



# Keg wine technology as a service innovation for sustainability in the foodservice industry

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## ABSTRACT

Keg wine technology that allows for more sustainable packaging and distribution of wine is an innovation launched in the otherwise conservative wine industry. Yet, the study of keg wine through the lenses of sustainability offering in services is daunted by the challenges around sustainability innovation in service providers. Drawing on the sustainability-oriented service innovation (SOSI) tool (Calabrese et al., 2018a, 2018b), this paper uses keg wine as a case study of the forces that drive or hinder the adoption of sustainability innovation in service activities like foodservice. Data from owners and general managers of Swiss foodservices provides initial insight into the perceived benefits and challenges for the adoption of innovations with sustainability potential. Specifically, results show that the willingness to adopt keg technology increases when potential long-term sustainability benefits are paired with new business interactions and new delivery systems. The study offers insights that could be used whether a restaurant is adopting innovative keg wine or not, especially as sustainability is an increasingly determinant driver of customer purchase behavior.

## 1. Introduction

Wine is a lifestyle beverage. The wine industry is the bedrock of a socio-economic network and environmental ecosystem in winemaking regions. As more consumers integrate the choice of healthier, more ethical, and eco-friendlier food and beverages in their lifestyle, the wine industry is pushed to develop more sustainable production, packaging, distribution, and consumption solutions (Flores, 2018; Forbes et al., 2009). While the wine industry is increasingly engaged in sustainability practices, a growing body of academic literature has also underscored the importance of considering sustainability as a potential competitive advantage for wine industry stakeholders (Annunziata et al., 2018; Atkin et al., 2012). The sustainable agenda is extensive, reaching from agricultural methods to wine preservation, distribution systems, and new business models (Broccardo and Zicari, 2020; Flores, 2018; Navarro et al., 2017; Fiore et al., 2017; Santini et al., 2013). One critical sustainability area that deserves further analysis is advanced packaging for distribution and storage of wine specifically in relationship with downstream activities like foodservices (Ferrara et al., 2020). According to Nielsen, foodservices account for nearly 45% of wine spending and 15% of volume consumption in countries like the U.S. (Nielsen, 2022).

In a context of social isolation and economic uncertainty, the COVID-19 pandemic has impacted wine consumers' environmental awareness and sustainable consumption in different ways (Severo et al., 2021). While the downturn has brought on-premise wine sales to a halt – i.e., consumption in hotels, bars, and restaurants, it has also increased off-trade sales (e.g., retail outlets, wines & spirits shops, and direct e-commerce) and off-premises wine consumption. Increase in wine consumption worldwide and changes in consumption behavior have accelerated and intensified the need for food services to make their supply chain, delivery processes, food safety systems, and packaging solutions more sustainable, for example by introducing innovations oriented towards sustainability in wine packaging, distribution, and consumption (Rowan and Galanakis, 2020).

Keg wine, also known as wine-on-tap, stems from a traditional preservation and packaging solution that has the potential to turn into a distribution and service innovation launched in the on-premises and on-trade wine industry. Proponents, mainly managers of F&B establishments in the U.S., argue that keg technology can potentially offer a technological, environmental, and financial alternative to wine glass bottle packaging, distribution, and consumption (Nuebling et al., 2017a, 2017b). Despite its potential sustainability benefits, tap wine remains

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marginal on most wine lists in Europe. In turn, there is a need for studies on the drivers of keg adoption and the sustainability potential of keg wine technology for service providers like the foodservice industry. Thus, the research question at the core of this paper is: *What are the factors influencing the adoption of keg wine as a service innovation for sustainability in the foodservice industry?*

Drawing on the sustainability-oriented service innovation (SOSI) tool (Calabrese et al., 2018b), this research aims at identifying the drivers that motivate managers of foodservice establishments in the context of Switzerland to introduce keg wine as a sustainable packaging and distribution solution for their businesses. The SOSI tool aims at focusing on both service innovation and sustainability, by considering several factors and stakeholders. The unique contribution of this study is to uncover the underlying reasons behind adoption of sustainability innovations in service providers like foodservice, which are traditionally less inclined to introduce changes in their service offering (Martin-Rios and Ciobanu, 2019). This prompts the question of what dimensions of the SOSI have great potential to catalyze the adoption of innovation. The findings show that sustainability concerns are a key driver of change, as they relate to new business interactions and new delivery systems. It can be concluded that less innovative service activities are more likely to adopt service innovations oriented to sustainability if they result in organizational benefits for their business models and they can be effectively communicated to customers in addition to the sustainable advantages they generate. In addressing United Nation's Sustainable Development Goals, wine industry stakeholders, including foodservices, play a key role in informing consumers about the sustainability benefits of innovations such as keg technology (Schäufele and Hamm, 2017). Thus, the study of the introduction of keg wine contributes to theory by demonstrating the role of the SOSI tool for better fostering organizational sustainability transitions within a business model perspective (Bocken et al., 2014).

## 2. Literature overview

### 2.1. Sustainability concerns in wine packaging and distribution

Wine is not just a beverage, and it is not only a business, but also a cultural artifact at the core of a whole ecosystem in winemaking regions across the globe. Growing concerns about the long-term social and financial viability of wine production-related activities and their environmental impact have pushed the industry to search for novel sustainable packaging, distribution, and consumption solutions (Broccardo and Zicari, 2020; Mariani and Vastola, 2015; Barber, 2010; Forbes et al., 2009). While the traditional wine making industry is undeniably engaged in sustainability, a growing body of academic literature has revealed that other wine industry stakeholders can also engage in sustainability to gain a competitive advantage (Ferrer-Lorenzo et al., 2019).

