Technical Engineer in Computer Science by Universitat Rovira i Virgili (URV) and a Master Degree in Computer Science and Security Engineering in the same university. He has been software engineer for 6 years in an Automotive Technological Centre (IDIADA), and he has collaborated with URV research groups (ITAKA, AGA) to create Multi Criteria Decision Aid Systems for sludge management from sewage treatment plants. From 2012 in Barcelona Digital, and from 2015 in Eurecat, he has worked on many European projects (Life+, H2020, Manunet) like IES, LowUP, Optician2020, FurnIT-Saver, Cutrob+ and other private projects applying Artificial Intelligence based technologies. Currently, he is working as technical manager and researcher on projects about data analytics, efficient resource management, predictive maintenance, interoperability and IoT applied to the Agrifood sector and other domains.

Maddi Etxegarai (Female) - Researcher in the Smart Management System unity in Eurecat.
She is a doctor in Geomechanics from the Universitè Grenoble-Alpes (France) and Master in Physics from the Universidad Complutense de Madrid (Spain). After the master, she worked for two years in the European Spallation Source (ESS, ERIC), a cutting-edge neutron facility in Sweden, where she participated in the design and development of the detectors. The Ph.D. was a collaboration between

Francesc Bonada (M) R&D Project Manager at Smart Management Systems (SMS) Unit.
He holds a bachelor degree in Telecommunications Engineering ('07) at the Universitat Politècnica de Catalunya. At the moment he is finishing his PhD in Signal Theory and Communications at the same university, focusing on optical amplification and signal processing for next generation passive optical networks. Currently, he is involved in research projects for the application of Artificial Intelligence and Data Science in the Industry 4.0, focusing on process control and optimization of plastic and light alloys injection manufacturing. He has been involved in several H2020, FP7, Networks Of Excellence and National Projects (Des-MOLD, Mold4ProdE, SoundCAST, Flexicast, SARDANA, ACCORDANCE, BONE, Euro-fos, CVREMOD, eMolde, S-EBIT, CIMEC, TEYDE, PressNOzz, Mo3Dlling). Currently is the technical coordinator of H2020 project PREVIEW.

Lucía Arévalo (F) - Head of Research Communications Office at EURECAT.
She holds a degree in Informacion Science (Journalism) from the Universitat Autònoma de Barcelona, a Master's in Strategic Communications Management from Esade and a Master's in Corporate Communications Management by the Polytechnic University of Catalonia – School of Business Administration. She is a journalist specialised in Corporate Communications and Digital Marketing with more than 15 years of professional experience in companies of the Media, ICT and R&D sector. Before joining EURECAT, she worked at Barcelona Digital Technology Center as a Head of Corporate Communication and Marketing. She has large experience in developing, executing and monitoring projects's dissemination plans.

María Navarro (Female) European Program Manager
She has more than 10 years' experience in project management. She holds a PhD in Chemical Engineering and has a broad experience as project researcher and coordinator in several fields such as waste water treatment, agriculture, recovery of residues, disasters resilience and management, among others. She has participated in several national and European projects (FP7 and H2020).

Jorgina Cuixart (Female) Consultant on business development at Eurecat.
She is responsible for the exploitation of R&D results and support services to SMEs. Jorgina holds a bachelor degree on Environmental Sciences by the Autonomous University of Barcelona. Prior to Eurecat, she worked at the London Waste and Recycling Board on its infrastructure investment programme, as well as at London Councils and EUROCITIES supporting local authorities in policies and EU funded projects in the field of sustainable urban development.

List of up to 5 publications and/or other research or innovation products, or patents related to the project

Publications

- G. Anzaldi, E. Rubion, A. Corchero, R. Sanfeliu, X. Domingo, J. Pijuan, F. Tersa "Towards an Enhanced Knowledge-based Decision Support System (DSS) for Integrated Water Resource Management (IWRM)", Open access journal Procedia Engineering, 2014 http://dx.doi.org/10.1016/j.proeng.2014.11.230
- Gabriel Anzaldi et. al., Irrigation Expert Simulator (IES): a platform for training farmers and technicians in customized irrigation scheduling, Sustainable Agriculture Trough ICT innovation, EFITA-WCCA-CIGR Conference, 2013.

Innovation Products

- **INDIANA** (TRL6) Knowledge Discovery framework compiling different Machine Learning classifiers, together with a classifier booster based on scramblers and genetic algorithms that enhanced the performance for anomaly detection, pattern and knowledge discovery for industrial processes.

- Simulareg: Simulation tool available on internet for farmer training on water irrigation management on agriculture.

Patent

A computer implemented method for generating mold model for production predictive control and computer program products thereof (2017) EP17382532.

List of up to 5 relevant previous projects/activities

1. SIM4NEXUS Internet of Extensive Crops – H2020-WATER-2015-two-stage – Starting June 2016 – 7.9 M€ Project Budget
   SIM4NEXUS aims to predict society-wide impacts of resource use and relevant policies on sectors such as agriculture, water, biodiversity and ecosystem services through a model-based analysis.
2. GRAPE - Ground Robot for vineyArd monitoring and ProtEction.
   The project aims at creating the enabling technologies to allow agricultural service companies and equipment providers to develop vineyard robots that can increase the cost effectiveness of their products with respect to traditional practices. In particular, the project addresses the market of instruments for biological control by developing the tools required to execute (semi) autonomous vineyard monitoring and farming tasks with Unmanned Ground Vehicles (UGVs) and, therefore, reducing the environmental impact with respect to traditional chemical control.
3. IES (LIFE+ - COORDINATOR - 2012/2015) Is a set of simulation and decision support tools integrated in a web platform that will behave as an expert for a personalized scheduling of irrigation. Platform where farmers, irrigation technicians and experts interact with an agronomical knowledge-base to get recommendations for case specific scenarios. The main objective of the project is to optimize irrigation water use by farmers by providing them with a virtual irrigation platform "IES", for training and supporting farmers in scheduling irrigation. IES tested the defined models in several plots and checked the results in a great number of real use cases.

4. **AgROBOfood** - Business-Oriented Support to the European Robotics and Agri-food Sector, towards a network of Digital Innovation Hubs in Robotics - DT-ICT-02-2018 – 15M€ Project Budget.
   AgROBOfood is dedicated to accelerate the digital transformation of the European agri-food sector through the adoption of robotic technologies. It will consolidate, extend and strengthen the current ecosystem by establishing a sustainable network of DIHs. This will boost the uptake of robotic solutions by the agri-food sector: a huge challenge requiring an inclusive approach involving all relevant European players.

Relevant available infrastructure / equipment description

Service platform with automatic Big Data tools provisioning based in a mixed architecture GPU/CPU, able to delivery many different Big Data technologies for storing, processing, and analyzing large volumes of data. The platform is designed to deal with data from many sources and formats. Furthermore, EUT drives The Agritech Big Data DIH and the Big Data Centre of Excellence (Big Data CoE) in conjunction with the Barcelona City Council and Oracle, whose main objective is to promote Big Data through public-private initiatives with the aim of empowering the industry, particularly Agrifood industry, competitiveness. Aligned with this objective, the Big Data CoE can support i) the construction and validation of Big Data approaches prior to final implementation by providing Big Data infra-structure; and ii) Promoting and disseminating success cases through the industry in an innovative space to share experiences and knowledge between companies interested in such architectures.

4.1.2. LINKS FOUNDATION

Partner No 2	**PARTICIPANT NAME: LINKS Foundation**	**Country: Italy**	
www.linksfoundation.com/			

General description of the organisation:

The LINKS Foundation – Leading Innovation & Knowledge for Society – is a non-profit private Foundation founded in 2018 with the aim to boost the interaction between research and the business world towards the internationalization of the local socio-economic system. LINKS promotes, conducts, and strengthens innovation and research projects processes, improving products implementation as well as the study of new approaches and models. LINKS is the result of the merge of two distinguished research and innovation institutions: ISMB (Istituto Superiore Mario Boella), focusing on ICT, and SiTI (Istituto Superiore sui Sistemi Territoriali per l'Innovazione), focusing on Territorial Systems and Smart Cities. Similarly, to ISMB and SITI, this Foundation has been founded by Compagnia di San Paolo and Politecnico di Torino, inheriting the existing background of ISMB and SiTI in term of personnel-knowledge, facilities, goods and premises.
LINKS relies on technological and process competences of around 160 researchers and working in close cooperation with companies, academia and Public Administration. It is organized in Research Areas focused on core sectors of ICT that can manage the whole value chain, from basic technology up to its practical implementation (proof-of-concept). Additionally, LINKS extends its activities to process innovation, employing excellences and results of Research Areas into Strategic Programs that are interdisciplinary by nature and are aligned with the priority themes of the European agenda, including Smart Energy, Smart City and Smart Health. LINKS Foundation is also involved in several industrial cooperation activities with both large enterprises and SMEs, as well as in various higher-education initiatives in partnership with academic institutions.

Name and Description of the Department(s) contributing to the execution of the Project

Department of Data Science for Industrial and Societal Application (DSISA)
The Data Science for Industrial and Societal Applications (DSISA) research area focuses on Artificial Intelligence services for innovative Data Driven Solutions across several domains, including Security & Disaster Management, Agriculture, Industry, Environment, Space, Health & wellbeing, Cultural Heritage.

DSISA acts along the whole innovation process promoting a human-centred approach across the entire data value-chain, which entails data gathering from multiple sources (e.g. mobile, wearable,

IoT devices, satellites), data aggregation and processing, and data valorisation though the delivery of added-value end-to-end services and solutions.
DSISA expertise is centered on top-notch ICT tools and systems, with a focus on Big Data architectures and Deep Learning, and socio-technical approaches aimed to co-design and deliver innovative solutions to both private companies and public bodies, effectively working with local as well as international stakeholders.

Role:

Technical coordinator. Leader of Task 2.3 "*Phenological Phases Detection*".

Relevant Experience:
The DSISA research area of LINKS Foundation has a strong expertise and research interests in the field of Image Processing, Deep Learning, Intelligent Systems, geolocalized Data Analysis and Big Data architecture, which makes it a perfect match for the objectives of Task 2.3, that is phenological stages detection through analysis of images coming from EO, cameras, drones and also other sources of data.

CV or Profile description of Key staff carrying out the work
Fabrizio Dominici (male)- Head of Department of Data Science for Industrial and Societal Application (DSISA) – Role in the project: Technical and innovation manager.

Fabrizio Dominici is the head of the LINKS Data Science area and of the Microsoft Innovation Center. He has the responsibility to manage a group of 20+ researchers that work in the domain of digital innovation implementing Intelligent Systems that exploit top-notch technological solutions such as Artificial Intelligence, Machine Learning, Big Data, NLP and GIS. The area promotes a human centered approach to design solutions that cover the whole data value-chain which starts from the data generation on devices (e.g. mobile, wearable, embedded) and the data gathering from multiple sources of data (e.g. crowdsensing, geospatial-sensing, social-media, in-situ monitoring), up to the data monetization through the prototyping and provisioning of added-value services. Since 2012, he is also director of the Microsoft Innovation Center of Torino, which is an innovation unit set up through a cooperation agreement between Microsoft Corporation and LINKS. He has a valuable experience in managing multidisciplinary innovation projects at National and European level. He supports the European Commission as expert and has been the coordinator of FLOODIS (EC contract n. 607220) and ASSIST (ESA contract n. 4000115961/15) and he is managing I-REACT (EC contract n. 700256) and support European Commission as expert. Moreover, Dominici is author of several publications and acts as reference person of LINKS in the European BDVA (Big Data Value Association)

Claudio Rossi (male)- Senior Researcher in ICT Systems and Data Analysis.

Claudio Rossi after a double bachelor's degree from the Politecnico di Torino (Polito) and the Institut National Polytechnique de Grenoble (INPG) he obtained a Master of Science in Electrical and Computer Engineering from the University of Illinois at Chicago (UIC) in 2005. He

graduated in Electronics from Polito with summa cum laude. He worked for 1 year as software analyst at Consorzio per il Sistema Informativo (CSI) and for 3 years as project manager at Fiat Group Automobiles (FGA). He led the realization of a new passenger car plant in India and supported the definition of lean manufacturing best practices and standards. From June 2010 to July 2014 he worked for the Telecommunication Group (DET) of Polito as project manager, software analyst, programmer, and system admin, mainly focusing on the realization of a novel peer-to-peer social network, and on interference estimation and classification techniques using innovative algorithms and Software Defined Radios. He was a researcher intern at Telefonica I+D and in Dec. 2013 he obtained his PhD from Polito with the thesis titled "Cooperation Strategies for Enhanced Connectivity at Home", proposing several techniques to overcome connectivity issues, boost connection speed, achieve energy efficiency in wireless residential networks. He is now a senior researcher and project manager at Istituto Superiore Mario Boella: a private ICT oriented research center located in Turin, Italy, where he leads international research projects, mainly funded by the H2020 framework. He was the project manager and technical lead of the H2020 I-REACT project, which aimed to exploit advanced cyber technologies in order to increase resilience to disasters caused by climate induced natural hazards. His research interests include crowdsourcing approaches for Disaster Risk Reduction (DRR), social media analysis, and predictive applications based on Artificial Intelligence. He authored more than 30 peer-reviewed publications.

Vito Macchia (Male) - Senior Researcher in ICT Systems and Data Analysis

Vito Macchia is a R&D Engineer at Department at the Data Science for Industrial and Societal Application research area of LINKS Foundation. In 2009 he took the Master Degree in Computer Engineering from the Polytechnic University of Turin, with specialization in “Industrial Automation”. From March 2009 to September 2011 he worked as Research Fellow in the Robotics Research Group (RRG) at the Polytechnic University of Turin (Prof. B. Bona), funded by the regional project "MacP4Log". During this period his research was mainly focused on mobile robotics, autonomous navigation and computer vision, and he acquired experience with stereo cameras, omnidirectional cameras and RGBD cameras. From September of 2011 to January 2018 he was employed as researcher and full-stack developer at Istituto Superiore Mario Boella (ISMB), in the Mobile Solutions research area, where he collaborated to several european projects including webinOS, FLOODIS, GHOST, I-REACT and VISCA, being involved in the architectural design and implementation of several components, including infrastructure, backend, web-frontend and mobile application. Since 2018 he is continuing his work at LINKS Foundation, which absorbed ISMB, in the DSISA research area, expanding his research interests also to Machine Learning and Artificial Intelligence, DevOps.

