

KEG WINE ON TAP: A SUSTAINABILITY-ORIENTED INNOVATION

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Problem

There is a worldwide call for a more sustainable wine industry, with a better environmental, social and economic impact. Growing concern about entwined economic, social and environmental challenges has resulted in the United Nations' 17 Sustainable Development Goals – UN SDG. A sustainable wine industry should incorporate management of product quality, waste and carbon footprint, and human resource into all its processes, from production to distribution and consumption.

As more and more consumers around the world integrate the choice of healthier, more ethical and eco-friendlier food and beverages in their lifestyle (Barber, 2010), the wine industry is compelled to explore innovative ways to implement and deliver sustainable production, distribution and consumption solutions. Thus, there is a growing interest into studying sustainable innovations within the wine industry as a competitive advantage for its stakeholders (Atkin et al., 2012). However, the wine industry is very slow towards sustainability. It has traditionally relied on heavyweight glass packaging, which represents a considerable carbon footprint and has a major impact in terms of water and energy demand (Barber, 2010; Mariani and Vastola, 2015). Alternative packaging solutions are bag-in-box, polyethylene terephthalate (PET), cans, TetraPak, and keg wine. Life Cycle Assessments (LCA) conducted for several beverages regularly show the superior environmental benefits of reusable kegs over bottles (e.g. Cimini and Moresi, 2016).

In this context, keg wine on tap may be a sustainability-oriented innovation for wine distribution and consumption (Calabrese et al., 2018). Yet, except for exploratory studies conducted in the USA (Nuebling et al. 2017), the perceived ecological, social and economic benefits of keg wine have not been subject to much research investigation. Keg wine can only be successful if it reaches a wide acceptance and overcome potential resistance from consumers. If there is no marketplace acceptance, keg wine would fail, despite being a sustainability-oriented innovation. In Europe, the consumers' willingness-to-pay for sustainability claims account for around 14% of the average price (Mueller-Loose and Remaud, 2013). In most Food & Beverage (F&B) establishments, consumer choice is limited by the wine list description and yet, wine choice is more complex than for any other food or beverage offered, making it one of the most differentiated products on the market. However, key drivers of wine choice remain understudied (Jaeger et al., 2010). Restaurant consumer attitude and willingness-to-pay for wine with innovative sustainability characteristics is particularly understudied, while it is a promising research and development topic (Schäufele and Hamm, 2017).

Objective

Our goal in this research was to create and develop reusable plastic kegs for distributing wine on tap as a sustainability-oriented innovation that would be beneficial to all stakeholders in the wine industry, "to serve the specific purpose of creating and realizing social and environmental value in addition to economic returns" (Adams et al. 2016, p. 181), and thus, to achieve UN SDG in the wine industry.

Research Design

The research was conducted in Switzerland. According to the Federal Statistical Office (2014), Switzerland is ranked 20th worldwide in terms of the vineyards surface with 148 km². Yet, it is 4th in the world by the annual wine consumption per capita (33 liters per capita). Wine is Swiss's 1st alcoholic beverage, representing CHF 5 Mio/year since 2011, with +12% growth expected for 2022. 80% of Swiss aged 18-74 drink wine while only 60% drink beer: 40% drink wine regularly, once a week/day and, 25% regularly drink wine in F&B establishments, where the main packaging for wine is glass bottle.

Hence, a Swiss start-up founded by an oenologist, and a French company making kegs, joined forces with three research partners, in order to conduct several studies:

- Ecole de Changins conducted wine conservation studies and experiments considering the behavior of different wines under several temperature conditions (from 15°C to 30°C) for 12 months. This study allowed to test different materials notably the pouch's quality plastic and their impact on the wine. Different filling protocols were tested to optimize the process. Classical oenological parameters were considered (Winescan®, SO₂, CO₂, etc.) and a sensorial analysis was finally conducted. In parallel, a hygiene protocol was developed to secure the microbiological stability from the tank to the pouring system.
- Institut Français de la Vigne et du Vin studied the environmental impact of kegs in comparison with glass bottles throughout a Life-Cycle Assessment (LCA) that was then validated by a third-party expertise. Two perimeters were considered in the study: the empty packaging and the packaging filled with wine. All the steps of the value chain were considered, from the production of raw materials to wine service in bars and restaurants and packaging end-of-life. For the Life Cycle Inventory, primary data were collected as much as possible from the keg designer and retailer. PEFCE for wine default activity data were used when difficult to measure (bottling and cooling). The European impact method ILCD 2011 Midpoint, established by the JRC, was used to calculate the indicators. Several scenarios of eco-design (recyclability of the keg, material of the pouch and of the head's spring, reuse of the head) were tested, as well as two distance scenarios for distribution (25 or 275 km).
- The keg may preserve the wine quality and the environment, it still had to be accepted by the markets, therefore, Ecole hôtelière de Lausanne conducted market studies: survey data was collected among Swiss wine stakeholders. Two studies were conducted, one with owners/managers of F&B establishments/events and winemakers as well as oenologists and sommeliers in Switzerland - 104 questionnaires were filled in by keg wine non-users, 40 semi-structured interviews were conducted with 30 with keg wine non-users and 10 with keg wine users, and one with wine consumers in Switzerland - 336 online questionnaires and 30 interviews with 15 consumers of wine on tap and 15 non-consumers of wine on tap, in order to analyze their perceptions and attitudes, as well as alleged motivation to consume keg wine. Pearson correlations, factor analyses and logistic regression models were conducted using SPSS.

Results

Results show that from chemical, sensorial, gustatory and organoleptic points of view the best strategy to allow the highest quality of wine conservation in plastic kegs with notably no sulphites consumption showing perfect protection of the wine against oxidation. To validate the approach, protocols were transferred to commercial partners and all critical points were pointed by auditing all steps of the process. Finally, monitoring procedures were also designed in a HACCP context. Based on such positive results, conditioning, storage and distribution protocols were developed in a guide for best practices.

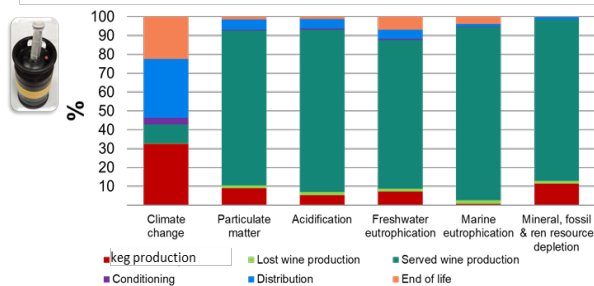
From an ecological perspective, the comparison between plastic keg and glass bottle showed that plastic keg has a lower environmental impact for most of impact indicators. For example,

the keg has a carbon footprint 42% lower than the glass bottle for the perimeter “empty packaging”, except for resource depletion, whatever the compared logistic scenarios. This can be explained by the different materials of the packaging solutions, their different weight and different end-of-life.

However, it is important to put the environmental advantage of the keg into perspective, as wine production has a high contribution to keg impacts when served wine is considered in the perimeter of the study. The carbon footprint of the keg filled with wine is 17% lower than the filled glass bottle. Also, for the same reason, the comparison of environmental impacts between plastic keg and glass bottle is very sensitive to the quantity of wine losses. The keg can have more impacts to glass bottle if 6% of wine losses are considered instead of 2%, the baseline. It will be important in the future to have a better estimation of those losses, as the keg can then have higher impacts than glass bottle for some impact indicators. For the keg, we considered wine losses at the step of wine service, if barmen change the keg before the very end of the pouch and if wine stays in tap pipes, with a hypothesized remaining volume equivalent to six wine glasses.

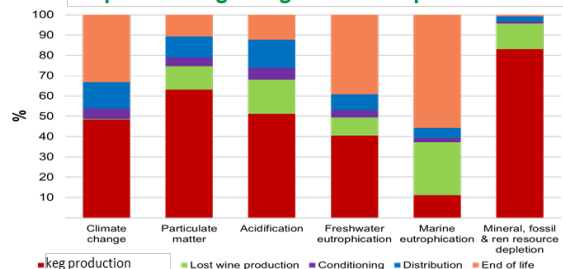
Keg production and end-of-life are the two main steps to focus on in eco-conception, as they contribute the most to impact indicators. Eco-conception of the keg has been studied in the project and could reduce up to 15% the Climate change indicator, and up to 77% the Resource depletion indicator when considering the perimeter of an empty packaging. The most efficient eco-design action is the switch to a disposable head to a washable head: 80% reduction for the indicator Mineral and fossil resource depletion.