The main drivers of wine sustainability include pressure arising from stakeholders all along the six core activities in the wine value chain: creation of the vineyard; viticulture and grape production; vinification; packaging processes; transportation; and distribution-consumption (Barber et al., 2009; Marshall et al., 2005; Schäufele and Hamm, 2017). The scope of this study relates to the three last steps in the value chain, from packaging to transportation and consumption. Two of the most representative wine institutions, the International Organization of Wine (OIV) and the International Federation of Wine and Spirits (IFWS) include general principles of sustainable viticulture. For example, the OIV Resolution OIV-CST 518–2016 highlights the importance of sustainability priorities and how these objectives must be incorporated into all of the industry's six core activities (Mariani and Vastola, 2015).

Research shows that—of all stages of the wine value chain—packaging has the greatest environmental impact, as measured by its carbon footprint, global greenhouse gas emissions, and global warming potential (Ponstein et al., 2019; Navarro et al., 2017; Amienyo et al., 2014; Rugani et al., 2013). The production of heavy glass bottles

has a major impact in terms of water and energy consumption, while the selenium emissions associated with the process creates is highly toxic for the human body (Mariani and Vastola, 2015). Light bottles, use of recycled glass and/or refillable glass bottles lead to lower energy use, reduction of waste to be landfilled and/or reduction of emissions during transportation by a lighter load for instance (Ponstein et al., 2019; Rugani et al., 2013). Some of the most popular alternative packaging solutions are bag-in-box (BIB), polyethylene terephthalate (PET), cans, or TetraPak. Their ecological benefits and disadvantages have been studied thoroughly, thanks to Life Cycle Assessments (LCA), for instance. Breakage, weight, the impact of transport and storage temperature on the wine quality or the relationship between packaging materials and organoleptic and sensory dimensions have been thoroughly analyzed (Ghidossi et al., 2012). There is no consensus about the best wine container nor the acceptance of alternative containers to the traditional glass bottle. Wine producers, distributors, retailers, and consumers increasingly acknowledge the need for innovative wine packaging that allows proper preservation and temperature in the least amount of storage (Ferrara et al., 2020).

Consumer perception is deemed a main factor in alternative wine packaging acceptability and adoption (Steenis et al., 2017). When it comes to sustainability considerations, consumers mainly judge packaging material (Barber et al., 2009) and other considerations, like the impact of production and transportation, are for the most part ignored (Boesen et al., 2019; Schäufele and Hamm, 2017). Consumers favor glass over other materials. Studies adopting LCA have demonstrated that certain plastics have a lower carbon footprint than glass (Accorsi et al., 2015; Cimini and Moresi, 2016; Simon et al., 2015). Yet, for the most part plastic remains, in the consumer's imagination, the least sustainable packaging material, whereas glass is perceived as a superior material in terms of its sustainability (Boesen et al., 2019).

This lack of consensus as to the best packaging and dispensing solution in turn proves problematic to the adoption of sustainability innovations. Foodservice establishments are particularly sensitive to customer demands, and hence an ideal setting to analyze the likelihood of the uptake of new wine packaging and distribution technologies as potential service innovation oriented to sustainability.

### 2.2. Service innovation and the SOSI tool

Sustainability is acknowledged as a key driver of innovation (Hall et al., 2018). Research on sustainability innovations has developed as a body of literature within the innovation research field (Hansen et al., 2009). Sustainability innovation is defined as innovation that purposely integrates economic, social, and environmental value-creation during the design of new products, processes, and practices as well as new business models and value chains (Adams et al., 2016). Scholars have studied how such innovations lead to better economic, organizational, and environmental performance, resulting in long-term competitiveness and performance (Przychodzen and Przychodzen, 2015; Boons and Lüdeke-Freund, 2013; Hall and Wagner, 2012).

Recent studies have identified that service organizations are less prone to introduce sustainability innovations, in part because these tend to be more disruptive than other forms of innovation (Wiener et al., 2018; Kennedy et al., 2017; Inigo and Albareda, 2016; Schaltegger et al., 2016). The SOSI tool offers businesses with the opportunity to integrate sustainability transitions through the implementation of service innovation oriented to sustainability (Martin-Rios and Pasamar, 2018). The unprecedented economic shock caused by the COVID-19 pandemic intensifies the need for a sustainable transition and accelerates the demand for innovations oriented towards sustainability in service and business processes (Rowan and Galanakis, 2020). In this context, sustainability challenges many aspects of the service production and delivery, including all relationships along the value chain. Moreover, sustainable innovation requires companies to make a strong business case that includes developing longer term strategic planning as well as

redefining company-consumer relationships and behaviors. Finally, sustainable innovations require a systemic and multi-stakeholder approach to collaboration and business practices (Martin-Rios et al., 2022). The likelihood of success of this kind of innovation is hampered without wide-ranging collaboration across stakeholders along the entire value chain: producers, suppliers, sub-suppliers, distributors and vendors, social and institutional agents (Adams et al., 2016; Klewitz and Hansen, 2014).

Specifically aimed at service innovation, the SOSI tool has been proposed as a holistic approach and tool to support the development of service innovations that address the challenges of tackling UN 17 SDG (Mio et al., 2020). It is also suitable for sustainability transitions driven by and oriented toward environmental, social, and economic challenges (Calabrese et al., 2018a). The SOSI tool is grounded in three theoretical constructs: Business Model Canvas (Osterwalder and Pigneur, 2010), service innovation model (den Hertog et al., 2010), and the sustainable business model (Bocken et al., 2014). Based on these three models and the factors they include, the SOSI tool focuses on the core drivers of generating and implementing sustainable innovation as a combination of four macro factors and nine micro factors (Calabrese et al., 2018b). The first factor that can foster the generation of innovations oriented towards sustainability is 'service offering' (SOSI\_SO) and refers to the design of new service offering and solutions by companies, which implies the design, development, and delivery of innovative sustainable value propositions. The second macro factor 'customer interaction' (SOSI\_CI) involves the collaboration between companies and customers favorable to sustainability matters and stakeholders with whom a new relationship or new service channel must be established. The latter includes customers expecting more customized, more community-based, or more direct communication (for example through digitalization). The third factor 'delivery system' (SOSI\_DS) comprises new delivery systems, including the use of new physical or intellectual resources and the development of more sustainability-oriented operational activities, supply chains, and partnerships. The fourth macro factor 'impacts model' (SOSI\_IM) implies that firms need to simultaneously focus on economic, environmental and social key indicators or 'impacts' to estimate costs and benefits and measure return on investment. These four factors are connected to nine micro factors or building blocks, as originally described by Osterwalder and Pigneur (2010).