Alessandro Farasin (Male) -. Senior Researcher in ICT Systems and Data Analysis

Alessandro Farasin is a R&D Engineer at Department at the Data Science for Industrial and Societal Application research area of LINKS Foundation and a PhD student at the Department of Control and Computer Engineering department of Politecnico di Torino. In 2013 and in 2016 he worked for Microsoft as Technical Evangelist, mainly focused in supporting SME and start-ups in architecting cloud infrastructures and realizing scalable solutions. In 2016 he obtained a Master of Science with honours in Computer Science at the Università degli Studi di Torino. His principal competences concern Machine Learning, Big Data, Virtual Reality and Image Processing. His PhD studies are focused in exploiting and creating Machine Learning techniques in Geospatial contexts. In ISMB he is involved in several European H2020 projects focused on Geospatial topics (such as I-REACT and other H2020 projects like VISCA and optiTruck) in which he is responsible for architecting and developing cloud-based software solutions, as well as Machine Learning models and Intelligent systems, capable to process great amount of data in real-time

List of up to 5 publications and/or other research or innovation products, or patents related to the project

- **VISCA Decision Support System** - Includes both the VISCA Dashboard, for displaying vineyard statistics and phenological predictions, and the VISCA Importer for parsing and extracting statistics and data from high-resolution meteorological data
- R. Imam, M. Pini, G. Marucco, **F. Dominici**, F. Dovis - "Data from GNSS-Based Passive Radar to Support Flood Monitoring Operations", International Conference on Localization and GNSS (ICL-GNSS), 2019
- **A. Farasin**, P. Garza - "PERCEIVE: Precipitation Data Characterization by means on Frequent Spatio-Temporal Sequences", International Conference on Information System Information Systems for Crisis Response and Management (ISCRAM), 2018
- L. Lopez-Fuentes, **C. Rossi**, H. Skinnemoen - "River segmentation for flood monitoring", IEEE International Conference on Big Data (Big Data), 2017
- **C. Rossi**, W. Stemberger, C. Bielski, G. Zeug, N. Costa, D. Poletto, E. Spaltro**, F. Dominici**, - "Coupling Crowdsourcing, Earth Observations, and EGNSS in a novel Flood Emergency Service in the Cloud" - IGARSS Conference, 2015

List of up to 5 relevant previous projects/activities

1. VISCA - Vineyards Integrated Smart Climate Application - (technical partner), European Commission-H2020-SC5-01-2016-2017, 2017-2020, Innovative data driven tools designed to include climate forecasting at different scales, from daily to decadal, which give farmers an action window to take decisions beforehand. The project relies on a BigData geospatial architecture to support analysis and forecasting algorithms on Copernicus information
2. PININ - PIemuNt chèINa - is a Regional Project funded by Regione Piemonte aimed at enhancing the quality of high-end Piedmontese agri-food products, introducing technologies for the traceability and authentication of food products, for innovation in the marketing of products in the food chain and for the detection of fakes and scams through innovative technologies such as Blockchain, Artificial Intelligence and Big Data, IoT, Augmented Reality, in addition to Geoweb and Business Processes. The project is part of part of the "Made in Piedmont" of the S3 regional strategy, in the agri-food sector. POR FESR 14/20 Piattaforma Tecnologica Bioeconomia.
3. I-REACT - Improving Resilience to Emergencies through Advanced Cyber Technologies (project coordinator), European Commission-H2020, 2016-2019. The project was the first European-wide data driven platform that integrated emergency management data coming from multiple sources, including data provided by citizens through social media and crowdsourcing, data from earth observations, predictive models, wearable devices and E-GNSS, including Copernicus EMS services. This allows to produce information faster and allow citizens, civil protection services and policymakers to effectively prevent and/or react against natural disasters as well as to provide valuable processed data for commercial purposes.
4. FLOODIS - Integrating Gmes Emergency Services with Satellite Navigation And Communication For Establishing A Flood Information System (Project coordinator), European Commission-FP7, 2013-2015. The main goal of this project is to develop the complete infrastructure for alerting professional users of an impending disaster and subsequently provide them with regular updates and geographical information (maps layers via mobile mapping application) concerning the disaster. The main sources of data were EFAS and Copernicus EMS.

5. Research on geospatial data use. For instance, for the Autonomous Burnt Area Detection Model. The goal of this activity is first determining which services currently provide satellite data and how these data are structured. Then, exploiting the retrieved satellite imagery in order to build a prediction model, based on a convolutional neural network, to find the boundaries of burnt areas, based on a segmentation approach.

Relevant available infrastructure / equipment description

DSISA will act in the project also through its Microsoft Innovation Center (MIC), a joint innovation group between Microsoft corporation and DSISA, targeting the digital needs of industry through a multidisciplinary innovation process. It focuses on the design and the implementation of intelligent systems exploiting top-notch technological solutions such as Artificial Intelligence/Machine Learning, Big Data, NLP and GIS. The MIC promotes a human cantered approach to design solutions that cover the whole data value-chain, which starts from the data generation on devices (e.g. mobile, wearable, embedded) and the data gathering from multiple data sources (e.g. crowdsensing, geospatial-sensing, social-media, in-situ monitoring), up to the data valorisation and monetization with the prototyping and provision of added-value services deployed on cloud-computing back-ends.

The MICs in the world have the goal to create opportunities for entrepreneurs, SMEs and startups and for the development of technical skills empowering them to achieve more. In this framework, the MIC Torino can leverage on technical resources such as subject matter experts, leading edge technologies and technical support. Through the resources available within the MIC, DSISA has a tailored access to the computational power of Microsoft Azure to prototype operational services.

4.1.3. SYMINGTON

Partner No 3	**PARTICIPANT NAME: Symington**	**Country: Portugal**	SYMINGTON Family Estates
www.symington.com			

General description of the organisation:

Symington Family Estates (SYM) is an entirely family-owned and managed Portuguese SME company and is one of the leading quality Port producers, responsible for the making of approximately 32% of all premium Port categories.

The Symingtons have been Port producers for five generations since 1882 but their family's involvement in Port dates back fourteen generations to 1652 through their great-grandmother Beatrice Atkinson. Five of the family (Paul, Johnny, Rupert, Dominic and Charles) work together, caring for the vineyards and the wine making for four historic Port houses: Graham's, Cockburn's Dow's and Warre's.

Determined by the number of varieties per 1,000 km2 Portugal has the greatest diversity of vines of any wine producing country in the world and in total has 250 indigenous varieties, many of which come from the Douro. The Symingtons are the largest vineyard owners in the Douro, with just over 1000 hectares of vines at 27 Quintas, the vast majority of which are planted on terraces, including 130 ha of organically farmed vines, the largest in Portugal. They conduct extensive research into Douro viticulture and winemaking in their experimental vineyards at Quinta da Cavadinha in the Pinhão Valley, at Quinta do Bomfim in the main Douro Valley and at their 'Vine Library' at Quinta do Ataíde in the Vilariça Valley. In the past the family developed the modern treading lagares, which became the most significant advance in the production of premium quality Ports for many years.

The family is unique in that they also own and farm their own vineyards. The Symingtons are amongst the pioneers who are developing the Douro DOC wines, producing Chryseia, Post Scriptum and Prazo de Roriz with the Prats family of Bordeaux, as well as other Symington Douro wines from Quinta do Vesúvio, Quinta do Ataíde and the Altano range.
The family are the only Douro producer to have made a Port in the 21st century that merited a perfect 100 points from Wine Spectator; Dow's 2007 Vintage Port. The family's dedication to the wines of the Douro was further recognized when Wine Spectator ranked Dow's 2011 Vintage Port as the Nº 1 Wine of the Year in 2014. Another wine, made in partnership with Bruno Prats, Chryseia Douro DOC 2011, was classified as Nº 3 Wine of the Year in the same year. This international recognition was an important step for the wines of the Douro and has significantly increased their reputation worldwide.

Role:

The end –user will select a pilot-plot to follow the demonstration on demo sites (WP4) and validate the responsiveness of the VITIGEOSS platform through the Integrated Vineyard Management (WP3). The dataset collected in the selected vineyards will be used to fine-tune the calibration of all the models (task 4.2) included in Vitigeoss: the downscaled weather forecast models, the phenological stage prediction models, the key crop indicators tracking models, the vine disease early warning system forecast, and the business and sustainability manager.

Relevant Experience:

Symington Family Estates has amassed a substantial number of prestigious awards over recent decades for its Ports as well as for its Douro DOC wines. Few wine companies anywhere have received such a valuable range of commendations. Awards have been forthcoming not just in the form of medals and trophies at the most important and respected international wine competitions, but also in the form of awards for the family company as a whole and for the family winemakers. These endorsements are a vindication of the investments that the family continue to make in their Douro vineyards and wineries. Some of the most significant awards of recent years

- **Wine Spectator 'Wine of The Year'** was awarded to Dow's 2011 Vintage Port, ranked Nº1 in the TOP 100, whilst Chryseia 2011 Douro DOC is ranked Nº3. This is a landmark achievement for the Symington family, for the Douro and for Portugal. Particularly remarkable is the fact that two wines made by the same family in the same region (one fortified, one still) were ranked in the first three places.
- **Graham's voted the world's most admired port brand.** The Drinks International magazine has conducted its 6th annual survey of the World's 50 Most Admired Wine Brands. The jury consists of over 200 leading figures in the wine sector, masters of wine, sommeliers and journalists. The 2016 survey has nominated Graham's as the World's Most Admired Port Brand and the 14th Most Admired Wine Brand in the world. Dow's Port, also owned and managed by the Symington family, was placed 31 in the World's 50 Most Admired Wine Brands.
- **International Wine Competitions 2015.** In the 2015 editions of the three most prestigious UK wine competitions: International Wine Challenge (IWC), Decanter World Wine Awards (Decanter) and International Wine & Spirit Competition (IWSC), the Symington family received an impressive total of 11 Gold and 29 Silver medals across the range of their Ports and Douro DOC wines. The Symington family's Ports have consistently won more awards than any other Port producer over the last three decades at these three major international competitions, all scrupulously conducted blind by professional wine tasters.
- **Dow's 2007 Vintage Port was awarded a perfect 100 Points** by Wine Spectator and still is the only Port produced in the 21st Century with 100 Points.

Best Viticulture Award 2012. Awarded by Portugal's authoritative 'Revista de Vinhos' in recognition of the excellence of Symington Family Estates's Douro viticulture, the foundation stone of the quality of the Ports and Douro wines produced by the Symington family in the Douro Valley.

CV or Profile description of Key staff carrying out the work

Fernando Alves – R&D Viticulture Senior Manager
Received his BSc in Agricultural Engineering and his post graduate diploma in Plant Science-Viticulture from the University of Tras-os-Montes and Alto Douro - Vila Real. Since 1987 he has worked at ADVID, serving as both Technical Director of Viticulture and Executive Director of the association and also responsible by the candidature of ADVID to Cluster Douro Wine, under the Collective Efficiency Strategies of POFC-QREN. Since 2013 is the R&D manager for viticulture in Symington Vinhos SA. His main areas of interest and research are in climate change, crop protection, grapevine physiology, grapevine water stress and efficiency of the grape production.

Fernando Alves – R&D Viticulture Senior Manager
Received his BSc in Agricultural Engineering and his post graduate diploma in Plant Science-Viticulture from the University of Tras-os-Montes and Alto Douro - Vila Real. Since 1987 he has worked at ADVID, serving as both Technical Director of Viticulture and Executive Director of the association and also responsible by the candidature of ADVID to Cluster Douro Wine, under the Collective Efficiency Strategies of POFC-QREN. Since 2013 is the R&D manager for viticulture in Symington Vinhos SA. His main areas of interest and research are in climate change, crop protection, grapevine physiology, grapevine water stress and efficiency of the grape production.

Frank Steven Rogerson – R&D Oenologie Senior Manager
PhD in Food Science and Engineering by the Escola Superior de Biotecnologia, Universidade Católica, and a Post-Doc at Universidade do Porto at the Chemistry Department. Since 1997 works for Symington Vinhos SA first as R&D advisor and since 2002 as R&D Manager in Oenology.
The maian areas of interest are wine fermentations of investigations in during the grape harvest, and the wine in the bottle / barrel, but also the development the new techniques of quality control. Since 2008, the work also incorporated the study the impact of the level of vigor vine / vines in quality grape / wine and wine produced. More than 150 reports have been written and some of the published.

João Pedro Ramalho – Head of Oelologie Department
Received his BSc in Agricultural Engineering at the University of Tras-os-Montes and Alto Douro - Vila Real and his post graduate diploma in Oenology at from the ESB/Charles Sturt University (Austrália). Since 1989 works for Symington Vinhos SA in different positions. Actually is the Head of oenology Department including since 2013 the R&D in Oenology.

List of up to 5 publications and/or other research or innovation products, or patents related to the project

- GREGORY V. JONES, **FERNANDO ALVES**. (2012) - Impact of climate change on wine production: a global overview and regional assessment in the Douro Valley of Portugal. Int. J. Global Warming, Vol. 4, Nos. 3/4, 2012
- **FERNANDO ALVES***, FRANK ROGERSON, SÉRGIO JOÃO, RAQUEL VEIGA, IVO OLIVEIRA, HELENA FERREIRA, BERTA GONÇALVES. (2016) Vineyard drought adaptation in the Douro Demarcated Region. ClimWine Bordéus Accepted
- **FERNANDO ALVES***, FRANK ROGERSON, PAULO COSTA, IGOR GONÇALVES, PEDRO LEAL DA COSTA, CHARLES SYMINGTON. (2016) Effects of rootstock in dynamic of ripening of cv´s Touriga Nacional and Touriga Franca in Douro Region. ClimWine Bordéus accepted
- **FERNANDO ALVES**, JORGE COSTA, PAULO COSTA, CARLOS CORREIA, BERTA GONÇALVES, RUI SOARES, JOSÉ MOUTINHO-PEREIRA (2013). Grapevine water stress management in Douro Region: Long-term physiology, yield and quality studies in cv. Touriga

Nacional. 18th International Symposium GiESCO 2013. Porto, 7-11 Jul.

- **FERNANDO ALVES**, MILES EDLMANN, JORGE COSTA, PAULO COSTA, PAULO MACEDO, PEDRO LEAL DA COSTA E CHARLES SYMINGTON. (2013). Heat requirements and length of phenological stages. Effects of rootstock on red grape varieties at Douro Region. 18th International Symposium GiESCO 2013. Porto, 7-11 Jul.
- Enzyme Catalysed Modulation of *Touriga Nacional* Aroma & Flavor Tipicity. Communication. **XXIVth Entretiens Scientifiques Lallemand** (In Print).
- Industrial Trials Modulating *Touriga Nacional* Aroma Tipicity. Poster & Communication. **XXXIV World Congress of Vine and Wine.** 20-27th June 2011, Porto, Portugal 2011.
- Constructing Quality Ports with Automated Robotic Lagares. Oral Presentation & Communication. **XXXIV World Congress of Vine and Wine.** 20-27th June 2011, Porto, Portugal 2011.
- Constructing Quality Ports with Automated Robotic Lagares. **Le Bulletin de L'OIV. 84:965-967 pp419-427, 2011**
- A Method for the Estimation of Alcohol in Fortified Wines using Hydrometer Baume and Refractometer Brix. **Am.J.Enol.Vitic. 57(4): 486-490, 2006.**

List of up to 5 relevant previous projects/activities

1. **VINESCOUT** - Intelligent Decisions from Vineyard Robot – Horizon 2020 Programme under grant agreement no 737669 FTIPilot-01-2016 - Fast Track to Innovation Pilot – https://cordis.europa.eu/project/rcn/206207/factsheet/en – www.vinescout.eu

2. **VISCA -** Vineyards´ Integrated Smart Climate Application. Horizon 2020 Grant agreement ID: 730253. H2020-SC5-2016-TwoStage. https://cordis.europa.eu/project/rcn/210173/factsheet/en www.visca.eu

3. **ROBOTIC "LAGARES"** - The family's long winemaking experience in the Douro has encouraged **new vinification techniques** that combine the lessons handed down through generations with innovations that have ensured the quality of the family's Ports and Douro DOC. An example of this is the development by the family's winemaking team led by Peter and Charles Symington of the modern treading lagares, the first prototype of which operated at the 1998 vintage. These **new lagares** are the modern equivalent of traditional foot treading which for centuries produced the finest Ports. These modern lagares now match the traditional lagares in all key aspects and have surpassed them in some.

4. **SYMINGTON GRAPE LIBRARY** - In 2014, Symington established an **experimental grape vineyard** with 53 varieties of *Vitis vinifera*, made up of many almost forgotten indigenous varieties from the Douro as well as from other regions of Portugal, with a few well-known international vines to act as references. Two hundred vines of each variety have been planted in two contiguous vineyard parcels covering 2.25 hectares of relatively flat land. The uniformity of the terrain will remove many variables that could influence the research, and the large size of the plant population will enable Symington to undertake meaningful comparative studies. The family's viticulture team have established research protocols with various universities, and the findings will be shared with other producers, thus benefiting the wines of the Douro in general. This research project aims to safeguard the genetic diversity of the Douro's grape varieties, whilst studying their viticultural and oenological potential. The Symington viticulture team will seek to identify varieties that might be suitable for planting in the Douro's varied terroirs in the future and Charles and his team look forward to making new and exciting Ports and Douro DOC wines based on what they learn at Quinta do Ataíde in the coming years.

