

WineryFarming4.0: definition of smart solutions for the effective implementation of Agriculture 4.0 in winery production

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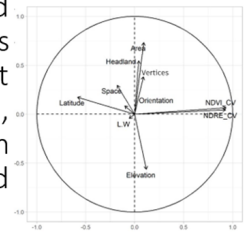
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THE PROJECT WINERY FARMING 4.0 - The integration of Agriculture 4.0 technologies (A4.OT) in vineyard improves production efficiency, quality, and environmental sustainability. However, widespread adoption faces challenges, particularly in small-scale farms where financial constraints and the farmers age reduce the adoption of digital solutions. To enhance A4.OT adoption in winery farms, the WineryFarming4.0 project undertakes different activities, including a comprehensive analysis of A4.OT adoption in Italian wine regions, identification of key aspects of cultivation practices for A4.OT support, and development of readiness and performance assessment tools. These tools aim to evaluate a winery's aptitude for adopting specific A4.OT and assess farm performance in terms of efficiency, economic viability, environmental impact, and social sustainability. In the following, with regard to the first year, the main project activities are summarized.

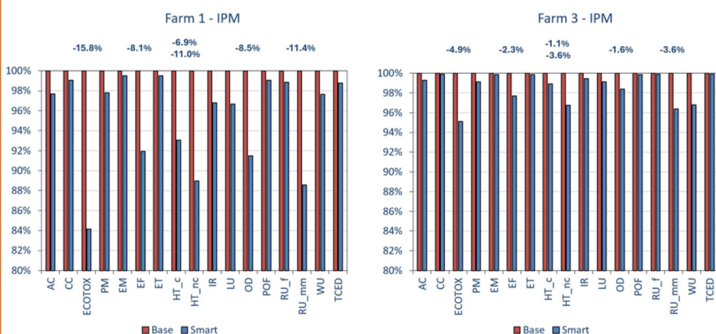
SURVEY – A online survey was designed to collect the data regarding the main structural and organization characteristics of winery farms as well as information about the adoption of Agriculture 4.0 technologies. Up to now more than 300 replies from farms and winery were collected.



VINE CULTIVATION AREAS – Long-term remote sensing monitoring of Italian vineyards revealed that vineyard row orientation significantly affects vegetation indices, with NS-oriented vineyards showing higher and more stable VIs than EW-oriented ones due to differences in light interception and environmental stress exposure. These findings suggest that row orientation, along with training system and row spacing, should be carefully considered in precision agriculture monitoring techniques to improve data reliability and support more sustainable and effective agricultural practices.



Life Cycle Assessment - With the project SmartDEFENSE, a digital technology called PocketSPRAY®, implemented in common smartphones to optimize fungicide use in vineyards, was tested in different organic & conventional farms and the environmental benefits were quantified by LCA. In IPM farms, impact reductions up to 11% were achieved in toxicity-related environmental effects.



Note: Climate change (CC), Ozone layer depletion (OD), Ionizing radiation (IR), Photochemical ozone formation (POF), Particulate matter formation (PM), Human toxicity - carcinogenic effect (HT_C), non-carcinogenic effect (HT_IC), Acidification (AC), Eutrophication freshwater, terrestrial and marine (EM, ET, ET_M), freshwater ecotoxicity (ECOTOX), Land use (LU), Water used (WU), Total resources use (RU_J), Mineral and metal resources use (RU_m), Total cumulative energy demand (TECD), V1.11

Multicriteria Decision Analysis & Global Sustainability – By a literature review, 24 measurable indicators (economic, environmental, social) were identified and aggregated into various attributes to reach an overall sustainability score.



The next steps involve weighting each indicator after which the model will be applied to wine companies to assess their sustainability.