The SOSI tool answers research calls for conceptual analyses and methodological studies that examine the adoption of sustainability in the service offering through a more systemic and more transformative approach (Warren et al., 2018; Inigo and Albareda, 2016). For instance, the study of Behnam et al. (2018) about innovation capability on eight innovation projects in Italy and Spain also confirms that the transformational approach embraced in the SOSI tool is useful when adopting discontinuous sustainability innovations. The holistic perspective embraced by the SOSI tool and its focus on the transition to a more sustainable future has also been applied to new forms of service innovation with an emphasis on sustainable development goals (Enquist et al., 2015). The study of 11 high-technological company cases in Sweden strengthens the argument that a key driver of sustainability innovation is the collaboration of multiple actors in public-private spheres: suppliers, customers, universities, and research institutes, as well as trade organizations, political associations, and governments (Melander and Pazirandeh, 2019). These findings are consistent with two of SOSI's macro factors, which place a strong emphasis on collaboration amongst stakeholders. As such, SOSI may be a relevant tool for analyzing the extent to which business collaborations trigger the adoption of innovations with a strong sustainability component. For example, a recent study shows the importance of these forms of innovation for two Brazilian companies and their respective suppliers and their sustainable supply chain relationships customers (Neutzling et al., 2018).

### 2.3. Keg wine technology for foodservice

Wooden kegs or barrels are one of the oldest ways to deliver wine. For centuries, wine was stored and served in wooden kegs in restaurants, with the resulting hygiene and traceability issues (Work, 2014). In the 1970s, cylinder-style steel containers like those used for beer were introduced to storing and dispensing wine. Keg wine was poured from stainless steel vats at the winemakers' wineries and then transported and installed by a distributor to F&B establishments, where it was served on tap. More recently, new materials and traceability technologies have been applied to kegs, including fully reusable, fully recyclable plastic kegs, which may constitute a packaging innovation that offers higher wine preservation quality than stainless steel kegs (Urbinati et al., 2019). In their inception, reusable kegs were not aimed at laying-down wines kept for ageing in cellars, but at wines sold in higher volumes and consumed relatively soon after production.

Keg wine technology is used in this research as a case study of the forces and restraints linked to the substitution of manufacturing practices, i.e., glass bottles, with alternative packaging solutions for distribution, storage, and consumption of wine. Ranked as one of the top beverage trends in 2016 by Nation's Restaurant News in the USA, keg wine served on tap as a complementary packaging to glass bottles has regularly been referred to as both an innovative and sustainable technological solution in popular and specialized media worldwide (e.g., Hospitality Biz India, 2018; Levinson, 2018; Liotta, 2018; Pregler, 2017; Strenk, 2017). Research in the brewing industry has shown that kegs have a lower carbon footprint than glass bottles, notably in virtue of the high reusability of kegs (Cimini and Moresi, 2016). For example, once connected to the tap dispenser, the plastic keg can preserve the wine quality and homogeneity for four to six months thanks to a specific keg filling technology that reduces oxidation of the wine transferred from the winemakers' tanks to the plastic and aluminum pouches contained within the kegs, and from these pouches to the tap dispensers, at the bars, restaurants, events, and catering locations.

From the wine market perspective, the adoption of keg wine might also impact the supply side of the global wine industry. The kegg operation is potentially more economical than the bottling operation, allowing winemakers to sell wine at a lowest price. As a substitute for bottling, a third-party distributor buys wine from selected wineries by foodservice, fills the kegs at the wineries under a tested oenological protocol, while relieving the wine makers from all operations. The distributor then sells, delivers, installs, and performs safety and traceability measures for foodservice establishments. To a certain extent, keg wine can lead to a larger distribution scale and a shorter distribution chain than bottled wine. For restaurants, kegs require only half as much space as glass bottles. Due to their innovative packaging, keg wine may spare foodservice operations expenses related to corked wine, stolen wine, or oxidated wine. The reusability of kegs can thus be considered advantageous from an ecological, but also a financial perspective compared to returnable/non-returnable bottles. Finally, in terms of cost distribution, keg suppliers offer several business models, including selling or leasing the keg technology to restaurants for which foodservices need to set price per serving or keg yield equations accordingly. Capital costs can be burdensome for certain establishments (Cimini and Moresi, 2016).

However, keg wine solutions are not well-perceived by consumers and their adoption in foodservice remains relatively marginal in Europe. Nuebling et al.'s (2017a, 2017b) research on stakeholder perception of keg wine in the U.S. shows that consumers, wine makers, and restaurants resisted using the keg technology. An important reason for the reluctance may be linked to the perception of tap wine as less sustainable than wine from a bottle, which also links to perceptions of lower quality and, as a result leads to a lower willingness to pay (Ponstein et al., 2019; Boesen et al., 2019). Nuebling et al.'s (2017a) results also confirm that wine-on-tap is less expensive on average (US\$10) than wine from the bottle (US\$11.5) in U.S. foodservice establishments.

Restaurants' price positioning and the message sent thereafter to consumers regarding keg wine seem to downplay the sustainability aspect of keg technology. Although keg wine is deemed an innovative and growing sustainable trend by experts, research to date has yet to explore the potential benefits, as assessed by the SOSI tool, of adopting keg wine in the context of European foodservice establishments and the various factors that influence its adoption.