Relevant available infrastructure / equipment description

Great wines are born in great vineyards and generations of Symington winemakers have put vineyard ownership at the heart of the family's winemaking philosophy. The family owns 27 quintas (vineyards) in the Alto Douro with over 1000 hectares of vineyard, being the foundation for the different wines of Graham's, Cockburn's, Dow's, Warre's and Quinta do Vesúvio, as well as of the Symington family's Douro DOC wines.

In addition to this, Symington Family Estates purchases grapes from approximately 1,200 growers in the Douro, many of whom have supplied the company for several generations. These farmers' vineyards, some of which are very small, are tended with passionate care by their owners and have excellent quality grapes.

Symington Family Estates has two important wineries in the Douro at Quinta do Sol near Régua and at Quinta do Bomfim near Pinhão. Their principal purpose is the vinification of grapes purchased at each vintage from over these 1,200 farmers. These two wineries are responsible for the production of the mainstream Ports and Douro DOC wines.

Moreover, the family has seven small specialist wineries at the family's most important quintas. Each of these wineries has its own winemaking team whose task is to produce the best possible wines from the grapes of each vineyard. The Symington's specialist wineries are located at Quinta do Vesúvio, Quinta da Senhora da Ribeira, Quinta dos Malvedos, Quinta de Roriz, Quinta do Bomfim (lagar winery), Quinta da Cavadinha and Quinta do Sol (Douro DOC 'Reserva Winery'). Each of these wineries produces no more than a few hundred barrels of Port and Douro DOC, making them some of the smallest and most specialised wineries in the Douro region. The international success and awards received for the family's wines in recent years are in large part due to these specialist wineries and to the family vineyards.

In 2014, Symington established an experimental grape variety vineyard at Quinta do Ataíde, where the company planted 53 varieties, made up of many almost forgotten indigenous varieties from the Douro as well as from other regions of Portugal, with a few well-known international vines to act as references. This vineyard will make a significant contribution to the understanding of these grape varieties and will safeguard the Douro's extraordinary vine diversity.

Since 2018 Symington build a new R&D wine lab at the head office in Vila Nova de Gaia.

4.1.4. ELEAF

Partner No 4	**PARTICIPANT NAME: ELEAF**	**Country: Netherdlands**	
www.eleaf.com			

General description of the organisation:

Established in 2000, eLEAF is a Netherlands based high-tech company that provides satellite based applications and data to optimise agricultural production and water management. eLEAF product offering is targeted at the entire agri-business value chain ranging from farmers to food processors as well as non-profit organizations, public institutions and governments.

To sustain the growing population in the era of climate change more food needs to be produced with less water resources in a sustainable way. This calls for a drastic improvement of the current performance of food production systems, where the use of pesticides and herbicides need to be critically evaluated. eLEAF's data can optimise food production and crop water use efficiency, identify food security threats and safeguard fair allocation of available water resources. This is where eLEAF makes a difference.

eLEAF`s mission is to be the global reference in the supply of reliable data on water and

vegetation on any land surface to support sustainable water use, increase food production, and protect environmental systems. Based on satellite data eLEAF provides insight into vegetation and crop production levels, the associated water use and water resources availability.

The core of eLEAF's technology is called Pixel Intelligence Mapping (PiMapping®). It generates detailed time series of among others biomass production, crop water consumption, crop water stress and water productivity. PiMapping® technology is used for field scale assessments up to continental monitoring. This data is quantified, accurate and based on state of the art satellite technology.

eLEAF`s agricultural products include our crop monitoring platform FieldLook, which provides farmers with weekly updates on their crop's health and water use and visualizes underperforming areas for immediate action. Starting as a precision agriculture application, FieldLook has gradually evolved in a powerful web portal communicating satellite derived information on single fields up to entire river basins. We offer irrigation advice and yield estimates for wheat, barley, potato, grapes (www.fruitlook.co.za), sugarcane and other crops.

In the Western Cape of South Africa our FruitLook, an instantiation of FieldLook, supports wine grape and other (fruit) farmers to enhance on-farm resource and crop management. During the 2018-19 production season over 70 000 hectares of agricultural land were registered on FruitLook by our users. Users indicate FruitLook helps them save 10 to 30% irrigation water and enhances awareness of in-season crop development with over 30% indicating it made a direct impact by increasing yields. For the sugarcane sector we have a full suite of application aimed at the specific mill logistics.

The water management products are aimed at water authorities. Agriculture is the largest consumer of the available water worldwide. Yet plant water consumption is hard to quantity and therefore hard to manage. eLEAF's algorithms quantify plant water use, be it for irrigated or rainfed crops, grassland or natural parks. This data can be provided for single fields up to entire countries or basins. Per day, per week or per year. eLEAF's water management tools provide water managers with improved insight into water need, allowing them to optimise the complex task of effective integrated water resources management.

eLEAF`s qualifies as a SME and employs 22 professionals. The company structure of eLEAF can be characterized as a flat organisation: project-/account-managers work in teams or individually under direct supervision of the managing director and supported by the finance (business support) department. The company is managed by its 100% Shareholder eLEAF Holding NV and had a turnover of 2.2 M€ in 2017.

Role:

eLEAF is a knowledge and integration partner due to its extensive experience in the operation of the Earth Observation based commercial application platform FruitLook in Southern Africa. eLEAF will ensure that VITIGEOSS becomes a manageable, lean and operable application store that can easily scale up and is businesswise sound. By combining partner services with the commercially tested FruitLook services, a one access integral application store will be created allowing access to end-users varying from wineyards to government.
To achieve this, eLEAF will undertake the task of application store integration as work package 3 lead, add commercially tested services to the store as service provider in work package 2 and conduct business development as partner in work package 5.

Relevant Experience:

- Hosting and development of the FruitLook and FieldLook platforms;
- Close to 20 years of experience in processing satellite based data for large geographical areas;
- Over 10 years of experience in processing operational data relevant for plant growth and associated water use;
- In-depth knowledge of dealing with large datasets and the operation and maintenance of the processing infrastructure to handle such datasets;
- Over 5 years of experience in data integration;
- Solid knowledge of viticulture and farm management in general;
- Worldwide experience in provision and development of satellite-based data services and applications to the agricultural sector;
- All-round business experience, including the commercial exploitation of similar services for agri-businesses that use our services to optimize their daily production management. This includes client interactions.

CV or Profile description of Key staff carrying out the work

Remco DOST (male) is a senior project manager, hydrologist and geo-information architect with over 20 years of experience in the application of Geographic Information Systems (GIS) and Remote Sensing (RS) for Earth Sciences. His key interest is to convert science into innovative applications and products. He has experience in remote sensing for water management, (mobile)GIS, data processing and modelling, data dissemination, geo-information architecture design and management and (web)cartography. He has managed, co-organized and participated in complex projects, field campaigns, (university) research and capacity building projects and technical assistance projects for various companies and organizations, such as ABInbev, EU and ADB.

Mr. Dost will act as the work package 3 manager, work package 5 business manager and international remote sensing specialist.

Karel VAN DER LANDE (male) Karel is working on the architecture and realisation of eLEAF's data processing factory, as well as the design and development of a web portal and interface in order to deliver data more efficiently to clients.

Mr. van der Lande will integrate the data sources in the backend and frontend solution.

Henk PELGRUM MSc, PhD (male). Dr. Pelgrum is a data scientist with over 20 years of experience in the fields of visible/near-infrared and thermal infrared remote sensing. He obtained a PhD from Wageningen University in 1999 for his research on spatial aggregation of land surface characteristics - Impact of resolution of remote sensing data on land surface modelling. Dr. Pelgrum has participated in numerous projects mapping evapotranspiration and biomass production at different scale levels and in different countries. Dr. Pelgrum works in eLEAF's R&D department, where he focuses on automating processing infrastructures and algorithms. For VITIGEOSS Dr. Pelgrum will focus on validation of the services demonstrated under work package 4 by eLEAF and provide technical support to establishment of services in work package 2.

Ruben GOUDRIAAN MSc (male) is a remote sensing expert and a project manager who joined eLEAF in 2011. He is the project manager for eLEAF's FruitLook project in South Africa, an operational data service for fruit farmers in the Western Cape which had a registered use of over 70 000ha during the 2018-19 season. He is involved in the continuous development of the FruitLook webportal, eLEAF's platform service that will be central to VITIGEOSS services. Mr. Goudriaan will act as business manager and international remote sensing specialist, and will offer

technical support based on his experiences in the wine sector in South African through FruitLook. He will be active in work package 3, 5 and 6.

Vincent DUPRÉ MSc (male) is an agronomist and precision agriculture specialist who focusses on the translation of eLEAF's geospatial data into precision farming applications to support actionable agricultural management activities. Examples of such services are monitoring of agronomic interventions, pest scouting, site specific pesticide application, yield mapping, or variable rate irrigation and fertilization. Mr. Dupré is actively involved in further developing eLEAF's FieldLook platform. Mr. Dupré is fluent in Dutch, English and Spanish. In VITIGEOSS Mr. Dupré will provide agronomic context to VITIGEOSS service and portal development through work package 2 and 4 and additionally provide a supporting role in work package 5 and 6.

Jasper VAN DER HOUT MSc (male) is an all-round specialist in system administration, database development and maintenance and data analysis. He particularly works on database development and quality control. Within VITIGEOSS he will be focus on the back-end configuration, deployment, testing and performance monitoring of the VITIGEOSS portal.

Frank VAN DEN BERG (male) is responsible for the front-end development of (FieldLook) applications in eLEAF. He has 10 years of experience in provision of IT based services in various roles and is versed in various programming languages. For VITIGEOSS he will focus on front-end development of services in work package 2 and the VITIGEOSS portal in work package 3.

Isadora DE REZENDE SILVA MSc (female) is an environmental engineer with a MSc in geo-information science for water management. At eLEAF she works as an image analyst in the Operations team. She has produced data for a variety of agricultural clients, including the ones serviced via FruitLook. For VITIGEOSS she will be working on processing the Earth Observation data required for eLEAFs applications in the VITIGEOSS portal under work package 4.

Johan DE BRAAK BSc (male) is Image Analyst and member of the Operations team of eLEAF responsible for the production of PI mapping data components on an operational basis. Currently, the data production for FruitLook in South Africa falls under his responsibilities. For VITIGEOSS Mr. De Braak will process the Earth Observation data required for eLEAFs applications in the VITIGEOSS portal under work package 4.

List of up to 5 publications and/or other research or innovation products, or patents related to the project

- **FruitLook (South Africa) -** Client: Western Cape Dept of Agriculture**.** Dates: 2010 – ongoing. FruitLook is an operational commercial EO service that provides insight in grapes growth, associated water use and nitrogen content on a weekly basis in South Africa's Western Cape province. FruitLook just started its 9th season, with data availability covering close to 100,000 hectares of wine grapes amongst many others crops, and 60% of its users have seen an increase of water productivity by 10%. (www.fruitlook.co.za). This service showcases eLEAF`s ability to provide Earth Observation based services for vineyards commercially and sustainable.
- **FAO Remote sensing for water productivity programme.** Client: UN Food and Agricultural Organisation (FAO) Dates: 2016 – ongoing. The FRAME project produces the data for FAO's open-access Water Productivity database. Based on remote sensing derived data it monitors land and water productivity for Africa and the Middle East. (https://wapor.apps.fao.org/home/1 and https://www.youtube.com/watch?v=ZX7SOhk97hA). eLEAF Leads the consortium that

provides the EO based data at local, national, basin and continental scale on a contract awarded by competitive bidding. This contract demonstrates eLEAF`s ability to provide and support services at very large scale.

- **FieldLook (Russia/Ukraine).** Clients: ABInbev, Pepsico, various other commercial customers**.** Dates: 2012 – ongoing. On a weekly basis farmer in parts of Russia and Ukraine get updates on crop status related to growth, water use and minerals via de FieldLook web based platform (www.fieldlook.com). This supports farmers with production optimization, irrigation advice and yield estimates.
- **SAT-DATA 2.0.** Client: SAT-WATER consortium (Dutch Water Boards)**.** Dates: 2016 – ongoing. The Dutch water boards are challenged with sustainable and effective water management while simultaneously having to balance agricultural, environmental, industrial and domestic water demands. Having access to accurate and reliable information on water use is key to be able to perform their tasks. eLEAF provides commercially 13 Dutch water boards with daily actual evapotranspiration and evapotranspiration deficit data as information to base (regional) water management decisions on.
- **Water auditing service.** Client: Department of Industry, New South Wales, Australia / Southern Africa water authorities Dates: 2019 – 2020. The water auditing application offers a solution for water managers tasked with checking water permit compliance in irrigation. Where permits are usually introduced in an effort to regulate water use, systems to monitor compliance are often absent or ineffective. The satellite based water auditing application monitors the volumes of water used in irrigated agriculture on a regular basis. It then automatically checks this against the permitted volumes, flagging non-compliance. It is field specific, can be applied for large areas and even international river basins. This tool gives the water managers the possibility to monitor, uphold and where needed enforce compliance to regulation.

List of up to 5 relevant previous projects/activities

1. **Earth Observation for Sustainable Development (EO4SD): agriculture and rural development cluster** Client: ESA EO4SD program Dates: 2016 - ongoing.

   eLEAF is the leading partner of the consortium. The EO4SD initiative supports the uptake of EO derived information in sustainable development. The project demonstrates the benefits of geospatial information products and services to support agricultural and management tasks to MDBs and Client States. Major themes addressed are agricultural production, land degradation, agricultural commodities, ecosystem services, food security, safeguards and irrigation. Services are developed in close collaboration with the stakeholders in the MDBs (World Bank, IFAD, ADB, and IADB) and Client States in Africa, Latin America and Asia.

2. **WEAM4i (Water & Energy Advanced Management for Irrigation) -** Client: EU FP7. Dates : 2013 – 2017.

   This was s a European project co-funded by the European Union under the 7th Framework Program within ENV-2013-WATER-INNO-DEMO-1, with a budget of 7.6 M € over 42 months. The WEAM4i consortium was composed of 17 members from different fields – business, research, irrigation communities and public agencies and organizations – from five European countries: Spain, Germany, Portugal, The Netherlands and France. The project addressed two of the priorities outlined by the European Innovation Partnership on Water, an initiative of the European Commission (DG- Environment): 'Water- Energy Nexus' and 'Decision Support Systems (DSS) and monitoring'. The aim of the project was to improve the efficiency of water use and reduce the costs of power irrigation systems. eLEAF`s role was to provide a water demand module, what we would call an application

these days, that prognoses the irrigation water demand of various intensive crops allowing for optimized water management.

Relevant available infrastructure / equipment description

eLEAF`s algorithms and processing infrastructure are developed in-house, and all the data processing is done by our team in Wageningen. The eLEAF IT infrastructure consists of a (virtualized) delivery environment hosted in our own data centre, which is connecting to two fibres, to support maximum availability and reliability and of a factory environment, which consists of a high performance 120 TB virtualized Server cluster, a Backup Facility, 22 x Workstation-PCs and 8 high performance notebooks. Software is used for specialised EO data processing, Geographic Information System analysis, as well as software component development. eLEAF operates an EUMETCast reception station (client), with access to all products that are distributed under the essential services with a basic subscription. An Enterprise Service Bus (ESB) is used to orchestrate multiple ways of dissemination and integration with supplier and customer systems and expose APIs. The Fieldlook frontend portal consumes API data services to expose crop production data to end users, which are primarily farmers.