Served wine production is the factor having the highest contribution to keg ecological impact for nearly all impact indicators



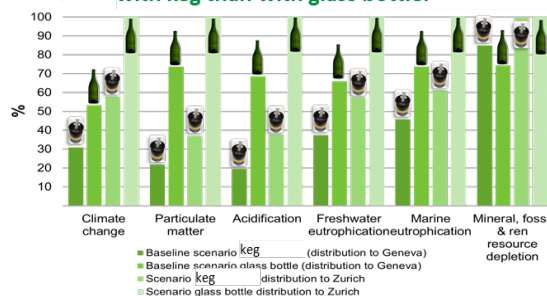
Ecoconception of the keg (production & end-of-life) can reduce environmental impact

- up to 15% regarding climate change and
- up to 77% regarding resource depletion.



Whatever logistic scenarios, the keg has a lower environmental impact than glass bottle for most of impact indicators:

e.g., environmental impact on climate change is 42% lower with keg than with glass bottle.



The findings of our research also provide initial insight into consumer likeliness to adopt keg wine. 96% of wine consumers are in favor of keg wine for economic and ecological reasons. One significant result is that the more they value sustainability; the more likely consumers are to favor keg wine. Additionally, consumer self-perception of ecological consciousness

positively relates to keg wine adoption. More precisely, consumer likeliness to adopt keg wine due to quality aspects correlates positively and significantly with the value they assign to sustainability characteristics. Consumer likeliness to consume keg wine to make economies correlates positively with their knowledge as wine connoisseurs. Finally, willingness-to-pay for wine with innovative sustainability characteristics like keg wine is higher among more senior consumers.

Regarding F&B establishments, 64% are in favor in keg wine, knowing that 88% of them sell more wine by the glass than they sell wine by the bottle and that 61% of them sell 4 to 10 different types of wine by the glass. The top 6 reasons for F&B establishments to adopt keg wine are:

1. General economic savings (E.g., cost of wine reduced by 20%, labor costs reduced by 17%, lower cost / sorting of waste, wine not corked-spoiled-stolen...).
2. Service efficiency & comfort (E.g., less heavy loads to carry: 36 kgs for a keg vs. 68 kgs for forty bottles, no cork pulling/broken in bottle neck, less client complaint, wine served at ideal temperature...).
3. Ecology & corporate social responsibility (E.g., task enrichment for staff having more time for enhancing the customers' experience, lower carbon footprint...).
4. Easier storage & space saving (E.g., up to 85% of space saved, 4 months of conservation for keg wine against 3 weeks for wine bottle dispensers, and 2 days for an opened wine bottle...).
5. More volume & flow allowed (E.g., kegs contain from 10 to 30 L of wine, a glass of wine is poured in < 5 seconds, a glass of Spritz can be poured in < 8 seconds with the perfect blend...).
6. Innovative system (E.g., keg filling & plugging new technology and innovative keg-head connector preserve wine from oxidation and ensures gustatory qualities & uniformity of wine...).

Implications & conclusion

Our research raised strong interest & huge media coverage on TV, radio, press, and Internet channels worldwide. Because we developed a sustainability-oriented innovative keg for wine, which is consistent with UN SDG, which preserves all wine qualities, as well as reduces adverse environmental impact, and improves the wine makers', restaurateurs', and consumers' experience, along with economic, social and ecological purposes.

Abstract

How could the wine industry be more sustainable? To answer this, an Interreg French-Swiss project gathered researchers to help a Swiss wine distributor and a French keg producer make their innovation more ecological, social and economical. What innovation? A reusable plastic keg with a disposable airtight pouch inside.

To assess the environmental impacts of this keg compared to glass bottles and help its eco-conception, IFV did a Life Cycle Assessment (LCA). Six indicators were considered as relevant. Results show an environmental benefit of the reusable keg except for resources depletion. A shift from aluminized to plastic pouch and from single use to washable pouch's head could improve the keg ecological profile.

The Changins School of Viticulture and Oenology tested the suitability of the keg for the conservation and consumption of wines, by chemical and sensory analysis. The nature of keg materials was studied in different storage conditions. A HACCP was also carried out to ensure the quality of the wine, from conditioning step to dispensing system. Results confirmed the

capacity of the keg to ensure wine quality and protect wines against oxidation, offering a real opportunity for sulphite free wines.

Market studies conducted by Ecole Hôtelière de Lausanne show that winemakers, restaurateurs, and wine consumers are in favour of keged wine, mostly for economic savings, and for its sustainability. Kegged wine also results in optimal logistics from wineries to restaurants, better service efficiency, and improved consumer experience, by meeting a growing demand for wine by the glass. Finally, keg wine served on tap is seen as a sustainable-oriented innovation that benefits all wine industry stakeholders.

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