#### 2.4. Hypotheses

This research contributes to recent research on service innovation oriented towards sustainability in hospitality and foodservice and provides a framework to explore the cognitive mechanisms and conditions that motivate managers to introduce sustainability practices in their businesses (Garay et al., 2019). Two theoretical concepts inform this research: keg wine technology as a potential service innovation for sustainability and the willingness of foodservice establishments to adopt such innovation. According to the SOSI tool, the adoption of keg wine might be a significant step towards a financially viable, more sustainable service solution that comprises multiple stakeholders in the wine value chain (Flores, 2018). The transformative and collaborative perspectives embraced through SOSI factors can thereby be key levers for fostering sustainable innovations aimed at foodservice establishments. As such, it is hypothesized that:

**Hypothesis 1.** SOSI factors (service offer, customer interaction, delivery system, and impact) are a positive predictor of the willingness to adopt keg wine technology in foodservice establishments.

Also, certain organizational characteristics of the restaurant can ease the adoption of keg technology. Larger restaurants, both in volume of clients and volume of wine sold are more likely to be frequented by "less traditional" wine consumers (Ferrara et al., 2020) and, hence, are more likely to adopt keg technology. Similarly, the current level of implementation of sustainability management practices are likely to enable the willingness of restaurant owners and managers to adopt keg technology as a potential service innovation oriented towards sustainability (Knight et al., 2018). Alternatively, it can be argued that an establishment with less emphasis on sustainability and catering to more traditional consumers might limit the overall attractiveness of keg wine and create less market penetration. As such, it is hypothesized that:

**Hypothesis 2.** Organizational characteristics—size by servings per day, implementation of sustainability practices, location, type of clientele, type of establishment, and volume of wine-by-the glass—are a positive predictor of the willingness to adopt keg wine technology in foodservice establishments.

### 3. Methods

#### 3.1. Case study

Since the times of the Roman Empire, Switzerland has been a wine-growing country. According to the Swiss Federal Statistical Office (FSO, 2017), Switzerland is ranked 20th worldwide in terms of the surface area of its vineyards with 148 km<sup>2</sup> and 4th in the world in terms of annual wine consumption per capita (33 L per inhabitant). A recent survey of more than 3000 Swiss adults shows that wine is the Swiss people's favorite alcoholic beverage: while only 6 out of 10 drink beer, 8 out of 10 drink wine and 40% of them regularly (MIS Trend, 2017). About one-quarter of them drink wine in F&B establishments, 60% visit a winery at least once a year, and more than one-third have already visited wineries "open days/cellars", although only 20% define themselves as wine connoisseurs (MIS Trend, 2017). More than 33,000 wine producers, and their employees, depend on this wine consumption. Moreover, wine sales account for 15%–20% of the revenues of F&B establishments in Switzerland.

Due to the restrictions related to the COVID-19 pandemic, most Swiss

foodservice establishments had to close for almost one year. In terms of wine consumption though, an effect of the COVID-19 pandemic has resulted in an increased consumption of wine at the expense of other alcoholic beverages, as well as an increased environmental awareness and sustainability-oriented attitude towards local consumption (Weiskopf et al., 2020). In general, the COVID-19 crisis has changed (albeit temporarily) consumption patterns from drinking wine with family, friends and colleagues to online wine tasting and "solitary" consumption (Lockshin et al., 2020). Questions remain as to whether these changes in consumption preferences will last once restrictions are lifted and consumers return to restaurants.

The study and data collection for this article took place immediately before the first Covid-19 lockdown in Switzerland that started in March 2020. Exploratory qualitative interviews with F&B managers were used to elaborate and refine a survey questionnaire. The directory of F&B establishments and demographic data was obtained through Gastro-Suisse, the Swiss Restaurant Association. Interviews and the pilot testing were done in the French-speaking part of the country, which represents some 8000 establishments of a total of 28,000 establishments in Switzerland. A subsample of 800 establishments was randomly drawn from the directory. Fieldwork was conducted in French and all interviews have been translated to English so that the entire research team could conduct content analysis. To ensure measure equivalence in the French version of the questionnaire used in this study, survey questions were translated from English into French and then translated independently back into English (back-translation) (Brislin, 1970).

#### 3.2. Step 1: interviews

First, 80 F&B establishments out of the 800-random subsample were selected based on their location and type of clientele. Each establishment was approached by phone to explain the research project, request their participation, and secure a face-to-face interview. Drawing on a general interview guide approach, 47 managers from restaurants, brasseries and bars shared their views about a range of predefined subjects related to their perceptions and expectations of sustainability-oriented foodservice management practices, as well as wine management practices, including logistics, sales and marketing and relationships with wine suppliers and wineries. Other questions addressed their perceptions of consumer expectations and behavior about wine drinking and sustainability-oriented practices. Content analysis of these interviews provided rich, contextual data about current sustainability practices in foodservices of the French speaking regions in Switzerland. The findings also allowed the researchers to create a pilot questionnaire, and then make further adjustments to the survey, particularly about sustainability practices, financial priorities, and overall vocabulary, which was used in the next step. The underlying goal of the preliminary interviews was to determine survey questions about SOSI tools. As a result, for example, a short and neutral definition of keg wine and the different technologies in place was included in the survey. That way, survey items like 'My regular and loyal clients are too traditional to accept this kind of innovation and new system' included the term 'innovation' to refer to kegs, as illustrated in the preliminary description. Finally, it became apparent that long and overly complex questions about the specific dimensions of SOSI would make it difficult for the respondents to answer. As a result, it was decided to use questions proposing dichotomous choice items as responses.

#### 3.3. Survey

The questionnaire draws on the same analytical tool used by Calabrese et al. (2018b), considered the business perspective rather than the customer perspective, and was adapted to the characteristics of the foodservice audience in the Swiss market (see Appendix 1). The survey was sent to the sample of 800 F&B establishments of the French-speaking regions in Switzerland previously identified, except for

those 80 establishments already contacted during the interview phase. Of the remaining 720 foodservice operations, 130 surveys (18%) were collected yielding 104 useable surveys. Respondents were restaurant owners and managers. None of them had keg wine in place at the time of the study.