4.1.5. BARCELONA SUPERCOMPUTING CENTER

Partner N 5	**PARTICIPANT NAME: BARCELONA SUPERCOMPUTING CENTER**	**Country: Spain**	
	www.bsc.es		

General description of the organisation:

The Barcelona Supercomputing Center - Centro Nacional de Supercomputación (BSC), created in 2005, has the mission to research, develop and manage information technology in order to facilitate scientific progress. At BSC, more than 350 people from 40 different countries perform and facilitate research into Computer Sciences, Life Sciences, Earth Sciences and Computational Applications in Science and Engineering. BSC is one of the four hosting members of the European PRACE Research Infrastructure as well as one of the first eight Spanish “Severo Ochoa Centre of Excellence” awarded by the Spanish Government.

Name and Description of the Department(s) contributing to the execution of the Project

The Earth Sciences Department at BSC (ES-BSC) was established with the objective of carrying out research in Earth system modelling. The ES-BSC activities are focused on global climate modelling and prediction based on research and developments with the EC-Earth climate forecasting system. The department also undertakes research on the development of dynamical and statistical methods for the prediction of global and regional climate on time scales ranging from a few weeks to several years, with special focus on technologies that allow high-resolution modelling. The formulation of predictions includes the development and implementation of techniques to statistically downscale, calibrate and combine dynamical ensemble and empirical forecasts to satisfy specific user needs in the framework of the development of climate services (i.e., tailored climate information that supports decision-making).

The assessment of the sources of predictability and the limitations in the exploitation of current climate prediction systems, mainly in Europe, inspires many of the publications delivered by

the unit. Besides contributing to the 5th phase of the Coupled Model Intercomparison Project (CIMP5) critical for the UN IPCC Fifth Assessment Report (AR5), global climate research activities at ES-BSC enable the provision of historical reconstructions and initial conditions to the EC-Earth community for the analysis of climate dynamics and seasonal to decadal climate predictions. The ES-BSC is already active in the planning and design of the future CIMP6, and is working to make key contributions including groundbreaking high-resolution climate simulations with EC-Earth. Over the years, the department has been active in numerous European Projects, including FP7 and H2020, not only as partner but also as coordinator. It is also currently involved in at least five COPERNICUS projects, coordinating one of the actions.

Role:

For this project, BSC will undertake research on the development and assessment of dynamical methods for the prediction of essential climate variables for agriculture. This will be mainly implemented within WP2, for which BSC is in charge of task 2.1 about developing weather and climate forecasting. Short term weather forecasts and sub-seasonal and seasonal climate predictions will be provided. The formulation of predictions also includes the development and implementation of techniques to calibrate dynamical ensemble forecasts and provide skilful and reliable predictions of climate anomalies and extreme events that satisfy specific user needs in the framework of the development of climate services.
BSC will also lead WP6 on Communication and Dissemination, ensuring that VITIGEOSS objectives, activities and outcomes reach the relevant target groups in and beyond the demo site countries. BSC will be specifically in charge of task 6.2, about transferring knowledge and added value to target groups through the generation of communication materials (info sheets and an executive summary). Since the institution is strongly involved in many climate services initiatives (including being part of the Climateurope Coordination and Support Action), they will share lessons learned in the co-production approach to develop a commercial climate service with the climate services community.

Relevant Experience:

The ES-BSC has put a strong effort to find a balance between the research inspired by the scientific topics identified by the communities and the need to respond to social challenges and needs. This is expected to stimulate the interaction between the service-oriented and research-based groups and trigger new opportunities for interdisciplinary research in a unique environment. In this sense, the ES-BSC is a unique interdisciplinary team that performs cutting-edge impact research ensuring its transfer to the society. The department is currently composed of about 100 people, including scientific, technical and sup-port staff. It is involving in International and National projects, between them, ES-BSC is coordinating one H2020 project (S2S4E) and two Copernicus contracts.

CV or Profile description of Key staff carrying out the work

Dr. Marta Terrado (female)

She holds a PhD in Earth Sciences (University of Barcelona) and a Master's degree in Geographical Information Systems (Polytechnic University of Catalonia). Marta has an experience of more than 10 years in agriculture, water management and ecosystem services research. She is currently working as science communication specialist in the Earth Science Department at BSC, facilitating knowledge transfer and user engagement for climate change adaptation at the science-stakeholders interface. She has management experience as work package leader in the EU-funded project APPLICATE and is involved in other H2020 projects, including MED-GOLD, Climateurope and IMPREX and in the development of the platform seasonalhurricanepredictions.org.

Dr. Terrado will lead WP6 and will be in charge of the transfer of knowledge and added value to the target groups, and ensuring the project objectives regarding capacity building and management of communication and dissemination are correctly achieved.

Dr. Albert Soret (male)

He holds a PhD in Environmental Engineering from the Polytechnic University of Catalonia (Barcelona). He is head of the Services group at the Earth Sciences Department of the BSC. The group host ~24 engineers, physicists, social scientists, economists, communication experts, and air quality/climate researchers who try to bring the latest developments in earth sciences to the society. He is a postdoc researcher with 14 years of experience in the areas of Air Quality and Climate. His main expertise includes emission modelling, meteorological modelling, air quality modelling and climate services. His research facilitates technology transfer from local, national to international levels to advance sustainable development in key sectors such as energy, urban development, infrastructure, transport, health, and agriculture and water management. He is the principal investigator of the S2S4E project (EC-H2020). Member of the External Advisory Board of Clim2Power (ERA4CS). Work Package leader within Clim4Energy (Copernicus), VISCA (H2020) and MAGIC (Copernicus) and he is also involved in EC-FP7 and H2020 projects and CAMS contracts: NEWA, EUPORIAS, SPECS, IMPREX, PRIMAVERA, CAMS95 and APPRAISAL.

Dr. Soret will be in charge of task 2.1 about the technical development of weather and climate forecasts, ensuring that forecasts are prepared for operational implementation.

Dr. Raül Marcos (male)
He holds a PhD in Physics (University of Barcelona) and a MSc in Meteorology (University of Barcelona). He has 7 years of experience working on the study of seasonal forecasting and its applications in a range of fields: agriculture, water resources, forest fires and renewable energy. He also has experience in the development of climate services in these areas.

Dr. Marcos will work within WP2 in the development and implementation of techniques to calibrate dynamical ensemble forecasts to provide skilful and reliable predictions.

Dr. Isadora Christel Jiménez (female)

She holds a PhD and a Master’s degree on science communication. She has seven years of research background followed by more than eight years of experience in the field of science communication. She has demonstrated effective applied practice, facilitating user engagement and tailoring climate information to the needs of relevant sectors of society. She has management experience as Work Package leader in EU-funded projects such as EUPORIAS, APPLICATE, PRIMAVERA and currently in CCiCC. She is communication manager of a COST action (inDust) and part of the coordination team of the S2S4E project. She leads the Knowledge Transfer team of the Earth System Services Group (ESS). The team is formed by three science communication experts, two social scientists, a research engineer specialised in user engagement, a User eXperience designer and a front-end developer.

Dr. Jiménez will be involved in WP6, sharing her expertise and participating in the generation of communication and dissemination materials to transfer the results of VITIGEOSS to target audiences.

Pierre Antoine Bretonnière (male)
He holds a Master’s Degree in "Mathematical and Mechanical Modelling" from the Matmeca

engineer school in Bordeaux (France). Graduated in 2010, he has worked in several climate research institutes (CERFACS - Toulouse - France, Catalan Institute of Climate Sciences - Barcelona - Spain and the Earth Sciences Department of the Barcelona Supercomputing Center). His work focuses on climate models outputs, data management and model coupling. He was the person in charge of the data management plan in the SPECS FP7 project and has participated in several other European projects (PRIMAVERA, QA4SEAS,etc.). He is also involved in the Research Data Alliance (RDA) framework as chairman of the "Weather, climate and air quality" interest group.
Mr. Bretonnière will be in charge of downloading and homogenizing the appropriate meteorological and climate data from the Copernicus CDS and NMME needed to attain BSC's tasks in WP2.

List of up to 5 publications and/or other research or innovation products, or patents related to the project

- Development of the S2S4E Decision Support Tool (DST; www.s2s4e.eu/dst), an operational climate service that integrates, for the first time, sub-seasonal to seasonal climate predictions with renewable energy production and electricity demand, developed within the S2S4E H2020 project (www.s2s4e.eu).
- Soret, A., Torralba, V., Cortesi, N., Christel, I., Palma, Ll., Manrique-Suñén, A., Lledó, LL., González-Reviriego, N., and Doblas-Reyes, F.J. (2019). Sub-seasonal to seasonal climate predictions for wind energy forecasting, J. Phys.: Conf. Ser.,1222, doi:10.1088/1742-6596/1222/1/012009
- Turco, M., A. Ceglar, C. Prodhomme, A. Soret, A. Toreti and F.J. Doblas-Reyes (2017). Summer drought predictability over Europe: empirical versus dynamical forecasts. Environmental Research Letters, 12, 84006, doi:10.1088/1748-9326/aa7859.
- Ceglar, A., M. Turco, A. Toreti and F.J. Doblas-Reyes (2017). Linking crop yield anomalies to large-scale atmospheric circulation in Europe. Agricultural and Forest Meteorology, 240-241, 35-45, doi:10.1016/j.agrformet.2017.03.019.
- Terrado, M., Lledó, Ll. Bojovic, D., St. Clair, A., Soret, A., Doblas-Reyes, F.J., Manzanas, R., San-Martín, D., Christel, I. (2019) The Weather Roulette: a game to communicate the usefulness of probabilistic climate predictions, Bulletin of the American Meteorological Society, doi: doi.org/10.1175/BAMS-D-18-0214.

List of up to 5 relevant previous projects/activities

1. Coordination of the H2020 project S2S4E, Sub-seasonal to seasonal predictions for the energy sector (S2S4E- 776787), which offers an innovative service to improve the management of renewable energy variability.
   The main result of the project is a Decision Support Tool (www.s2s4e.eu/dst), an operational climate service to enable renewable energy producers and providers, electricity network managers and policy makers to design better-informed strategies at sub-seasonal to seasonal timescales.

2. Coordination of the COPERNICUS contract 512 Evaluation and Quality Control (EQC) function of the Copernicus Climate Change Service (C3S).
   The contract has the aim to ensure that the service meets the needs of a range of users for high-quality data and information, and to propose the necessary evolution of the service itself, while shaping the research agenda to address the most important challenges detected.

3. H2020 project: Turning climate-related information into added value for traditional

MEDiterranean Grape, OLive and Durum wheat food systems (MED-GOLD-776467). MED-GOLD will develop novel pilot climate services focusing on three staples of the Mediterranean food system: Grape, olive and durum wheat.

4. H2020 project: Vineyards´ Integrated Smart Climate Application (VISCA-730253).
   The main objective of VISCA is making European wine industries resilient to climate changes, minimizing costs and risks through an improvement of the production management (quality and quantity of final product), while evaluating its replicability to other high-added value agriculture sectors.

5. H2020 project: PRocess-based climate sIMulation: AdVances in high resolution modelling and European Climate Risk Assessment (PRIMAVERA-641727).
   The main objective is to develop a new generation of advanced and well-evaluated high-resolution global climate models capable of simulating and predicting regional climate with unprecedented fidelity, for the benefit of governments, business and society in general.

Relevant available infrastructure / equipment description

BSC is the National Supercomputing Facility of Spain and hosts a range of high-performance computing (HPC) systems including MareNostrum 4 the new supercomputer that has a performance capacity of 13,7 Petaflop/s. The general purpose element has 48 racks with more than 3,400 nodes with next generation Intel Xeon processors and a central memory of 390 Terabytes. The second element of MareNostrum 4 is formed of clusters of three different technologies. These are technologies currently being developed in the US and Japan to accelerate the arrival of the new generation of pre-exascale supercomputers.

The BSC is a key element of and a coordinator of the Spanish Supercomputing Network, which is the main framework for granting competitive HPC time to Spanish research institutions. Furthermore, BSC-CNS is one of six hosting nodes in France, Germany, Italy and Spain that form the core of the Partnership for Advanced Computing in Europe (PRACE) network. PRACE provides competitive computing time on world-class supercomputers to researchers in the 25 European member countries.

4.1.6. PRICEWATERHOUSECOOPERS

Partner No 6	PARTICIPANT NAME: PRICEWATERHOUSECOOPERS	Country: Portugal	
www.pwc.pt			

General description of the organisation:

With offices in 158 countries and more than 250,000 people, PwC are among the leading professional services networks in the world. We help organisations and individuals create the value they are looking for, by delivering quality in assurance, tax and advisory services. PwC provides advisory services to clients across all industry sectors.

Our values represent PwC and what characterises us. They are the bases to our relationships and interaction with society, as part of an integrated strategy that allow us to succeed in every business dimension. Our clients are part of the largest and most complex organizations, as well as the most innovative leaders in the world.

PwC Portugal has offices in Lisbon, Porto, Praia (Cape Verde) and Luanda, PwC's network enables us to leverage vast and deep knowledge of member firms around the globe to provide greater value to our clients.

Our professionals are recognized in every industry for their breakthrough analysis, development and implementation of solutions for companies operating in this sector.

Some distinctive awards:

- *Classified as one of the best global leading companies in labor diversity (DiversityInc, 2018)*
- *Nominated leader of EMEA Business Consulting Services in 2019 (IDC Marketscape report, 2018 and 2019)*
- Classified as leader in "Global Digital Business Transformation" ("The Forrester Wave" report, 2019)
- *Nominated as leader in "CRM and Customer Experience Implementation Services" and "Data and Analytics Services Providers" (Gartner's Magic Quadrant, 2019)*

At PwC, we believe that is necessary to innovate to stay one step ahead of existing practice.

Role:

PwC will ensure that the project objectives, activities and outcomes reach the market (WP5). Moreover, key outcomes from the other WPs will be used as basis for the preparation of the business plan. In fact, the PwC's WP will support commercial exploitation of the project results in an international scale and at the preparation of a realistic business plan.

Role:

PwC will ensure that the project objectives, activities and outcomes reach the market (WP5). Moreover, key outcomes from the other WPs will be used as basis for the preparation of the business plan. In fact, the PwC's WP will support commercial exploitation of the project results in an international scale and at the preparation of a realistic business plan.

Specific objectives

- Raise the awareness of the target groups and potential users about Vitigeoss: understand what it can deliver and how it relates to their needs
- Define a successful market entry strategy
- Assess project's feasibility

Main tasks

- **Task 5.1 Portraying the project:** High level discussion with partners in order to obtain a good understanding of the strategic objective and the key elements of the value proposition and business model
- **Task 5.2 Market analysis and competitive assessment:** Overview of the wine sector in Europe and conduct a desk/secondary research on competitors in order to perform a competitor's assessment
- **Task 5.3 Stakeholders consultation:** Assess Vitigeoss potential market acceptance through interviews with wine producing players: Using Vitigeoss participants network, interview relevant producers in the top 3 producing countries in Europe (Italy, France and Spain) and Portugal and perform a market survey during the two workshops already planned and a SWOT analysis
- **Task 5.4 Review Value Proposition and define market entry strategy:** Review all insights from Market and competitive assessment and stakeholders consultation and review Vitigeoss value proposition, together with participants and analysis of market entry options and key success factors
- **Task 5.5 Business plan and feasibility study:** Creation of a financial model in order to estimate potential revenue and operational costs, over 10 years
- **Task 5.6 Implementation roadmap:** Define an implementation roadmap for the business plan

Relevant experience

As a fully integrated global team with offices and staff all over the world, PwC constantly works with clients across different geographies. The following two engagements are examples of when our team has provided market analysis and competitive assessment, market entry strategies and business plan and feasibility studies:

- Advice to a national wine producing Group on the analysis of profitability by vineyard and by type of product. Definition of strategic options covering internal optimization, distribution channels and optimization of product portfolio references in order to make the business viable. Elaboration of a document with the restructuring plan jointly defined for support in the process of renegotiating its bank liabilities

- PwC advised a Portuguese company engaged in the wine production market, in the Portuguese still wine and rum market assessment and on the identification of potential target acquisitions, in the context of a inorganic growth strategy

Experience, one of your most important considerations in selecting your Contractor is the know-how and reliability to deliver. **You want to work with a team that has done this work before and that has a successful track record in collaboration with large, complex, national and international institutions to deliver projects that are similar in scope and complexity.** We have highlighted more than 5 projects that we have worked, in recent years, in this industry and specific topic, demonstrative of our expertise in providing each of the services covered in this

tender that we plan to leverage on this important project.

