Deliverable 4.8: Second preliminary report between research teams (WP2), DSS developers and end-users on a full year application of the CS-DSS

WP	4	Demonstration		
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[1] Dissemination level: **PU** = Public, **PP** = Restricted to other programme participants (including the JU), **RE** = Restricted to a group specified by the consortium, **CO** = Confidential, only for members of the consortium

[2] Nature of the deliverable: **R** = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

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Deliverable abstract

After a year of DSS application, the first impressions of the tool were collected during the 3rd General Meeting which took place in Barcelona between 9th and 10th December 2019. The present document summarizes the comments of the end-users about DSS usability and the improvements that should be implemented during the next year. Besides, it is resumed some of the decision making that can be made based on the different DSS widgets.

[3] Creation, modification, final version for evaluation, revised version following evaluation, final.

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1. Document objectives

The objective of the present document is to present the impressions gathered during the 3rd general meeting held in Barcelona after the first year of use of the DSS. The document is divided into 3 sections:

1) DSS feedback.
2) Decision making based on DSS predictions
3) Main suggested improvements

2. DSS feedback

After the first review of the usability of the tool exposed in Deliverable 4.6, the end-users have clearly seen potentialities in the tool. The most important and recognized innovation of the DSS is the integration of different kinds of information, allowing the end-user to access a wide range of useful data, from weather to irrigation predictions, all together in the same environment.

At the same time, although end-users also have recognized there is a large amount of useful information available through the DSS, they also agreed that DSS is complex and key information is difficult to access in an intuitive manner. Some improvements in this line has been suggested and implemented to ease the information access. The most interesting parameters are the following:

- Several shortcuts for accessing “Parcel details” directly from the maps available in the Dashboard.
- Inclusion of accumulated sugar accumulated plots and accumulated irrigation plots from the beginning of the season.
- Inclusion of some tools to work on Weather station data, giving the possibility to transform the data into different useful indicators, such as Winkler index (still under development).

It was also agreed among end-users that a transition period from the tool release and their fully use is necessary, in which specific training and expert support is required in order to integrate all the available information into the end-user day-to-day processes. Hence, the evaluation of the DSS in the last season 2019 consisted in implementing the necessary training sessions, through a main presential meeting in Torino on July 2019 as well as remote biweekly meetings among DSS developers and end-users. The purpose of periodic remote meetings was to collect periodic feedback from end-users as well as to provide expert support for interpretation of operational results from DSS and helping in the end-user decision-making process including DSS information.

Special difficulties were found with interpreting the seasonal weather forecasts and their associated uncertainty. Interpretation of probabilistic forecasts and understanding of the seasonal forecast skill has been challenging. Although they might see potentialities in this type of information, seasonal forecast is a very new tool and the associated decision-making is still not well defined and integrated in the day-to-day end-users' activities.

During the meeting, it was foregrounded that different companies will take distinct advantage of the tool. The best example is the irrigation forecasts; whilst for Symington and Codorniu it can provide very useful information, it was useless for Mastroberardino, simply because they do not irrigate their grapevines. However, Mastroberardino recognized that the irrigation forecasts might be useful in the future if the frequency and intensity of droughts is increased in the region due to climate change.

Some improvements in terms of robustness of the models were also pointed out, especially the ones which are depending on the availability of weather station data, such as the irrigation model. If the weather stations do not work properly, the irrigation model cannot launch the irrigation recommendation. So, LINKS is now developing an algorithm based on machine learning to fill gaps with weather data from surrounding weather stations. the time gaps.

3. Decision making based on DSS predictions

It was proved during the last 2019 season that decision-making processing using DSS information was not clear. Therefore, in the general meeting it was agreed to schedule a series of periodic remote calls to define the key decision, which can be made by using VISCA DSS. These calls (as part of WP4 activities) are scheduled on a weekly basis until the start of the 2020 season on April and are coordinated by IRTA (as WP4 leaders) and METEOSIM (as Project coordinators). The periodic meeting has the following objectives:

1. Brainstorming of decisions in relation to DSS information
2. Definition of a Decision Tree" linking DSS information with actual decisions.
3. Design of a set of experiments to evaluate the results of applying the "Decision Tree" on several targets like the quality of grapes, yield and operational costs (manpower and/or equipment). These experiments will cover a subset of the identified decisions, those identified more relevant and critical for vineyard management.

The designed experiments will be implemented in certain pilot plots. The exposed objectives are expected to be achieved before the start of the next season on April 2020.

Given that some components of the model have a high degree of uncertainty, especially those related to the long-term forecast like seasonal forecast and phenology forecast, the experiments should be implemented for a significant amount of seasons (this would help to explore a long-term added value), which is not possible under the course of this project. However, the defined experiments will serve as a case study for a single year evaluation.

The experiments will be defined to evaluate the influence of DSS information on different targets in three different cases:

- **Case I**: The decision will be taken according to the tool and the forecast will be finally correct. Benefits are expected.
- **Case II**: The decision will be taken according to the tool and the forecast is finally incorrect. Losses are expected.
- **Case III**: The decision will be taken without the information provided by tool (Business as Usual scenario) and the forecast provided by the tool is finally correct. Losses are expected.

4. Main improvements

The following tasks are planned to be implemented as improvements of the tool:

- Automatization of irrigation system: After the beginning of the season in March, when bud break usually takes place in the three demo sites included in the project, the data recording of the irrigation system will be collected and inserted into the DSS automatically. At the moment, it is inserted manually by the user. This improvement will save a lot of time from the users. Although this was not agreed under the scope of the project, it has agreed to implement so as to avoid extra effort from the users and try to avoid missing information in the DSS. Past irrigation forecast is crucial for the correct working of the irrigation model since it is used to correct the water balance, hence adjusting the irrigation forecasts. Besides, it will also serve end-users to have a historic of the irrigation applied which is very useful to manage the irrigation system, especially under situations of limited water supply.

- Inclusion of commercial plots into the DSS: During the 3rd General Meeting in Barcelona, LINKS suggested (and encouraged) the end-users to include commercial vineyards into the DSS. Although the experimental pilot plots have been very useful as a base to design the working procedure of the DSS, they are artificial in the sense that experimental parcels are small in size and the irrigation and phenology units coincide. This might well not be the case in real parcels, where the prediction of the phenology could integrate several irrigation blocks. Therefore, the entire assistants agreed that the inclusion of commercial parcels would serve as a real test of the DSS.

Calculation of Winkler index[4] based in Weather station data: Mastroberardino has suggested to include the calculation of the Winkler index based on weather records. The Winkler index is used mainly to classify climatic regions based on the accumulated degree days, providing a simple methodology to select the best variety for a specific location. It can be also used to compare vintages.

[4] Amerine M, Winkler A. 1944. Composition and Quality of Musts and Wines of California Grapes. Hilgardia 15(6):493-675. DOI:10.3733/hilg.v15n06p493