### 3.4. Measures

Survey questions included business positioning, type of customers, wine volume sold, percentage of beverage revenue due to wine, wine variety, or adoption of sustainability practices, including a battery of questions related to keg wine (see Appendix 1). Respondents had to select reasons that would make them adopt, or not adopt keg wine, framed according to the SOSI micro and macro factors, including innovation, sustainability, economics, and consumer acceptance, as well as service efficiency, storage gain, consumer reaction, attachment to traditional service practices, wine offer, or profitability incentives. Calabrese et al. (2018b) derived the macro and micro-SOSI factors from a descriptive case study of electric mobility. In this study of keg wine, all the SOSI items were taken from the macro and micro factors in Calabrese et al. (2018b) and adapted to the foodservice reality. Due to the lack of existing measures in the literature, four new scales were designed to assess each of the four dimensions of keg wine as a service innovation with sustainability potential. The resulting SOSI items in the survey included dichotomous items (See Appendix 2). Results from the qualitative interviews gave support to the use of unadorned items for the four SOSI dimensions. Answers for each dimension were added up for a final score. Therefore, the possible values for each aggregate measure for each SOSI dimension were SOSI\_SO 0–6 (six items), SOSI\_CI 0–5 (five items), SOSI\_DS 0–4 (four items), and SOSI\_IM 0–5 (five items). The use of aggregated measures is common in studies regarding the diffusion of innovative practices (Pasamar et al., 2015). For the purpose of this study, the final aggregate measure for each SOSI factor was also standardized prior to statistical analysis, as follows: raw score minus the population mean value divided by the population standard deviation (Aiken and West, 1991). Table 1 shows the descriptive statistics of the measures and constructs used for the statistical analysis.

Close to 40% of respondents own or are employed by a casual restaurant (brasserie and bistro), 37.5% in a concept restaurant, 16% in a pub and the remaining 8% in a traditional restaurant. Clients fell into one of the three categories: families, people who go to these restaurants for leisure, and seniors. Respondents also identify tourists and workers among their main clients. In terms of location, 48% of the respondents work in a central establishment, 24% classify their establishment as urban, and 21% of them are located in a small town or village. Most surveyed establishments serve between 70 and 200 meals per day and less than 50 L of wine per week.

Overall, 43.3% of respondents stated that they would be willing to adopt keg technology in their establishment. Using firm-level survey data for restaurant firms, techniques were applied to identify patterns of adopting keg wine innovations within these companies. Items related to SOSI factors were measured by comprehensive scales that asked about the reasons involved in the decision of whether to implement keg wine solutions (Table 2).

A set of different regression models was performed to analyze the introduction of keg wine as service innovation with potential for sustainability in Swiss F&B establishments. Given that the dependent variable used in this study is dichotomous, taking the value of 0 or 1, logistic (or logit) regression (Naumovska et al., 2020) was applied to explain the interaction between the four SOSI factors and WKW, willingness of keg wine adoption. Logistic regression is used to obtain an odds ratio in the presence of more than one explanatory variable. As such, logistic regression differs from linear regression in the attributes of the response variable, which is binomial (Gusmeretti et al., 2019). A binomial logistic regression predicts the probability that an observation falls into one of two categories of a dichotomous dependent variable.

**Table 1**  
Descriptive statistics of variables included in the analysis.

Variable	Description	Percentage
DEP: WKW	Willingness of keg wine adoption	-1 56.7
		+1 43.3
SOSI_SO: Service offering	Design of new services as sustainable solutions	-2 12.5
		-1 30.8
		0 39.4
		+1 15.4
		+2 1.9
SOSI_CI: Customer interaction	Interaction with stakeholders and customers	-2 21.2
		-1 32.7
		0 26.0
		+1 16.3
		+2 3.8
SOSI_DS: Delivery System	Service delivery infrastructure	-2 27.9
		-1 31.7
		0 20.2
		+1 8.7
		+2 1.0
SOSI_IM: Impact	Sustainable cost and benefits aspects	-2 6.7
		-1 35.6
		0 49.0
		+1 8.7
		+2 13.5
Control: Size1	Size of the establishment: servings per day	-1 29.8
Control: Size2	Size of the establishment: wine by the glass	0 23.1
		+1 33.7
		-2 26.9
		-1 29.8
		0 26.0
Control: Establishment	Segmentation by type of service offer	+1 11.5
		+2 5.8
		-1 43.3
		0 40.4
		+1 16.3
Control: Client type	Segmentation by type of customers	-2 13.5
		-1 29.8
		0 23.1
		+1 5.8
		+2 27.9
Control: Location	Geographical location of restaurant	-1 24.0
		0 48.1
		+1 27.9
Control: Sustainability	Actual implementation of responsible practices	-1 61.5
		+1 38.5

**Table 2**  
Description of SOSI factors, adapted from Calabrese et al. (2018b).

SOSI dimensions and items			
Service Offer (SOSI_SO)	Customer Interaction (SOSI_CI)	Delivery System (SOSI_DS)	Impact (SOSI_IM)
- Practicality	- Easiness	- Service efficiency	- Ecology
- Economical	- Loss avoidance	- Storage	- Cost
- Innovativeness	- Economies of scale	- Serving method	- CSR
- High volume	- (Non-innovative producer)	- Supply order management	- Recycling and waste sorting
- High quality	- (Client perception)	- (Storage)	- Consumer education
- (Non-innovative client)		- (Distribution)	

Note: Reversed items in parenthesis.

## 4. Results

Table 3 shows the correlation matrix with all measures transformed into a Z-score or the standard normal variate.