Quality delivery, due to our deep knowledge and experience in the development of Strategic Projects for both public and private clients, PwC and Strategy& are the pre-eminent strategy through execution firm that delivers superior value, offers premium talent, and is differentiated by its ability to help clients build their own capabilities on a global scale**.**

A national network and international presence in all EU Member States, an aspect that allows us to involve the right stakeholders. On the other hand, it will enable us to gather best practices from other EU countries.

Simply: **Quality. Experience. Delivery and, above of all, Commitment**. This is the value you can expect from PwC.

CV or Profile description of Key staff carrying out the work

Cláudia da Silva e Sousa da Costa Rocha (female) - Project Leader and Quality Assurance.
BSc in Economics by University Porto; Post Graduation in Financial Markets by ISCTE; Post Graduation in Corporate Finance by ISCTE; Post Graduation in Financial Analysis by ISEG; Business Management Executive Program by Nova-Católica; Leadership and Strategy Executive Program by Kellogg/Católica; Driving Value through **Business Acumen and Leading Organizations in** Disruptive Times by INSEAD Executive Programmes. Cláudia joined PwC in 1996 and she is currently the Strategy Advisory leader in PwC Portugal, Angola and Cape Verde. With more than 23 years of professional experience, she has been working for several years with private and public organizations, assisting them in the execution of major investment projects, in Portugal, Angola and Cape Verde. She has been responsible for the coordination of multidisciplinary teams in projects related to the elaboration of business plans, companies and businesses valuations, financial structuring of capital projects, model reviews, economic and financial feasibility studies, analysis of strategic options including financial restructurings, fundraising and identification of strategic partners in the development of new projects, market analysis and business plan frameworks, economic impact analyses and other specialized interventions. Cláudia's client base in the agriculture and wine: Blandy Super Bock Group (ex-Unicer), Sogrape, Sogevinus, Companhia das Quintas, Herdade Grous, The Fladgate Partnership, Coca Cola, to mention a few.

Pedro Fonseca Pires Duarte Guerreiro (Male) - Project Manager & Strategy Senior Expert
Relevant certifications: Undergraduate Degree in Industrial Engineering and Management; Master in Science in Industrial Engineering and Management; Prince2 **Practitioner** Certification.

Pedro joined PwC in 2019 and currently is Manager of Strategy Advisory department, at the Lisbon office focusing on Market Studies and Strategy Options. Previously, Pedro worked at Deloitte in Portugal, Alicante and Madrid, being responsible for Strategic Project across industries. His core competences within Market Studies, Strategy, Operational Planning, Governance and Organisation, Project Management, and Analytics, to mention a few.

Ana Rita Conde Serras (Female)- Senior Technical Expert
BSc in Economics and MSc in Finance both by Nova School of Business and Economics. MSc Finance dissertation in Mortgages Derivatives; Strategic Management and Value Creation (Universidade Católica); Advanced Financial Modelling – Camilla Culley. Rita joined PwC in 2006 and currently is Director of Strategy Advisory, PwC Portugal.
Rita has over 12 years of experience in advisory services. She has been involved in several cross sector projects, including market assessment projects in the Wine industry, mainly comprising commercial due diligence, market analyses, valuations, business plans, feasibility studies,

strategic options analyses, amongst others.

Rita's client base within the drinks industry includes: **Blandy, Super Bock Group (ex- Unicer), Coca Cola, The Fladgate Partnership, Nutre, to mention a few**

List of up to 5 publications and/or other research or innovation products, or patents related to the project

- **Value Creation in Portuguese Wine Companies and Vineyards**: Recommendations from the analysis developed by PwC for the CV3 Project on the financial structure of companies in the sector, analysing the cluster by market segments according to their size and focusing on long-term sustainable balance sheet structures.
- **Digital trends transforming the wine industry**: In this study, we present some insights about the wine industry, mentioning topics like digitalization of the industry, cyber security, food brand and others.
- **Wines and Spirits Newsletter**: Periodical publication made by PwC regarding the current state of the French wine industry. The content of this publication provides the user with information about legislation, industry state, expert opinions and more.
- **Can you see the trend? The South African wine industry insights survey**. A PwC publication highlighting results, trends and opportunities for South African wine businesses.
- **Argentina's wine industry report**: This PwC study develops an analysis of the wine industry in Argentina context.

List of up to 5 relevant previous projects/activities

1. **Confidential**: Advice to a national wine producing Group on the analysis of profitability by vineyard and by type of product. Definition of strategic options covering internal optimization, distribution channels and optimization of product portfolio references in order to make the business viable. Elaboration of a document with the restructuring plan jointly defined for support in the process of renegotiating its bank liabilities
2. **Confidential**: PwC advised a Portuguese company engaged in the wine production market, in the Portuguese still wine and rum market assessment and on the identification of potential target acquisitions, in the context of a inorganic growth strategy
3. **Confidential**: Assistance to a national Group in the wine sector in the elaboration of a business plan incorporating a set of measures of operational improvement of saving of costs and options of restructuring of its bank liabilities of ~€70 million to present to financial institutions
4. **Confidential**: PwC advised the main wine producing groups in obtaining access to European and national Investment Funds regarding production investments and R&D activities
5. **Confidential**: Advice in the indicative valuation of a company in wine and sparkling wine production, in the context of an insolvency process

Relevant available infrastructure / equipment description

N/A

4.1.7. Universita degli Studi di Napoli Federico II – Departimento di Agraria

Partner No 7	PARTICIPANT NAME: Universita degli Studi di Napoli Federico II	Country: Italy	
www.agraria.unina.it/			

General description of the organisation:

The Università degli Studi di Napoli Federico II was founded in 1224 by the will of Frederick II, King of Italy and Holy Roman Emperor. Nowadays, it is organized in 4 Schools and a total of 26 Departments. Its staff includes 3198 researchers/professors and 2566 technicians (data for 2017).

Name and Description of the Department contributing to the execution of the Project

The technical contribution to the Project will be made by the Department of Agricultural Sciences that is settled at the historical Faculty of Agriculture located in the royal palace of Portici (Napoli) that is a long established Institution with expertise in the fields of plant science, fire ecology, animal ecology and behaviour, conservation biology and ecological modeling.
The institutional education activities range from undergraduate courses to doctoral studies in the field of agriculture, food science, forestry and environmental science.
The scientific relevance of the research activity of the Università degli Studi di Napoli Federico II in the Subject "Agricultural Sciences" has international recognition, being ranked, for the year 2019, as number one in Italy out the top 43 Universities evaluated, 7 out of 312 in Europe, and 31 out of 800 in the World (see National Taiwan World University Ranking).

Role:

The main aims of this research unit will be (a) to carry out cultivar-specific calibrations of the phenological models (WP2), and (b) design and manage, throughout the project, the pilot plots at the demo-sites in order to provide the datasets required for the fine-tuning of the calibration of all the models included in VITIGEOSS (the phenological stage prediction models, the key crop indicators tracking models, the downscaled weather forecast models, and the vine disease early warning system forecast) and for the validation of the VITIGEOSS services (WP4).
NAP will lead WP4.

Relevant Experience:

The selected research group of the Università degli Studi di Napoli Federico II (Department of Agricultural Sciences) will make available a wide scientific expertise that covers all the aspects of the environmental physiology of grapevines required for the project. It includes scientists specialized in (a) studying, in open-field conditions, grapevine responses (in terms of vine development, vine health, yield, and berry/wine composition) to weather conditions in climate change scenarios (tasks 2.4, 2.6, 2.7, 3.1, 3.4, 4.1, 4.2, and 4.4,); (b) modelling grapevine phenology and vegetative/reproductive growth (tasks 2.3, 4.1, 4.2, and 4.4); (c) studying applications of precision viticulture that applies both remote and proximal sensing technologies (WP2).

CV or Profile description of Key staff carrying out the work

Boris BASILE (Male) - Associate Professor

PhD in Fruit Tree Physiology at the University of Naples, he is Associate Professor of Viticulture at the University of Naples. He is a whole-tree environmental physiologist specialized on grapevines. His field of expertise includes water and light relations, carbon partitioning, and

development of fruit trees in general. The main objective of his research is to develop innovative vineyard management practices aiming to optimize, in a changing climate, fruit yield and berry composition at harvest. He has ongoing collaborations with different scientific groups of modelers to build models aiming to predict plant phenology and growth.
Role in the project: Manager of Work Package 4, calibration of phenological models, design of the pilot plots at the demo sites, and supervision of decisions at the demo sites.

Stefano MAZZOLENI (Male) - Full Professor
PhD at University of Aberdeen (UK) - MSc at Michigan State University (USA). Full professor of Applied Ecology. He has a wide experience in project management and coordination of several EU funded projects and National and Regional research programmes. Main research work on vegetation dynamics, fire ecology, litter decomposition and soil organic matter dynamics, plant-soil interactions and effects of disturbance, Software tools for ecological modelling.
Role in the project: Calibration of the phenological models for the all the cultivars included in the project, monitoring of phenological events and supervision of decisions at field level.

Francesco GIANNINO (Male) - Assistant Professor
Ph.D at University of Naples. Researcher at University of Naples. Expert in modelling and integrated software. The research interest is mainly devoted to the design, development and analysis of mathematical models in Ecology. Methodological and computational aspects have been considered for several different applications.
The research has been carried out in the frame of several international projects and collaborations with European research groups which are leaders in the area of ecological modelling.
Role in the project: Calibration of the phenological models for the all the cultivars included in the project, monitoring of phenological events and supervision of decisions at field level.

Angelita GAMBUTI (Female) - Associate Professor
Her research mainly focuses on the characterization of grape and wine polyphenols. Research topics range from the individuation and quantitative analysis of phenolic compounds responsible for chromatic characteristics, antioxidants properties, bitterness and astringency in grape and wine to the individuation of the enological practices able to better transfer these compounds from grapes to wines and preserve wine quality over time. A particular interest and expertise with respect to the understanding of factors affecting the accumulation of sensory active compounds in grape during ripening has been also developed.
Role in the project: Monitoring technological and phenolic ripening of the berries at the Italian demo-site, evaluation of the impact of viticultural practices on wine main characteristics.

Giandomenico CORRADO (Male) - Associate Professor

He is a plant molecular geneticist working on fruit trees and vegetable crops whose aim is to translate basic research for the benefit of farmers. His scientific interest is the study of genetic and genomic variation in plants, with regard mainly to the transcriptional response to stress. His expertise relevant to the project concerns the identification, development and application of diagnostic nucleic acid-based biomarkers for agri-genomics. ***Role in the project*** Design of the pilot plots at the demo sites, monitoring vine health status, supervision of decisions at field level.

Fabrizio CARTENI (Male) - Researcher

Ph.D at University of Naples. His main research activity is focused on plant eco-physiological and developmental processes studied with different modeling approaches (i.e. System Dynamics, Individual-Based Models, Hybrid models). Other subjects of interest are the emergence of vegetation spatial patterns studied through reaction-diffusion models and growth dynamics of microbial populations. ***Role in the project:*** Calibration of the phenological models for the all the cultivars included in the project, monitoring of phenological events and supervision of decisions at field level.

Pasquale SCOGNAMIGLIO (Male) - Post Doc

Ph.D at the University of Naples. His main research activity is focused on grapevine eco-physiology. He has large experience in the design and the management of open-field trials aiming to study the effect of microclimate and vineyard management practices on grapevine phenology and vegetative and reproductive growth. ***Role in the project*** Calibration of phenological models, collection and analyses of data at the Italian demo-site.

Alessandro MATAFFO (Male) – PhD Student

Ph.D student at the University of Naples. His research interests focus on the definition of innovative vineyard management strategies to optimize, in a climate change scenario, grapevine fruit production from both a quantitative and qualitative point of view. His research is also focused on trying to analyze the relationship between changes in vine phenology and berry ripening. ***Role in the project:*** Calibration of phenological models, collection and analyses of data at the Italian demo-site.

List of up to 5 publications and/or other research or innovation products, or patents related to the project

Relevant Publications

- Caccavello G., Giaccone M., Scognamiglio P., Mataffo A., Teobaldelli M., Basile B., 2019. **Vegetative, yield, and berry quality response of Aglianico to shoot-trimming applied at three stages of berry ripening**. American Journal of Enology and Viticulture, 70(4): 351-359.

- Caccavello G., Giaccone M., Scognamiglio P., Forlani M., Basile B., 2017. **Influence of intensity of post-veraison defoliation or shoot trimming on vine physiology, yield components, berry and wine composition in Aglianico grapevines**. Australian Journal of Grape and Wine Research, 23(2):226-239.

- Basile B., Caccavello G., Giaccone M., Forlani M. (2015). **Effects of early shading and defoliation on bunch compactness, yield components, and berry composition of Aglianico grapevines under warm climate conditions**. American Journal of Enology and Viticulture, 66(2):234-243.

- Cartenì, F., Giannino, F., Schweingruber, F.H., Mazzoleni, S. (2014). **Modelling the development and arrangement of the primary vascular structure in plants.** Annals of Botany, 114(4):619-627.

- Vincenot, C.E., Giannino, F., Rietkerk, M., Moriya, K., Mazzoleni, S. (2011). **Theoretical considerations on the combined use of System Dynamics and individual-based modeling in ecology.** Ecological Modelling, 222(1):210-218.

Relevant Products

- **Primary vascular structure in plants model (2014):** A spatially explicit reaction-diffusion model defining a set of logical and functional rules able to simulate the differentiation of procambium, phloem and xylem and the emerging radial patterns of vascular tissues. The model was design in SIMILE and implemented in Matlab.
- **Phenology model (2015):** A model to simulate phenology in different tree species. The model was design in SIMILE and implemented in Matlab.
- **Fire propagation model (2013):** A new Decision Support System (DSS), named TIGER MEG, was developed in collaboration with the national forest service Corpo Forestale

dello Stato (CFS). The system is able to simulate the wildfire contour line according the following inputs: vegetation type, slope, wind, vegetation moisture. The system offers also a new way to estimate the area of origin of forest fires, in support of the existing methods of analysis used by the investigators. The system is aimed to be an advanced tool for teaching applications to show the interactions between wind and fire in different landscape scenarios. The model was design in MATLAB and implemented in C++.

- **Organic Matter DYnamic model (OMDY) (2013):** A model to simulate the organic matter decomposition according different quality and environmental input data. The model was design in SIMILE and implemented in Matlab

- 5. **Vegetation dynamic (2012, 2013, 2014):** A model able to describe the dynamics of the plant biomass in the presence of toxicity produced by the decomposition of accumulated litter in the soil. The model reproduces the emergence of patterns of a single clonal plant species. The model was design in SIMILE and implemented in Matlab.

List of up to 5 relevant previous projects/activities

1. VISCA: **Vineyards' Integrated Smart Climate Application** (**Modelling coordinator, Pilot plot coordinator) Funded by:** Horizon 2020 (Grant Agreement n. 730253) **Years:** 2017-2020

   The aim of the VISCA project was to integrate climatic data, phenological and irrigation models, and end-users´ requirements into a Climate Service (CS) - Decision Support System (DSS), co-designed with relevant South-European wine companies from Spain, Italy and Portugal, in order to provide with well-founded decisions of specific aspects of crop planning (i.e. budburst, harvest, defoliation, pruning, minimum water needs, etc.), make warning against extreme events in short term, and produce a historical and future projection on the effects of climate change over phenological events.

