

Wine waste management and opportunities for new valorisation technologies

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Circular economy is an economic system that replaces the ‘end-of-life’ concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. It operates at different levels, with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations (Kirchherr et al, 2017). Mousset (2018) applies the circular economy concept to biomass in order to offer a better understanding of issues and challenges in this sector. In the context of agriculture and agri-food chain, the circular economy aims to reduce the pressure on natural resources by implementing strategies at three levels: Production (preserve natural lands, eco-conception of new products or agricultural routes, optimize biomass valorisation, prioritize use per sector and find innovative pathway for by-products), Consumption and use (Consumer information, rational choice of a product according to its sustainability, sustainable nutrition, reduce food waste) and Waste management (material recovery, bioenergy production, nutrients return to the soil ground).

This study focuses on the waste management in the second most important French agricultural sector: the viticulture. In the wine production sector, huge amounts of waste and by-products are generated each year. French wineries generate 850 000 tons of grape marc, 1,5 million hectolitres of wine lees and wastewater (Réséda, 2017). Thus, valorisation pathways are necessary to develop and implement in the local vine and wine chain to favour the reuse, recycling and recovering of the waste and by-products yearly produced and ensure optimum use of residue streams. Since almost one century, distilleries industries are located in French vineyard areas. These structures were created to avoid the wine overpressing and to improve the wine quality. The distillery achieves nowadays a performant valorisation pathway for wine waste. By using different treatments and technologies, distillery transforms grape marcs and wine lees into polyphenols, anthocyanins, tannins, tartaric acid, must concentrate, brandies and spirits, animal feed, alcohol, bioethanol and fertilizer. However, the current valorisation pathway is not completely circular, generating some ultimate waste that could be still valorised. Therefore, distilleries need to upgrade their technologies to diversify their economy into higher value added activities and definitively enter into the virtuous loop of circular economy. In parallel, since the French decree n° 2014-903 winemakers are authorized to valorise by themselves their by-products through methanization or spreading, making possible to create value added products on site. In practice, these solutions are never chosen by the winemakers because the large majority of them often lack the background knowledge regarding their waste valorization routes that would otherwise enable them to move forward. In order to help the stakeholders of the vine and wine sector to select the most economic and sustainable waste treatment system, a better understanding of waste management constraints and opportunities is necessary to identify the new technologies implementation potential¹.

In this purpose, two surveys were conducted in south of France (Languedoc Roussillon area). The first one aims at providing a clear picture of the current situation as regard the nature of wastes generating by the vine and wine sector and collecting all relevant information to understand why a waste management system is preferred among all the other existing valorization routes. This survey collected also information to understand how sustainable development is viewed by the stakeholders with its constraints and advantages. The second survey aims to evaluate the new technologies acceptance and potential development.

For the first survey, twelve winemakers (wine productions directors) were selected according to different criteria (cooperative versus independent, organic versus conventional, small, medium and large wine volume production) and interviewed through face-to-face meetings with a semi-directive discussion. The interview transcriptions were analysed with a thematic analysis.

For the second survey, a total of six wine-makers and technical centers, two distilleries and three public decision-makers have been interviewed in the Languedoc-Roussillon area in July and August 2018. Interviews were composed of approximately twenty questions evaluating interviewees’ knowledge about the valorization potentialities of their by-products and the new valorization processes, but also about their preferences, expectations, demands and constraints regarding these new valorization possibilities. Each survey took about 45 minutes to be completed through face-to-face meeting. After having interviewed all stakeholders, all data has been

¹ developed in the framework of H2020 NoAW project

stored in the “NoAWVote”, a software specifically developed for the NoAW project to aggregate stakeholders’ preferences (Karanikolas et al. 2018).

The first survey shows that the wine waste management is well structured around the distilleries logistics and their valorisation pathways. However, the management of wastewater and grape-growing waste (vine shoots, vine stalks and vines) is almost non-existent and not yet developed. Distilleries organise the logistics for lee and marc collection at the production place. This first survey permitted to know that, among others, winemakers interviewed are satisfied about the relationship with the distillery. They mentioned different advantages: the compliance with the legal obligation of waste treatment, a good working relationship, the low cost of this valorisation pathway, the collection convenience in periods of high activity and the environmental performance. However, they identified also some disadvantages: producers of small wine quantity have to organize by themselves the transportation of their waste to the nearest distillery which leads to an additional cost; the bad quality of storage container and the vine marcs separation. In addition, discussions with winemakers revealed that they have a poor knowledge of distilleries activities and are unable to mention products made of wine by-products (except alcohol, grape seed oil and fertilizers). This survey also highlighted that wastewater treatment is an issue for winemakers. Different options are possible (treatment plant on site, convention with municipality to reject in the wastewater network, spreading on fields, management by a subcontractor) but none of these seems to satisfy them because of the cost, labour time and administrative complexity.

The second survey shows that, with regard to preferred valorization products, stakeholders have different visions according to their activities. For instance, if winemakers and distilleries have chosen biofertilizers as their preferred new by-product, winemakers selected them for their easiness and relative cheapness and also because it is a priority for them while distilleries selected them because they are potentially high value added products. But as distilleries do not have agricultural fields to directly spread them, they have to evaluate their cost-effectiveness at the market price. Technical centers and decision-makers chose bioenergy. Indeed, they know that biofuel is made from distilleries alcohol and it is widely spread, they also think biomass for heating could be developed at a local scale. Regarding expected benefits for new valorization routes, low environmental and economic costs are the most supported ones. An ease of implementation and management is also expected by wineries and distilleries (third choice for both of them). Distilleries are very interested in reducing their very high external energy consumption and decision-makers hope to improve soils quality by returning back organic wastes; however they do not expect further benefits, they think the winemaking sector is already efficient in wastes management treatment compared to other sectors. Lastly, when asked about principal obstacles, industries agree in cost as the most important one, partially related to the amount of available waste that not allow economic scale. Decision-makers think the principal problem is that distilleries are the best possible choice and they are already working and performing well, making difficult to other valorization industries to rise.

This study permits to conclude that if lees and marcs management by distillery seems efficient and convenient for winemakers, while the other by-products (vine shoot, etc.) potential are under-exploited: the priority is get rid of this material, instead of valorise it. We can thus conclude that the implementation of a valorisation technology for wine by-products have to be preferably implanted in distillery because this structured system represents significant advantages for all players and permits a residues volume massification. There is a need for developing innovative valorisation pathways for grape-growing by-products.

However, new valorization routes present logistical and quantitative problems if implemented at an individual scale. Even for a collective implementation, cost-effectiveness (which is one of the most important criteria to encourage industries) has not been proved yet. Stakeholders do not have access to enough information about new valorization routes and they are not willing to try and implement them without guarantees of profitability, despite their interest in reducing final wastes and environmental damages. If any new valorization route is to be developed, it has either to beat the performance and easiness of distilleries or to complement them in reducing winemaking wastes.

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