A binomial logistic regression was estimated to analyze the primary data collected among a set of Swiss restaurants (see Table 4). The

**Table 3**  
Correlation matrix.

	WKW	Size 1	Size 2	Establishment	Type of client	Location	Sustainability	SOSI_SO	SOSI_CI	SOSI_DS	SOSI_IM
WKW	–										
Size 1	.073	–									
Size 2	.138	.299**	–								
Establishment	.110	-.053	-.057	–							
Type of client	-.016	.253**	.105	-.072	–						
Location	-.074	-.097	.028	-.017	.093	–					
Sustainability	.227*	.117	-.030	-.006	.224*	-.097	–				
SOSI_SO	.172	-.024	.035	.150	-.144	-.120	-.133	–			
SOSI_CI	.267**	.116	-.005	-.023	.046	-.115	.164	.064	–		
SOSI_DS	.352**	.220*	.154	.087	.120	.143	.128	-.108	–0.41	–	
SOSI_IM	.331**	-.012	.036	-.135	.340**	.037	.114	-.003	.183	.176	–

\*p < 0.05 (2-tailed).  
\*\*p < 0.01 (2-tailed).  
\*\*\*p < 0.001 (2-tailed).

**Table 4**  
Results logistic regression willingness to implement keg wine.

WKW	Coef.	SEE	Wald statistics	p-value	Exp (B) <sup>a</sup>	Sig
Constant	-.341	.251	1.857	.173	.711	
Foodservice characteristics						
Size 1	-.117	.287	.165	.685	.890	
Size 2	.306	.267	1.316	.251	1.358	
Establishment	.337	.258	1.712	.191	1.401	
Location	-.143	.258	.309	.578	.866	
Sustainability	.457	.263	3.015	.082	1.579	*
Client type	-.435	.284	2.342	.126	.647	
SOSI tool						
SOSI_SO	.514	.266	3.752	.053	1.673	*
SOSI_CI	.609	.294	4.299	.038	1.839	**
SOSI_DS	.969	.319	9.221	.002	2.635	***
SOSI_IM	.828	.313	7.014	.008	2.290	***

\*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

<sup>a</sup> Exponent B (adjusted odds ratio) represents the odds that increase of willingness to introduce keg technology (WKW/Not WKW) given a one-unit increase in the independent variable while controlling for other independent variables in the model.

parsimonious design of the questionnaire to guarantee data quality was a good fit with this logistic regression model, which was preferred because the dependent variable was dichotomous: a restaurant’s willingness to adopt keg wine innovation technology, where 0 = reluctance and 1 = willingness. It is thus argued that willingness essentially is about recognition of the sustainability innovation value of keg wine technology. Given the binary dependent variable, willingness to adopt keg wine, the model assumed that probability of willingness of keg technology adoption in the restaurant,  $\pi_i = \text{Probability}(\text{WKW} = 1)$ , is related to  $X_i$  by

$$\log\left(\frac{\pi_i}{1 - \pi_i}\right) = \alpha + \beta X_i$$

where  $X_i$  is a vector of SOSI explanatory variables that may influence foodservice management’s willingness to adopt keg wine,  $\alpha$  is intercept,  $\beta$  is the vector of coefficients, and  $\pi_i / (1 - \pi_i)$  is the odds ratio of the probability of being willing to introduce keg technology to the probability of not being willing to introduce keg technology. The effect of each explanatory variable was measured by the adjusted odds ratio, Exp(B) in Table 4, which represents the impact of a one-unit increase in the explanatory variable on the predicted odds of a restaurant’s willingness to adopt keg wine while holding other explanatory variables constant.

Six organizational variables were included in the model: size1 of the establishment (servings per day), size2 of the establishment (wine by the glass), type of establishment/service offer, type of clientele, geographical location of establishment, and actual implementation of responsible

practices. The regression results show that the willingness of keg technology adoption in restaurants is positively affected by the presence of sustainability practices taking place in the organization. Restaurant size was also hypothesized to impact willingness of sustainable innovation adoption. The regression results contradict this hypothesis. Large restaurants that supposedly attract “less traditional” wine consumers (Ferrara et al., 2020) were not more inclined to adopt keg technology. Other explanatory variables were not significantly related to willingness to adopt kegs, including location and business position. Hence, hypothesis 2 is found to be partially significant.

Whereas the adoption of keg technology is positively related to the existence of other sustainability management practices, structural factors like establishment size were not associated with the willingness to adopt kegs. In addition, derived from the initial interviews was the question of the break-even point in the profitability of the restaurant in relationship with diversity in wine supply and wine consumption. Initially the larger the variety of wines offered by the restaurant the more problematic that each single wine is sold in a convenient volume. During the interviews, it was discussed whether the introduction of kegs in restaurants with an extensive wine list would raise questions about its feasibility and consumer convenience. The interviews with restaurant owners suggest that emphasis is on service and sustainability aspects while short-term economic efficiency comes second.

Results from the logistic regression explain the interaction between the four SOSI factors and the decision to implement keg wine. The overall model is significant ( $\chi^2 = 15.46, p < 0.051$ ). More specifically, results reveal that the four SOSI factors have a positive and significant impact on whether an establishment shows willingness to introduce keg wine in their offering. For every one-unit increase in each SOSI factor, the likelihood of a restaurant’s willingness to adopt keg technology increased as follows: SOSI Service Offer by 1.7, SOSI Customer Interaction by 2.3, SOSI Delivery System by 2.6, and SOSI Impact by 1.8. The statistical results of the binomial logistic regression model, supported by the Wald test, show, with significant statistical evidence (p-value < 0.05), that four SOSI factors (SOSI\_SO, SOSI\_CI, SOSI\_DS, and SOSI\_IM) contribute significantly to the values calculated in the category “willingness” (1) of the dependent variable (keg wine adoption (0, 1), when adjusted to the logit function. Since the statistical parameters of the binomial logistic regression model present significant statistical evidence, it can be stated that the proposed regression model has a moderate adjustment power. Hence, hypothesis 1 is confirmed.