2. **LIFE SOILCONSWEB: Multifunctional Soil Conservation and Land Management through the Development of a Web Based Spatial Decision Supporting System (Modelling coordinator)**
   Funded by: EU LIFE08 ENV/IT/000408 **Years:** 2010-2014
   The aim of the SOILCONSWEB project was both to produce, to test and to apply an IT tool to support stakeholders' decision on landscape issues aiming to both the best soil conservation and land management and to an easy landscape implementation of some important environmental related EU directives and regulations and NAP. In the project, this research group provide a dynamic model to describe the Peronospora cycle.

3. **Fire PARADOX "An Innovative Approach of Integrated Wildland Fire Management (Modelling coordinator)**
   Funded by: EU Integrated Project FP6 -018505 **Years:** 2006-2010
   FIRE PARADOX sets the basis for a fire management policy in the European Union. The central objective of Fire Paradox is to prevent the current disastrous social, economic and environmental consequences of wildfires in the Mediterranean environments. The approach is innovative: the regulation of the wildfire problem is based on the wise use of fire. In the project, this research group provide a fire 2D simulator to evaluate the fire propagation dynamic.

4. **Phenological shifts of balsam fir and black spruce under defoliation by spruce budworm and climate warming (Modelling coordinator)**
   Funded by: Ministère des Forêts, de la Faune et des Parcs du Québec **Years:** 2018-2020
   The objective of the project is the development of a new process-based model based on

carbon allocation to predict budburst phenology under defoliation by spruce budworm and climate warming.

5. **EU - ModMED Modelling Mediterranean Ecosystem Dynamics ENV4 CT-97 0680 (Project Coordinator and Modelling coordinator)**
   Funded by: EU ENV4 CT-97 0680 **Years:** 1997-2000
   The objective of the Modmed project has been the improvement of the understanding of Mediterranean ecosystems dynamics and degradation.

Relevant available infrastructure / equipment description

NAP is fully equipped to carry out open-field and lab research on the environmental physiology of grapevines

Equipment available: gas-exchange analyser, fluorimeter, leaf area meter, Schollander pressure chamber, ceptometer, SPAD, Time Domain Reflectometry (TDR) system, digital refractometers, titrators, HPLC system, ion chromatography system.

They support other research groups without modelling expertise in the implementation of models in their specific field of interest.
Software expertise: modelling tool add language (Matlab, Simile, Stella,), statistic package (SPSS, Statistical, …), GIS systems (ArcGIS, QGIS,).

4.1.8. MASTROBERARDINO

Partner No 8	PARTICIPANT NAME: Mastroberardino	Country: Italy	
www.mastroberardino.com			

General description of the organisation:

Mastroberardino company is fully committed to traditional cultivation of ancient grape varietals, with ability to blend modern technology with time-tested techniques. The Mastroberardino long-term goal has been focusing on wines reflecting the typical characters and notes of the Irpinia territory (located in the province of Avellino – Campania region – Italy). The family owns an extensive network of vineyards in the DOCG's area like Montemarano, Mirabella, Lapio, Pietradefusi in "Taurasi DOCG" appellation; Montefusco, Santa Paolina, Tufo, Petruro in "Greco di Tufo DOCG" appellation; Santo Stefano del Sole, Lapio, Montefalcione, Manocalzati in "Fiano di Avellino DOCG" appellation; the Apice estate in "Sannio DOC", and the vineyards located in the archaeological site of Pompeii. Mastroberardino has been working to identify different zones with distinctive type of soil in the Irpinia areas, in order to select the most quality sites to get the best grapes for making wines with personality.

The Mastroberardino vineyards are located in different altitudes, starting from 450 meters above the sea level up to 700 meters. The benefit is the high difference in temperature between daytime and night, a unique microclimate in the worldwide viticulture scenario.

The company collects climate data on daily basis in all vineyards using weather stations in order to understand the vines healthy conditions and possible plant water stress.

A micro-vinification center located in the old winery of Atripalda (Avellino) is the key to analyze the specific character and peculiar notes of the grapes coming from the different vines in the family estates.

Mastroberardino qualifies as a SME and employs an average of 66 workers in different departments. The company had a turnover of 11.5 M€ in 2017.

Name and Description of the Department(s) contributing to the execution of the Project

The technical contribution to the Project will be held by the Department of Production that is composed by the viticulture office, the oenological staff and the quality lab.

Role:

The role is to support the research in several vineyards planted with aglianico grape in different terroirs with the aim to achieve the calibration of phenological and management models for the case of Aglianico. The result could be the technical supporting tool for phenological events and management decisions at field level.

The end –user will select a pilot-plot to follow the demonstration on demo sites (WP4) and validate the responsiveness of the VITIGEOSS platform through the Integrated Vineyard Management (WP3). The dataset collected in the selected vineyards will be used to fine-tune the calibration of all the models (task 4.2) included in Vitigeoss: the downscaled weather forecast models, the phenological stage prediction models, the key crop indicators tracking models, the vine disease early warning system forecast, and the business and sustainability manager.

The second and the third vegetative seasons of the project will be dedicated to fully validate the Intelligent Services that will run operationally. The performance of the VITIGEOSS services will

be monitored by evaluating the capacity of the tool (task 4.4) in:

- forecasting the vine phenology
- monitoring the key crop indicators
- forecasting the occurrence of vine diseases
- optimizing the use of resources

Relevant Experience:

Mastroberardino has been a partner of the **VIVA Sustainable Wine** experimental project conducted by the Italian Ministry of the Environment, for the Evaluation of the Viticulture Impact on Environment. A comprehensive protocol has been specifically created to study the environmental impact of wine production through some parameters: Air Carbon Footprint, Water Footprint, Vineyard Sustainability, Territory Impact analysis. Today Mastroberardino have completed and certified the analysis related to the company (analysis of organization) according to VIVA technical specifications:
http://www.viticolturasostenibile.org/EtichettaVirtuale/EtichettaOrganizzazione_v1.aspx?id=31128a90-8187-47bf-bcd5-93b430996745

- **VIVA** is a voluntary program that, through 4 scientifically recognized indicators, aims at assessing and improving the vineyards and wine production sustainability performances.
- **VIVA** is promoted by the Italian Ministry for the Environment, Land and Sea, and verified by an independent third organization. It applies common rules through the use of technical specifications, based on the current main standards on the issue.
- **VIVA** assesses the sustainability of the company, the process and the product.
- **VIVA** is scientifically updated, based on the Italian academic research and the international expertise.
- **VIVA** is committed to protect the environment, the biodiversity and the landscape, allowing the exchange of best practices.
- **VIVA** promotes the socio-economic aspects related to the wine production.
- **VIVA** supports a "sustainability culture" at local, national and international level by creating a multi-stakeholder system.

Mastroberardino company has a relevant experience and knowledge about the indigenous grape varieties of the Campania region and about the traditional territory of cultivation. The company collaborates with different research institutes to improve and increase the knowledge and the quality production. Moreover, into the micro-vinification cellar it is possible to follow and analyse the results coming from the pilot plot experiment.

CV or Profile description of Key staff carrying out the work

Dr Antonio Dente (male) - *Position in Organisation:* Chief agronomist

Agronomist, he looks after the management of the company vineyards (workers coordination, fertilization and treatments decisions, new plantation decisions, research and development).

Degree in Agriculture, defines the annual management plan of interventions and treatments in the vineyards. He oversees grape production activities, the organization of work and assigns tasks,

organize and control the daily activities of the field, conducts monitoring of the analytical control of production parameters.
He collaborates with the laboratory manager in the choice of the monitoring of the production phases plans. He organizes and coordinates the planning of the harvest stages.
The Chief agronomist supervises, organizes and plans the work and the program in the vineyards, taking samples and studying the results.

Prof. Piero Mastroberardino (male) - *Position in Organisation:* Owner – CEO of the Board
He is the legal representative of the company. He has extraordinary and ordinary administration powers. He is in charge of human resources management.
The Management activity consists in carrying out the guidelines and directives expressed by the administrative executive committee.
Full Professor of Management, Department of Economics, University of Foggia.
The CEO supervises, coordinates and obtains constant information about the project from the technical team.

Dott.sa Daniela Strollo (female) - *Position in Organisation:* Chief Quality Management
Chemistry graduated, collaborates with the CEO to the definition of annual plans for quality improving and related objectives;
She carries out activities to ensure the application and maintenance of the requirements of UNI EN ISO 9001: 2008, elaborates quality programs in order to achieve the objectives, monitor the implementation of approved programs and take the necessary corrective measures to prevent the occurrence of non-compliance of the product, process or system.
She organizes and directs the laboratory activities.
The Chemist, laboratory director, coordinates with the agronomist and oenologist for the choice of methods of analysis, according to the fields of investigation chosen by the scientist in charge.

Dott. Massimo Di Renzo (male) - *Position in Organisation:* Chief oenologist
Oenologist, he looks after the work in the cellar and the production of the wines.
He oversees the production of wine, the organization of work and assigning tasks, organizes and controls the daily activities of the cellar; conducts monitoring of the analytical control of production parameters; collaborates with the laboratory manager in the choice of the monitoring of the production phases plans; manages and organizes the production planning activities. He cares research and development related to wine production.
The Chief winemaker coordinates the production of wine obtained from the study of winemaking potential crop of experimental vineyards.

Dott.sa Antonella Gallo (female) - *Position in Organisation:* Lab assistant
She works in the lab where she organizes and follows the laboratory activities.
Food technologist, she coordinates with the lab director, the agronomist and oenologist for the choice of the analysis methods, according to the fields of investigation chosen by the research in charge.
Dott. Antonio Capone (male) - Position in Organisation: Viticulture assistant
He works in viticulture following the vineyards activities.
Agronomist, he coordinates with the chief agronomist for the choice of the management decisions, according to the company aims.

<u>List of up to 5 publications and/or other research or innovation products, or patents related to the project</u>

- A. Leone, P. Magliulo, N. Leone, A. Capone, A. Dente, F. Fragnito, G. Leone, A. Petrecchia, A. Buondonno, 2017. **Proximal and remote sensing to study the rural landscape at farm scale.** Paesaggi Rurali – Regione Campania
- Idolo Tedesco, Stefania Moccia, Silvestro Volpe, Giovanna Alfieri, Daniela Strollo,

Stefania Bilotto, Carmela Spagnuolo, Massimo Di Renzo, Rita P. Aquino & Gian Luigi Russo, 2016. **Red wine activates plasma membrane redox system in human erythrocytes.** Free Radical Research ISSN: 1071-5762 (Print) 1029-2470 (Online) Journal homepage: http://www.tandfonline.com/loi/ifra20

- P. Scognamiglio, M. Giaccone, V. De Micco, A. Dente, M. Forlani, B. Basile, 2016. **Influence of pre-anthesis defoliation on yield components and berry composition of Greco grapevines.** Tenth International Symposium on Grapevine Physiology and Biotechnology
- Piero Mastroberardino, Claudio Nigro, Giuseppe Calabrese, Flora Cortese and Gemma Carolillo, 2009. **Family business: institutional framework and entrepreneurial power.** Int. J. Globalization and Small Business, Vol. 3, No. 4, 2009

List of up to 5 relevant previous projects/activities

1. VISCA: **Vineyards' Integrated Smart Climate Application (Modelling coordinator, Pilot plot coordinator) - Funded by**: Horizon 2020 (Grant Agreement n. 730253) **Years:** 2017-2020
   The aim of the VISCA project was to integrate climatic data, phenological and irrigation models, and end-users´ requirements into a Climate Service (CS) - Decision Support System (DSS), co-designed with relevant South-European wine companies from Spain, Italy and Portugal, in order to provide with well-founded decisions of specific aspects of crop planning (i.e. budburst, harvest, defoliation, pruning, minimum water needs, etc.), make warning against extreme events in short term, and produce a historical and future projection on the effects of climate change over phenological events.
2. **VIVA Sustainable wine** - **Funded by**: The Italian Ministry for the Environment, Land and Sea - **Years:** 2012-2014
   The project represents the first specific study on environmental impact of wine production, using, together with the classical WFP and CFP ratio, the Territory and Vineyard ratio which extends the commitment to the whole area involved in grapes and wines production. The project aims to define the guidelines for a sustainable production, develop a code which provides a certification for companies that will adopt these guidelines, and train experts able to develop protocols for implementing sustainability in the whole industry and to raise consumers' awareness at National and International levels.
3. **PROJECT CAMPUS QUARC** - **Funded by**: Campania Region POR 2007-2013 - **Years:** 2012-2014
   The project Campus QUARC aims to improve the efficiency of the production processes to increase the competitive markets of five agri-food sectors of excellence in the Campania Region: Wine, Pasta, Olive Oil, Dairy Products and Chestnut.
   The tool is to create highly innovative systems, improving the quality (also extended to food safety) throughout recognition, genetic, origin and environmental.
4. **PROGETTO DIVINO** -"Soluzioni distributive innovative per la comunicazione della distintività del vino italiano sul mercato consumer internazionale" - **Funded by**: Ministero dello sviluppo economico - **Years:** 2010-2014
   The project aims to develop an innovative distribution format, dedicated to Italian wine, to be proposed on the international market "consumer". The value add in the competitive processes is in the ability to communicate a cultural identity and the sense of territory as a distinctive factor.

Relevant available infrastructure / equipment description

The company has a network of weather stations in the field and in particular a weather station is located in Mirabella Eclano estate where the experimental demo site will be run.

There is a micro-vinification cellar in the winery located in Atripalda (Avellino) where it will be possible to study the results coming from the experimental pilot plot. The winery has a fully equipped lab to analyse the berry, must and wine composition.

4.1.9. MIGUEL TORRES S.A

Partner No 9	**PARTICIPANT NAME: Miguel Torres S.A**	**Country: Spain**	
www.torres.es/			

General description of the organisation:

Torres is a family owned winery with vineyards in Spain, Chile and California exporting premium quality wine and brandy to over 150 countries.
Since it was founded in 1870, Familia Torres has managed to combine tradition and innovation with the aim of leading the premium quality wine and brandy sector, always producing with the utmost respect for the environment.
Torres owns 2.272 hectares of vineyards in Spain, Chile and California. Torres has a turnover of 260 million EUR (2017) and employs more than 1.300 people worldwide.
The Torres family's philosophy of winegrowing begins with respect for the land. In all vineyards and land, Torres completely avoids the use of chemical treatments, replacing them with biological alternatives, following the viticulture traditions of Torres' ancestors.
Torres investment in "green" projects has been accelerated even more with the Torres & Earth program, put in place in 2007 with a 10 million EUR budget for a 10 years period. Torres & Earth is not only a C02 reduction program, but actually a wider ecological-sustainable program that covers projects like renewable energies, optimization of water use, eco-efficiency in transport – for example using lighter bottles – ground-breaking research projects and vineyard-adaption-measures. Torres has committed itself to reduce CO2 emissions by 30% per bottle by 2020 compared to 2008 levels.
On sector level, Torres was one of the initiator's of WCP ("Wineries for Climate Protection") that started in 2011 with a symposium in Barcelona, calling for a 20% reduction in CO2 emissions by 2020 and other 5 environmental action points. Since then important progress was made in the process of auditing the wineries and establishing the rules and methods for the homologation.
The ecological record of Bodegas Torres is known and valued internationally by for example the Drinks Business Green Award of 2011.

Name and Description of the Department(s) contributing to the execution of the Project

The objective of the Torres Torres Family Innovation and Knowledge area is to implement new knowledge and technologies in all areas of the winery, improving the ability to innovate to lead the future. Directed by Mireia Torres, a member of the fifth generation, the area is structured in three lines of work: to promote research and development in all areas and especially in wine and winemaking, focusing on climate change and the recovery of ancestral varieties; Promote innovation within the company by promoting intrapreneurship and promoting the incorporation of new technologies.

Role:

We will provide data to WP2 and WP4, and at the same time we do the maintenance and monitoring of the plots where we have trials. During the WP3.4 TORRES will validate that

VITIGEOSS cloud-based application portal delivers against the user requirements.

Relevant Experience:

Torres is the coordinator of the project Gophytovid, "Optimization of the use of phytosanitary products in viticulture based on vigor maps" we use drone images to execute the project. In addition, we set up the 'Vitis Agrolab' along with IRTA, the aim of this project is to promote innovation in the field of viticulture and face climate change. The two entities will work together in an experimental farm located in Juneda, in the province of Lleida, to test and validate new technologies and innovative products that help winegrowers to be more sustainable and efficient.

CV or Profile description of Key staff carrying out the work

Montse Torres Viñals (female), trained as a enologist and agronomist and has several years of research experience. She joined Miguel Torres, S.A. in 1996. As project manager, she is the Head of research in the viticulture department at Miguel Torres, S.A., works to ensure solutions to improve wine and grape production in order to mitigate climate change based on robotics, IT technology, and biotech and vineyard management strategies. She has strong expertise in project coordination. Montse will work on coordination and supervision of field tasks.

Carlos Ezquerra Cerdan (male), IT Engineer and EMBA by EADA Business School joined Miguel Torres, S.A. in 2009 as IT Project manager. Carlos is now on the innovation department leading the Digital Transformation in collaboration mainly with the departments agriculture, marketing and commercial in Miguel Torres and participating in projects related to new technologies, data acquisition and analysis

List of up to 5 publications and/or other research or innovation products, or patents related to the project

- R. Savé, Mireia Torres, Montse Torres, & Felicidad De Herralde. **El cambio climático en la viticultura actual: una causa común de efectos y soluciones particulares.** Agroagicultura (Ae), núm. 33, Otoño 2018.
- UBALDE, J.M., SORT, X., NACCI, S. & POCH, R.M. (2013): **Determining soil moisture regimes for viticultural zoning purposes. Soil Forming Factors and Processes from the Temperate Zone**, 12, nº1: 1-16. (ISSN: 1582-4616 (Print), 2285-5696 (Online))
- MARTÍNEZ-CASASNOVAS, J.A., ESPINAL, S., RAMOS, M.C., UBALDE, J.M. , TORRES, M., SORT, X. (2013): **Analysis of inter-anual changes of NDVI for precision viticulture applications**. In: ESCOLÀ, A., ARNÓ, J., SANZ, R., PUIGDOMÈNECH, L. (ed): 9th European Conference on Precision Agriculture. Facing new challenges, providing new solutions; 7-11 September 2013, Lleida. Edicions de la Universitat de Lleida, 113-114.(ISBN: 978-84-695-8176-6
- RODRÍGUEZ FERNÁNDEZ, L. C.; LÓPEZ PAVÓN, C.; LISSARRAGUE, J.R.; TORRES VIÑALS, M.; MARTÍNEZ ARCE, L. **Consecuencias de la aplicación del riego para atenuar los efectos del calentamiento global en el viñedo**. Agricultura. 2012, 81(953): 504-512, 0 Ref. ISSN: 0002-1334. © CSIC. Base de Datos ICYT. Todos los derechos reservados)
- UBALDE, J.M., SORT, X., NACCI, S. & POCH, R.M. (2012): **Characterizing the soil moisture regime for viticultural zoning purposes. IXth International Terroir Congress**, Vol. 2 (Session 7): 79 – 82. Dijon-Reims (France).

List of up to 5 relevant previous projects/activities

1. **Deméter** (2008–2011) - CENIT Project. The Cenit Deméter Project comprised 26 companies, including wineries and supporting industries within the wine sector, that worked together on ways to adapt Spanish viticulture and winemaking to climate change. The project's research into climate change adaptation focused on both viticultural and enological techniques, approaching the work from new perspectives such as transcriptome studies of the grape during fruit maturation or metabolic studies of the yeast strain Saccharomyces cerevisiae in continuous systems.
2. **Mycorray** (2013 – 2015)- Project: FP7-SME-2012. The project's objective was to develop a DNA microarray tool to identify the primary fungi responsible for trunk diseases in European vineyards. Mycorray will provide an effective control mechanism for grapevine trunk diseases and reduce the financial loss caused by these pathogens, as well as the spread of disease, through precise and efficient interventions.
3. **INNOVINE**. (2013-2016) European project. Vineyard agronomic management and breeding for improved grape quality to reinforce competitiveness of the winegrowing sector. FP7; KBBE.2012/1/2-4. TORRES was the coordinator of Workpackage WP4.
4. Vinysost (2014-2018)- Project: CDTI. The project's objective is to develop "new vinicultural strategies for the sustainable management of large-scale crop production and to increase winery competitiveness on the international market." It is divided into the following areas of activity:
   - The influence of the container on wine preservation
   - Improved color stability
   - Improved microbiological stability
   - Reduction of copper use in viticulture
   - Carbon footprint optimization in fertilization
5. CIEN-**GLOBALVITI** (2016-2020). Project: CDTI. A comprehensive solution to improve wine and grape production in the face of climate change based on robotics, IT technology, and biotech and vineyard management strategies. 2016–2020.

Relevant available infrastructure / equipment description

15 sensors that allow us to measure in real time, the water potential of the trunk, to know the water status of the plant. To complement these measures and make a subsequent correlation, weekly water potential measurements are made with the pressure chamber in the sensor plants.

4.2. Third parties involved in the project (including use of third party resources)

No third parties involved in the project

Section 5: Ethics and Security

5.1 Ethics

N/A

5.2 Security[1]

N/A

[1] Article 37.1 of Model Grant Agreement. *Before disclosing results of activities raising security issues to a third party (including affiliated entities), a beneficiary must inform the coordinator — which must request written approval from the Commission/Agency;* Article 37. *Activities related to 'classified deliverables' must comply with the 'security requirements' until they are declassified; Action tasks related to classified deliverables may not be subcontracted without prior explicit written approval from the Commission/Agency.; The beneficiaries must inform the coordinator — which must immediately inform the Commission/Agency — of any changes in the security context and — if necessary —request for Annex 1 to be amended (see Article 55)*

Annexes

ANNEX 1 - DESCRIPTION OF VITIGEOSS PORTAL ARCHITECTURE. DESCRIPTION OF CONCEPTS

ANNEX 2 - DATA SETS

ANNEX 3 - LETTER OF INTEREST

Annex 1: DESCRIPTION OF VITIGEOSS PORTAL ARCHITECTURE. DESCRIPTION OF CONCEPTS

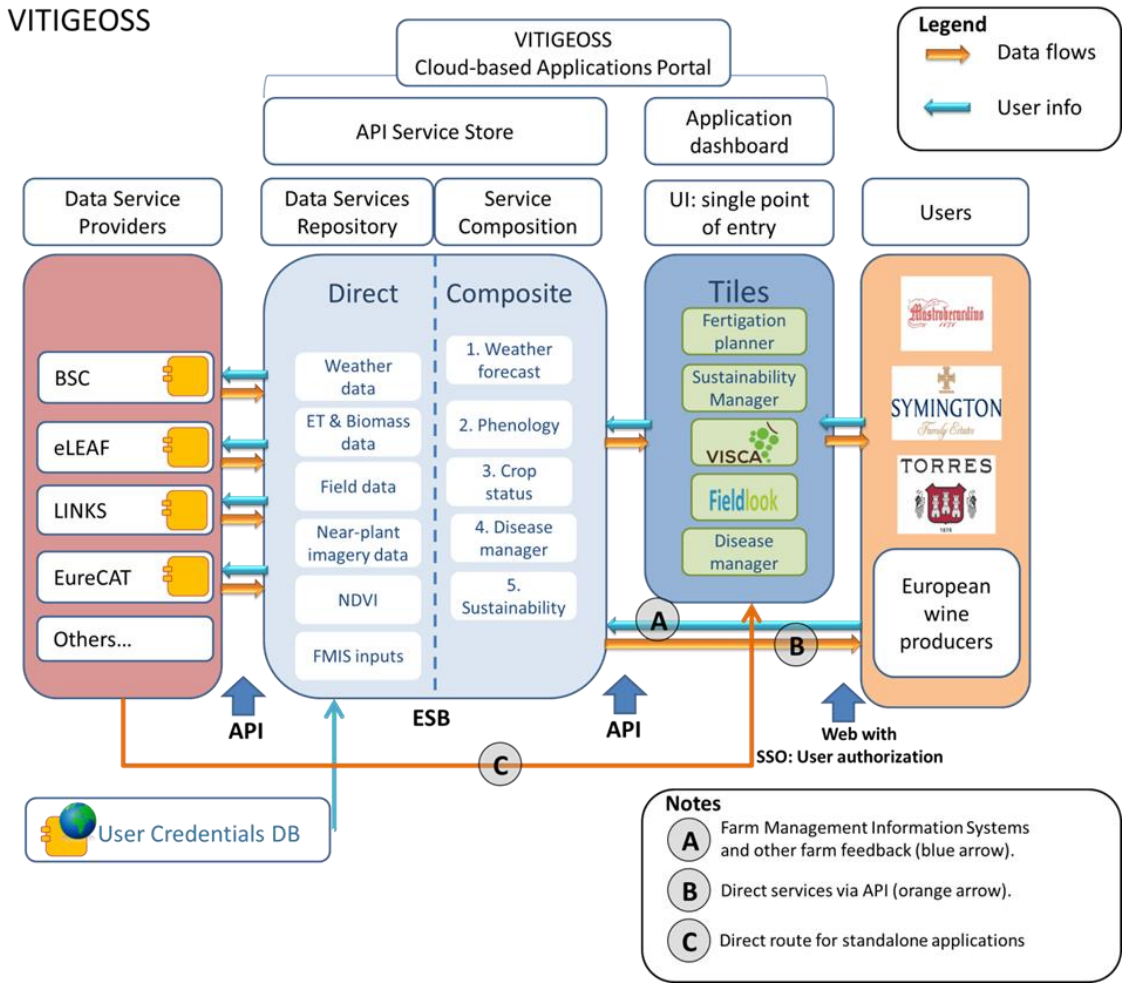

Figure 1. VITIGEOSS Portal Architecture

Data and information management

The data flow from service providers (orange arrows) only flow in one direction, from service provider (Bordeaux red box) to API service store and ultimately the end-user. There is a short cut for standalone applications like Visca or Fruitlook, developed by individual service providers, these can be made included and made available directly for end-users (see note C). Composite services developed in the consortium access data from all relevant service providers and generate an improved service specifically designed (WP2) with VITIGEOSS end-users in mind (orange box). Blue arrows indicate user info and configurations that are needed for the requested data, for example field boundaries or required timeframe for a specific user.

The user credential database has the relevant user credentials for authorisation of access to the VITIGEOSS services. The **generated data either remains at the service providing partners or at the end-user**. So no (vulnerable) central database is needed.

Authorization system

Phase 1: Group existing applications, authorization via Single Sign On (SSO) or central user Database for pilot. This enables a quick start with the project.

Phase 2: Explore HyperLedger for arrangement of authorization, traceability, trust and connectivity between service providers and end-users. It promises to:

- Be a transparent way for service delivery, accounting and authorization
- Ensure every authorized service provider works with the same end-user data
- Be able to streamline business processes
- Form a transaction log between end-users and service providers

Hyperledger is a key enabling technology because it ensures the user is in control of his or her data and barriers are taken away for cooperation between all service providers. In both the hyperledger system and single sign-on data is safely stored with the service providers and access is controlled by the end-users authorizations.

API service store

The API service store (light blue) forms a repository of data-services connecting with service providers to provide data to end-users. It encompasses a set of direct services that might be or not be available to end users and allows combining of consortium data and services into composite services. The API service store enables the connection of these (composite) services to the application tiles available to the end-user (green tiles).

Application dashboard

The application dashboard (dark blue) represents the user interface available on a public website. Single Sign On allows authorised end-user to attain and use different VITIGEOSS applications via a single point of entry, making the platform easy to use and accessible. The application dashboard offers a true **Decision Support System** with relevant applications for wine producers.

End-user API (A and B)

Useful in-field data can come from end-users, for example from on-farm meteo stations or farm machinery and Farm Management Information Systems (FMIS). This data might come from service providers managing the farm equipment or from the end-users themselves. If service providers are managing the equipment and supplying the data it is included in the direct services (light blue) from service providers, but end-users are able to supply valuable data back into their services directly (A). Advanced end-users might want to connect straight to the API Service Store for raw data for their systems or processes (B), this is also possible.

Standalone applications (C)

Service providers with operational services can expose these services (like Visca or FruitLook) immediately on the Application portal via a direct connection between service provider and Application portal (C).

Set-up

Set up of the system will be done during the first year of the project, which implies the specification of all data formats and protocols for the information exchanges between the main VITIGEOSS services. From the 2nd year the system will run in operation mode adding new versions of the services until the end of the project. Fig. 3 shows the Architecture of the Portal. A user acceptance test and validation will be performed on the use cases supported by the application.

ANNEX 2: DATA SETS

Type of Data	Data types	Variable	Description / example / units
Data from end users	Crop description	**Shapefile**	kml of field with proper field IDs
		Vineyard Name/ID	Name or Id of the vineyard
		Sectors/Parcel	Name or Id of vineyard sectors
		Altitude	meteres above the sea
		Orientation	degrees
		Crop	ex: vines/vineyard
		Cultivar	ex: pinot noir
		Planting date	ex: 2009
	Field description	**Irrigation system**	ex: none/drip/sprinkler
		Rootstock	ex: 41 b, rister 110
		Soil Type	ex: clay/loam/sand
		Soil Depth	in meters
		Slope	percentage
		Trellis system type	Bilatereal Canes, Quadrilaterla Canes, ….
		Row density	plants / row.
		Plant densisty	plants / ha.
	Irrigation system	**Type**	Dripper/sprinkler/flooding
		Emmiter Discharge rate	mm/hour
		Emmiters per plant or ha	number (identify units)
	Available & used resources	**Workers info**	Skills, timetable
		Machinery	Quantity, related tasks, fuel consumption ..
		Tools	Hand-held tolos, machinery implements
		Raw materials	Fertilizers, pesticides, water
		Resources costs	Cost unit per each resource

Historical data	**Vineyard management**	**Stress threshold Preveraison**	percentace ETc
		Stress threshold Veraison	percentace ETc
		Stress threshold Post Harvest	percentace ETc
		Sugar Level	Brix
		Acidity Level	grams/litre tartaric acid
		Alcoholic level	% vol
		Yield	Kg/ha
		Bud Break	date
		Blooming	date
		Fruit Set	date
		Bunches per meter	number
		Veraison	date
		Harvest	date
		Leaf fall	date
		Irrigation	mm/day
		Crop Forcing Date	date
		Canopy Management Date	date
		Trimming intensity (canopy mgmt %)	%
		Thinning of grape	%
		Disease evidences	Disease description: vineyard, parcel, vine, date
		Disease treatments	Dates, doses, products
		Workforce	Mean value of resources dedicated per agronomic task
		Detailed DEM	TO COMPLETE
		Phenology states	States, dates,
	In-Field data	**Weather data**	Minimum Hourly data. Preferred local weather stations
		*** Air temperature**	ºC
		*** Relative humidity**	%
		*** Wind speed**	Km/h

		*** Rain**	mm
		*** net radiation**	J
		other	when avilable: soil humidity sensors, foliar moistening, …
	Manual inspections	**Soil analysis**	Nutrients levels, type of soil
		Leaf Analisis	Nutrients levels
		In season observation	irrigation problems, etc
		Phenological observations	Changes on penological states
		Disease observations	first evidences of diseases
		other?	specify if available
New project data	**Remote (Satellite)**	**Seasonal climate predictions**	from Climate data store in Copernicus
		*** Temperature**	ºC
		*** Humidity**	%
		*** Wind speed**	Km/h
		GLCF (Green Leaf Cover Fraction)	Satellite data (e.g. Sentinel-2)
		NDVI	Copernicus, Sentinel-2
		Leaf Area Index	Copernicus, Sentinel-2
		Phenological stages	Bud Break, Flowering, Fruit set, Veraison (red variety), Maturity (red variety), Leaf Fall
		LST (Land Surface Temperature)	Satellite data (e.g. Sentinel-2)
		Surface Soil Moisture	Satellite data (e.g. Sentinel-2)
		Vegetation condition Index	Satellite data (e.g. Sentinel-2)
	Near in-field sensors (Drones)	**Leaf Area Index**	m^2m^{-2}, %
		Phenological stages	Bud Break, Flowering, Fruit set, Veraison (red variety), Maturity (red variety), Leaf Fall
	In field sensors (Fixed Cameras)	**Leaf Area Index**	m^2m^{-2}, %
		Phenological stages	Bud Break, Flowering, Fruit set, Veraison (red variety), Maturity (red variety), Leaf Fall
	Machinery	**Canbus data**	From data-logger installed in tractors

		*** Velocity**	km/h
		*** Engine speed**	rpm
		*** Fuel consumption**	l/h
		*** Hours worked**	hours worked
		Georeference (position)	from GNSS system installed in tractor
		*** Latitude**	based on NMEA standard
		*** Longitude**	based on NMEA standard
		Sprayer sensors	Sensors to be installed in sprayers used in pilot plots
		*** Tank level**	liters volume
		*** Pressure**	bar
		*** Flow**	l/h
		*** Electrovalves status**	sections running
	Other Sources	**Seasonal climate predictions**	from National Centers for Envirnomental Prediction
		*** Temperature**	ºC
		*** Humidity**	%
		*** Wind speed**	Km/h
		ETlook	Model developed by eLEAF using energy balance calculations based on satellite observations (a.o. Sentinel-2 information)
		*** Evapotransiration**	**mm/week**
		*** Biomass production**	**kg/ha/week**
		*** ET deficit (water stress)**	**mm/week**

To: María Navarro Abellán (Coordinator)
FUNDACIO EURECAT
C/Bilbao 72, 08005, Barcelona
Spain

Reading, 1/08/2019

[Subject: Letter of commitment to the VITIGEOSS proposal as member of the Advisory Board]

Dear Dr. Navarro,

The Climate Change Service (C3S), one of six thematic information services of the Copernicus Earth Observation Programme of the European Union, is an operational programme which, building on existing research infrastructures and best available scientific knowledge, aims to develop and deliver climate services able to meet societal needs.