## 5. Discussion and recommendations

This study depicts the forces that drive and hinder the willingness (i. e., intention rather than actual behavior) to adopt keg wine technology as a form of sustainability innovation in European, particularly Swiss, foodservice establishments. Keg wine served on tap exemplifies a certain packaging and dispensing solution that encapsulates the complexities of

sustainability innovation portrayed in the SOSI tool (Calabrese et al., 2018b). Proponents of wine on tap argue that keg wine enhances the sustainability of wine distribution methods, market structures, and patterns of consumption, through packaging and waste reduction for winemakers, and responsiveness to wine retailer environmental requirements (Nuebling et al., 2017a, 2017b). Novel keg technology offers sustainability opportunities. It can reduce waste production from packaging and increase resource efficiencies to the benefit of winemakers, foodservice establishments, and consumers, all while maintaining wine quality levels. Keg technology may be perceived as an affordable packaging solution that opens new distribution and commercialization channels providing large-scale emissions reduction. Hence, keg wine could attract a larger target audience. In addition, since bottling operations are replaced by keg distributors who ensure the filling, maintenance, refilling of the kegs, and transportation between wineries and F&B establishments, keg wine can also represent an innovative service for foodservices with sustainability benefits.

The results of the logistic regression confirm that the four SOSI factors are positively correlated with the intention to adopt keg wine in restaurants, including new service offering and solutions, new business interactions with stakeholders, new delivery and supply chain systems, and new economic and financial impact models. Moreover, regression coefficients show that of the four SOSI factors, new business interactions and new delivery systems have the greatest impact on innovation adoption, whereas new economic and financial impact models and new service offerings and solutions have a somewhat lower positive impact. For the most part, innovations with sustainability-oriented dimensions have been studied with a partial focus on either environmental factors like ecological packaging (Rugani et al., 2013; Steenis et al., 2017), social attributes including customer demand (Forbes et al., 2009), or financial aspects related to value creation and competitive advantage (Annunziata et al., 2018; Atkin et al., 2012; Silverman et al., 2005). This study addresses the adoption of a certain technological innovation and suggests that a limited consideration of keg wine in terms of 1) product innovation as a new offering, 2) business innovation towards stakeholders, and 3) process innovation regarding the wine supply chain may obscure the multifaceted character of sustainability innovation adoption.

The SOSI tool applied to the adoption of keg wine can enable wine stakeholders like winemakers, foodservices, and consumers to better understand how ecological, social, and financial factors impact their adoption of innovations. It is anticipated that willingness to adopt keg technology increases when the delivery network does not require additional delivery investments. Waste management opportunities for food services (Martin-Rios et al., 2021; Martin-Rios et al., 2022). For foodservices that are early adopters of keg wine to reap full benefits of the keg innovation, it might be important to consider which inter-organizational resources and capabilities they can share with winemakers and keg distributors. This can be achieved mainly through inter-organizational collaboration among winemakers, distributors, and restaurants. Yet, this type of innovation requires commitment from the entire value chain (Melander and Pazirandeh, 2019).

More to the point, keg wine implementation will be more likely if consumers see it as being beneficial. In line with consumers' growing environmental awareness, consumer acceptance may be fostered by the sustainability aspect of the packaging offering. The challenge might be to get consumers to see the delivery method as an element of that environmental awareness. A better understanding of customers' motives towards adopting keg wine can help restaurants identify which arguments to put forward to implement keg technology. Extensive communication with customers might lead to useful insights about the potential for the introduction of keg wine in the establishment. Since packaging acceptability and adoption is mainly driven by consumer perception (Steenis et al., 2017), foodservices that want to foster keg wine as a service innovation should inform their customers about the sustainability benefits of it, for example, its potential lower carbon footprint

versus glass bottles. The application of SOSI may help businesses to document, promote and showcase their environmental awareness and commitment to sustainable consumption as they adopt and promote keg wine.

It is also important to consider the current conditions of the wine supply and wine lists in restaurants and foodservices. Kegs might be less appropriate for restaurants with more extensive wine lists and for fine dining establishments that feature high-end wine pairings. It is envisioned that real opportunities of keg adoption will be more likely when offered for specific wine service, including daily menu vs. weekends and "à la carte" and wine sold by the glass vs. bottle. Offering wine by the glass can be upgraded by specific techniques such as pouring wine from keg into a glass pitcher before serving customer. Yet such initiatives must overcome resistance to change traditional wine preservation and distribution methods due to factors like the perceived increase in cost and lower quality.

Innovations can be categorized as receptive and resistant (Garcia et al., 2007). Receptive innovations do not make people alter their mindset and let them remain in their comfort zone, and even tend to be overly welcomed by people. Resistant innovations require higher levels of proactivity and commitment from the people involved, because they tend to raise conflicts that require a change from a status quo. For instance, resistance to substitute corked bottles with screw cap closures could be overcome through both vertical cooperation amongst wine industry stakeholders from wine makers to F&B establishments, as well as "coopetition" amongst each group of stakeholders along the wine value chain. This could include a marketing strategy that would address the consumers' mindset towards the innovation (Garcia et al., 2007).

Novel keg wine technology may also represent a resistant innovation in the conservative wine industry, especially in Europe. Whereas in countries like the U.S., wine in kegs has made inroads in food services, in Europe and more specifically in Switzerland, this system is still in a purely "start-up" state. One reason for such situation is the behavioral changes its implementation requires. Potential resistance of foodservices to adopt change might be due to "status quo" bias, as theorized by Samuelson and Zeckhauser (1988). Keg wine adoption encompasses trade-offs and requires significant behavioral changes that not all restaurant owners and managers might willingly address. By its very nature in terms of organizational culture (Erhardt et al., 2016), management in food services may exhibit a natural emotional preference for the current state of affairs in the context of decision-making, taking the status quo as a reference point and perceiving departure from that baseline as potentially problematic. Certain changes in the leadership tradition and practices of the whole wine industry and trade might be necessary to overcome both the resistance to change and status quo bias.