Through its Climate Data Store (CDS), C3S offers free and open access to data, information and tools providing consistent and authoritative insights about the past, present and future climate in Europe and the rest of the World.

In this context, C3S is supportive of any initiative aiming at using the resources made available by the programme to promote the development of user relevant climate services especially if said services address the needs of users in sectors such as water or agriculture, which are explicitly mentioned in our delegation agreement.

The VITIGEOSS proposal clearly falls in this category and should this be funded we would be happy to support the project team through the participation in the External Advisory Board.

Sincerely,

Carlo Buontempo, deputy head of Copernicus Climate Change Service

ECMWF Shinfield Park, Reading RG2 9AX, UK
Tel: +44 (0) 118 949 9000 | Fax: +44 (0) 118 986 9450 |Email: first.initial.surname@ecmwf.int
climate.copernicus.eu | copernicus.eu | ecmwf.int

COLDIRETTI
AVELLINO

To: María Navarro Abellán (Coordinator)
FUNDACIO EURECAT
C/Bilbao 72, 08005, Barcelona
Spain

Avellino, 31.08.2019

[Subject: Letter of commitment to the VITIGEOSS proposal as member of the Advisory Board]

Dear Dr. Navarro,

I would like to express the interest of **Coldiretti Avellino** in the proposal "Vineyard Innovative Tool based on the InteGration of Earth Observation Services and in-field Sensors" that will be submitted under the topic SC5-16-2019 "Development of commercial activities and services through the use of GEOSS and Copernicus data" of the programme H2020.

We believe that the project coordination and the consortium have acknowledged expertise, which will allow them to successfully reach the project objectives towards the deployment of an innovative commercial application to optimize sustainable grapevine cultivation via decision support systems (DSS) on phenology, irrigation, fertilizer, disease and business operations management, where satellites imagery will be combined with in-field measurements, models and best practices to build up an integrated but modular management tool covering the most critical operations.

Coldiretti Avellino, with more than 2.000 members and 8.000 assisted farmers, is the leading organization of farmers in the Avellino Province. Articulated through offices all over the province, has 10 offices and 20 sections**.** Coldiretti Avellino, over 60 years of activity, has developed different projects about :
• protection of biodiversity
• environmental sustainability of agricultural sector
• dissemination of organic farming
• no to GMOs
The wine sector has large interest in possible applications of remote and proximal sensing for optimize vineyard management practices.

I hereby confirm that **Coldiretti Avellino** fully supports the submission of the VITIGEOSS proposal and is willing to participate in this project as a member of the advisory board. Our involvement will entail:

- Participation in meetings and workshops organized during the lifetime of the project
- Identification of synergies within the wine sector
- Dissemination of the project and its results through our communication channels
- Providing feedback and support for an efficient penetration in the market

Wishing you success with VITIGEOSS,

The President of Coldiretti Avellino
Ing. Francesco M. Acampora

COLDIRETTI AVELLINO
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avellino@coldiretti.it

Generalitat de Catalunya
Departament d'Agricultura, Ramaderia,
Pesca i Alimentació
Direcció General d'Alimentació,
Qualitat i Indústries Agroalimentàries
Sub-direcció General de Transferència i Innovació Agroalimentària

To: María Navarro Abellán (Coordinator)
FUNDACIO EURECAT
C/Bilbao 72, 08005, Barcelona
Spain

[Subject: Letter of commitment to the VITIGEOSS proposal as member of the Advisory Board]

Dear Dr. Navarro,

I would like to express the interest of the **General Subdirection for Agrifood Innovation and Knowledge Transfer of the Department of Agriculture, Livestock, Fisheries and Food (Generalitat de Catalunya)** in the proposal "Vineyard Innovative Tool based on the InteGration of Earth Observation Services and in-field Sensors" that will be submitted under the topic SC5-16-2019 "Development of commercial activities and services through the use of GEOSS and Copernicus data" of the programme H2020.

We believe that the project coordination and the consortium have acknowledged expertise, which will allow them to successfully reach the project objectives towards the deployment of an innovative commercial application to optimize sustainable grapevine cultivation via decision support systems (DSS) on phenology, irrigation, fertilizer, disease and business operations management, where satellites imagery will be combined with in-field measurements, models and best practices to build up an integrated but modular management tool covering the most critical operations.

The General Subdirection for Agrifood Innovation and Knowledge Transfer runs and monitors policies, strategies, programs and plans in the field of technological innovation, advice to the agricultural sector, and training in the agrarian and rural world. It coordinates the actions aimed at the training of farmers, livestock farmers and other rural operators. In addition, it coordinates an annual plan for the dissemination and transfer of agrifood knowledge.

I hereby confirm that the General Subdirection for Agrifood Innovation and Knowledge Transfer fully supports the submission of the VITIGEOSS proposal. Our involvement would entail, among others, in the:

- Participation in meetings and workshops organized during the lifetime of the project

Gran Via de les Corts Catalanes, 612 - 614
08007 Barcelona
Telèfon: +34 933 046 745
agricultura.gencat.cat

Generalitat de Catalunya
Departament d'Agricultura, Ramaderia,
Pesca i Alimentació
Direcció General d'Alimentació,
Qualitat i Indústries Agroalimentàries
Sub-direcció General de Transferència i Innovació Agroalimentària

- Guidance and identification of synergies within the agricultural sector
- Dissemination of the project and its results through our communication channels
- Providing feedback and support for an efficient penetration in the market
- Promote the projects results within the agricultural community

Wishing you success with VITIGEOSS,

Sr. Jaume Sió Torres
Deputy Director for Agrifood Innovation and Knowledge Transfer

Barcelona, 11th July 2019

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08007 Barcelona
Telèfon: +34 933 046 745
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PTV
PLATAFORMA
TECNOLÓGICA
DEL VINO

To: María Navarro Abellán (Coordinator)
FUNDACIO EURECAT
C/Bilbao 72, 08005, Barcelona
Spain

Madrid, 21th June 2019

[Subject: Letter of commitment to the VITIGEOSS proposal as member of the Advisory Board]

Dear Dr. Navarro,

I would like to express the interest of Spanish Wine Technology Platform in the proposal "Vineyard Innovative Tool based on the InteGration of Earth Observation Services and in-field Sensors" that will be submitted under the topic SC5-16-2019 "Development of commercial activities and services through the use of GEOSS and Copernicus data" of the programme H2020.

We believe that the project coordination and the consortium have acknowledged expertise, which will allow them to successfully reach the project objectives towards the deployment of an innovative commercial application to optimize sustainable grapevine cultivation via decision support systems (DSS) on phenology, irrigation, fertilizer, disease and business operations management, where satellites imagery will be combined with in-field measurements, models and best practices to build up an integrated but modular management tool covering the most critical operations.

Thus, WTP main objective is to establish a common R&D&I strategy for the wine sector. Recently we have had the pleasure to discuss internally the timeless and the innovative nature of VITIGEOSS project. Considering its potential outcome, the WTP - as a recognized stakeholder - would like to provide its strong recommendation to support the project in order to facilitate our affiliates to benefit from its innovative products which will be developed during the next three years.

I hereby confirm that Spanish Wine Technology Platform fully supports the submission of the VITIGEOSS proposal and is willing to participate in this project as a member of the advisory board. Our involvement will entail:

- Participation in meetings and workshops organized during the lifetime of the project
- Dissemination of the project and its results through our communication channels
- Providing feedback and support for an efficient penetration in the market

Wishing you success with VITIGEOSS,

Mario de la Fuente Lloreda
Gerente PTV

C/ Musgo nº2, Bajo-B. Edif. Europa II
28023 Madrid (La Florida)
Tel.: (+34) 913 570 798
gerencia@ptvino.com

To: María Navarro Abellán (Coordinator)
FUNDACIO EURECAT
C/Bilbao 72, 08005, Barcelona
Spain

Amsterdam, August 21, 2019

Subject: Letter of commitment to the VITIGEOSS proposal as member of the Advisory Board

Dear Dr. Navarro,

I would like to express the interest of *HCP international* in the proposal "Vineyard Innovative Tool based on the InteGration of Earth Observation Services and in-field Sensors" that will be submitted under the topic SC5-16-2019 "Development of commercial activities and services through the use of GEOSS and Copernicus data" of the programme H2020.

We believe that the project coordination and the consortium have acknowledged expertise, which will allow them to successfully reach the project objectives towards the deployment of an innovative commercial application to optimize sustainable grapevine cultivation via decision support systems (DSS) on phenology, irrigation, fertilizer, disease and business operations management, where satellites imagery will be combined with in-field measurements, models and best practices to build up an integrated but modular management tool covering the most critical operations.

The aim of *HCP international* is to support sustainable development, with special emphasis on the application of innovative technologies, such as earth observation. *HCP international* achieves this by providing added value to customers through services in the field of marketing, acquisition, management and consulting. *HCP international* specializes topics related to earth observation, geo-information, agriculture, environmental management, water resources management, water supply and sanitation, disaster risk management, and climate action.

I hereby confirm that *HCP international* fully supports the submission of the VITIGEOSS proposal and is willing to participate in this project as a member of the advisory board. Our involvement will entail:

- Participation in meetings of the VITIGEOSS Advisory Board organized during the lifetime of the project
- Guidance and identification of synergies within the EuroGEOSS Initiative Action Group on Agriculture and activities related to Copernicus and the Group on Earth Observations (GEO).

Wishing you success with VITIGEOSS,

Mark Noort
Director *HCP international*

ASSOENOLOGI
IL VINO PER CULTURA E PROFESSIONE
SEZIONE CAMPANIA

To: María Navarro Abellán (Coordinator)
FUNDACIO EURECAT
C/Bilbao 72, 08005, Barcelona
Spain

Avellino, 31st August 2019

[Subject: Letter of commitment to the VITIGEOSS proposal as member of the Advisory Board]

Dear Dr. Navarro,

I would like to express the interest of **ASSOENOLOGI Sezione Campania** in the proposal "Vineyard Innovative Tool based on the InteGration of Earth Observation Services and in-field Sensors" that will be submitted under the topic SC5-16-2019 "Development of commercial activities and services through the use of GEOSS and Copernicus data" of the programme H2020.

We believe that the project coordination and the consortium have acknowledged expertise, which will allow them to successfully reach the project objectives towards the deployment of an innovative commercial application to optimize sustainable grapevine cultivation via decision support systems (DSS) on phenology, irrigation, fertilizer, disease and business operations management, where satellites imagery will be combined with in-field measurements, models and best practices to build up an integrated but modular management tool covering the most critical operations.

ASSOENOLOGI offers various professional services to its members, ensures the representation of winemakers category in the whole regional territory, and it is a target reference point for the wine sector of Campania. The wine sector has large interest in possible applications of remote and proximal sensing for optimize management practices in the vineyard.

I hereby confirm that **ASSOENOLOGI Sezione Campania** fully supports the submission of the VITIGEOSS proposal and is willing to participate in this project as a member of the advisory board. Our involvement will entail:

- Participation in meetings and workshops organized during the lifetime of the project
- Dissemination of the project and its results through our communication channels
- Providing feedback and support for an efficient penetration in the market

Wishing you success with VITIGEOSS,

ASSOCIAZIONE ENOLOGI ENOTECNICI ITALIANI
ORGANIZZAZIONE NAZIONALE DI CATEGORIA DEI
TECNICI DEL SETTORE VITIVINICOLO - ASSOENOLOGI
SEZIONE CAMPANIA
IL PRESIDENTE

Assoenologi sez. Campania
President
Oenol. Roberto Di Meo

ASSOENOLOGI Sezione Campania
c/o Università Federico II – Dip. Agraria - Sezione Scienza della Vigna e del Vino – Viale Italia – 83100 Avellino
e-mail: assoenologi.campania@gmail.com

INNOVI
CLÚSTER VITIVINÍCOLA CATALÀ

Pl. Àgora 1 - Centre Àgora
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(Barcelona)

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info@innovi.cat
www.innovi.cat

To: María Navarro Abellán (Coordinator)
FUNDACIO EURECAT
C/Bilbao 72, 08005, Barcelona, Spain

Vilafranca del Penedès, 24th June 2019

[Subject: Letter of commitment to the VITIGEOSS proposal as member of the Advisory Board]

Dear Dr. Navarro,

I would like to express the interest of ASSOCIACIÓ AEI INNOVI (INNOVI) in the proposal "Vineyard Innovative Tool based on the InteGration of Earth Observation Services and in-field Sensors" that will be submitted under the topic SC5-16-2019 "Development of commercial activities and services through the use of GEOSS and Copernicus data" of the programme H2020.

We believe that the project coordination and the consortium have acknowledged expertise, which will allow them to successfully reach the project objectives towards the deployment of an innovative commercial application to optimize sustainable grapevine cultivation via decision support systems (DSS) on phenology, irrigation, fertilizer, disease and business operations management, where satellites imagery will be combined with in-field measurements, models and best practices to build up an integrated but modular management tool covering the most critical operations.

INNOVI is the Catalan wine cluster and it is a non-profit organization that has the mission to promote the competitiveness of companies of the Catalan wine sector and auxiliary sector, in order to face globalization through innovation and collaboration.

I hereby confirm that INNOVI fully supports the submission of the VITIGEOSS proposal and is willing to participate in this project as a member of the advisory board. Our involvement will entail:

- Participation in meetings and workshops organized during the lifetime of the project
- Dissemination of the project and its results through our communication channels
- Providing feedback and support for an efficient penetration in the market

Wishing you success with VITIGEOSS,

INNOVI
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Clara Santamaria Echaniz

Cluster Manager

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