## 6. Conclusion

This paper is the first attempt to study keg wine from the sustainability innovation perspective, and the first one to provide insight into owners' and managers' perceptions, preferences, and expectations regarding keg wine in European foodservice establishments. Distribution and packaging have the potential to catalyze the adoption of service innovations with sustainability potential. Service innovations with sustainability potential are necessary for achieving sustainable development goals that would benefit our societies economically, socially, and ecologically over the long term. Results show that the introduction of keg wine as a potential sustainability-oriented innovation is appealing to businesses because keg technology may constitute a new value proposition for foodservices alongside winemakers and consumers. The introduction of keg wine may lead to environmental awareness and commitment to sustainable consumption, which will be reinforced if customers perceive it as being beneficial. In line with the SOSI tool, the four main drivers of sustainability innovations in terms of services — new service offerings, new customer and other stakeholder interactions, new delivery systems/supply networks, and new financial impact

models are integrated in the keg innovative solution. This distribution and packaging method may entail new customer segments, channels and relations for keg makers and wine suppliers. It also implies a new use of resources and new supply network and partnerships amongst wine stakeholders. Finally, keg wine can make all wine stakeholders consider the new costs and benefits associated with its uptake, including reduced cost of waste, higher staff efficiency, space savings, and lower carbon footprint.

This paper makes three main contributions. First, it aims to answer the call made by both researchers and practitioners for building a body of research on the potential contribution of sustainability-oriented innovations to foster change (Adams et al., 2016; Calabrese et al., 2018a). Hence, the current study makes a methodological and a theoretical contribution by using the SOSI tool for validating its reliability and for reaping the benefits of its transformational potential (Calabrese et al., 2018b). Secondly, this research makes an empirical contribution to the understanding of the adoption of sustainability innovation in the wine value chain by focusing on foodservice establishments that play a central role in bridging the gap between wine producers and wine consumers in the adoption and diffusion of innovation. In addition, this research is the first to study the perception of owners and managers of foodservices in Europe regarding keg wine-on-tap distribution. Finally, this paper paves the way for future research into the adoption of service innovations for sustainability, the role of SOSI tools to unleash changes in the business model, and specifically on inter-organizational collaborations as a potential means to reduce resistance to innovation by integrating wine stakeholders along the wine value chain.

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## CRedit authorship contribution statement

**Stéphanie Pougnet:** Investigation, Resources, Project administration, Validation. **Carlos Martin-Rios:** Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing. **Susana Pasamar:** Data curation, Formal analysis, Writing – original draft.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## APPENDIX 1. Interview Questionnaire

Amongst the advantages of wine served on tap from a keg, which one would you consider the most important one?

1. None, I do not see any advantage.
2. It is practical.
3. It is economical.
4. It is innovative.
5. It is ecological.
6. It is of high quality.

What reason would convince you to implement keg wine served on

tap in your establishment? (Multiple answers possible).

1. No reason at all would convince me
2. Innovation
3. Overall savings
4. Service efficiency/practical for serving wine
5. High volume and flow
6. Easy to use
7. Environment/Corporate Social Responsibility
8. Storage made easier and simpler
9. Being able to serve wine at the ideal temperature
10. Avoid loss due to theft, abuse, corked wine, turned wine from open bottle
11. Supply and order made easier
12. Savings on recycling and waste sorting
13. Economies of scale
14. Higher quality of wine
15. Educate consumer to new distribution and consumption systems

Would you implement keg wine in your establishment?

1. Yes
2. No
3. Maybe

If you do not want to implement keg wine, for what reason is it? (Multiple answers possible).

1. None, I have no reason not to implement keg wine
2. I already have a contract I signed with a specific wine producer who may not want wine in kegs
3. I do not see enough to gain and to get from keg wine
4. I am afraid how my clients would appreciate no branded wine
5. My regular and loyal clients are too traditional to accept this kind of innovation and new system
6. With no bottle, there will be no wine concept anymore
7. I have no space for the keg storage
8. I am personally attached to specific wine producers who may not want wine in kegs
9. I am afraid I would lose some flexibility regarding wine distribution
10. My wine offer is too large and various
11. My establishment is too small, I don't sell enough wine volume.

## APPENDIX 2. Measures for the Final Survey

### Independent Variables

SOSI Dimensions and items (Yes/No).

### Service Offer (SOSI\_SO)

It is convenient.  
 It is economical [inexpensive to put in place].  
 It is innovative [overall solution].  
 It ensures higher volumes of wine.  
 It involves better quality of wine.  
 (Reversed) My regular and loyal clientele is too traditional to accept this kind of innovation and new systems.

### Customer Interaction (SOSI\_CI)

It is easy to use.  
 It avoids loss due to theft, abuse, corked wine, turned wine from open bottle.  
 It involves economies of scale.



(Reversed) I am afraid of how my clientele would perceive the absence of wine bottles.

(Reversed) I already have a contract I depend on, which I signed with a specific wine producer who may not want wine in kegs.

#### Delivery System (SOSI\_DS)

It involves service efficiency/practical for wine transportation.

Storage is easier and simpler.

It allows being able to serve wine at the ideal temperature.

Supply and order are easier.

(Reversed) I have no space for the keg storage.

(Reversed) I am afraid I would lose some flexibility regarding wine distribution.

#### Impact (SOSI\_IM)

It is innovative and ecological.

It results in broader business benefits.

It is associated to Corporate Social Responsibility.

It means savings on recycling and waste sorting.

It educates the customer/consumer to new distribution and consumption systems.

#### Dependent Variables

**Willingness of keg wine adoption (WKW) (Yes/No).**

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