

HOW TO DEVELOP STRATEGIES OF ADAPTATION TO CLIMATE CHANGE BASED ON A FORESIGHT EXERCISE?

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Abstract:

Context and purpose of the study - Prospective studies raise a real intellectual interest for those who contribute to them or take cognizance of it. But they are often considered too difficult to operationalize, and most of the prospective exercises are not followed by action plans, particularly at value chain level. To overcome this difficulty in linking the work of experts and the decisions of stakeholder of value chains, a particular effort was made to operationalize the outcomes from a prospective study on the French vine and wine industry in the context of climate change. The approach consisted in collecting and using the feed-back of professionals from the wine industry about these outcomes to feed a strategic think-tank and thus allow decision-makers of the industry "to come back to the present, better equipped to influence it according to [their] intentions and [their] requirements "(Sébillotte, 2002).

Material and methods - From 2014 to 2016, a foresight exercise was carried out within the framework of the Laccave project, and permitted to design 4 adaptation strategies to climate change (conservative, innovative, nomadic, liberal) and to describe the paths leading to them (Aigrain et al. , 2017). In 2017, six participatory seminars were organized in the main French wine regions: Bordeaux / Cognac, Champagne, Burgundy, Languedoc, Rhône Valley and Alsace. During each of them, between 60 and 100 stakeholders of the industry were invited to discuss in small groups about the issues and consequences of each proposed strategy. Then, they were asked to identify the desirable or threatening nature of these strategies and to make proposals for actions that could promote or prevent their occurrence. All information collected was recorded in the form of verbatim (Aigrain et al., 2018).

Results - From these participatory workshops, the majority favored the development of technical innovations in order to maintain the current location of French vineyards and the value associated with them, while questioning the limits to keep the specificity of each appellation. The positioning vis-à-vis the conservative strategy is variable and depends on the regions. The appearance of new viticultural zones is concerning and represents a point of vigilance for the participants. The treatment of these numerous contributions is currently fueling the construction, in France, of a national strategy to adapt the vine and wine sector to climate change.

Keywords: Climate change, Vine and Wine industry, Adaptation, Foresight exercise, Participative approach

1. Introduction

By 2050, worldwide, climate change will affect the conditions of production and the organoleptic and marketing characteristics of wines. To achieve sustainability, the wine industry will have to adapt. In addition, the wine sector will be impacted by other factors such as the evolution of health and environmental concerns, some geopolitical or technological changes, new wine consumption conditions and modifications of agricultural policies. Many adaptation levers can be envisaged, such as the introduction of new varieties or alternative viticultural and oenological practices. New locations, reorganizations of the sector and of its regulatory framework, but also the redefinition of environmental, research and innovation policies have also to be considered (Jones and Webb, 2010, Ollat et al., 2016). The levers can be combined at different spatial or temporal scales of the industry. Nevertheless, a clear strategic and integrated vision about the putative futures is often missing. Engaging a broad reflection to support stakeholders of the industry to design their own adaptation strategy and research institutions to set their agenda remains rather challenging.

Foresight studies aim at exploring and preparing the future through a rational and holistic approach. In this context, they seem particularly appropriate to help define adaptation strategies. Based on the analysis of the available data (situation reports, heavy trends, emerging phenomena), on the understanding and consideration of the decision-making processes, these studies have the objective to define possible scenarios without trying to measure their probability of appearance (De Jouvenelle, 2004). They are based on interdisciplinary approaches combining social sciences and biological sciences, and may be implemented at global, national or regional scales, and/ or for specific socio-economic sectors (Gaudin 2005, Popper 2008). They are increasingly mobilized to take into account the challenges of sustainable development (Destatte 2010, Hage et al., 2010) and climate change (Fussler 2010, Cairns et al., 2013, Aulagnier et al., 2015), including for agriculture (Faysse et al., 2014, Schaller, 2015). In France, several foresight exercises were implemented for the wine industry (Sébillotte et al., 2003, CCE, 2009, FranceAgriMer 2014, Aigrain et al., 2017), but so far none of these studies had clearly addressed the climatic issue.

A foresight exercise was carried out within the framework of the LACCAGE project, set up in France by INRA to study the impacts of climate change and the potential adaptations of the wine sector (Ollat and Touzard, 2014). The objectives of this exercise were to identify and explore, by 2050, different types of adaptation strategies for the French viticulture in the context of climate change, to test a method for developing "trajectories" to reach a pre-defined "future", and to develop a common vision and networking practices between researchers and industry organizations (Aigrain et al., 2016a, b, 2017). A prospective team involving scientists from the LACCAGE project and members of two national administrations in charge of the Vine and Wine sector (FranceAgriMer and INAO), proposed four major types of adaptation strategies, as well as the trajectories leading to them (FranceAgriMer, 2016). Then participative forums were organized with stakeholders in six French wine regions in order to confront the four adaptation strategies to the analysis of professionals and to collect their strategic positioning (Aigrain et al., 2018). Here we report the results from these participative forums and how they may be used to set up a global and realistic adaptation strategy by the wine industry (Figure 1).

2. Material and methods

Foresight exercise—The prospective team built four pre-defined major adaptation strategies for 2050, taking as a working hypothesis a median climate scenario of the IPCC. These strategies were established by combining two major dimensions of adaptation: the choice of location of vines and the extent of technological innovation. Each strategy corresponds then to the development of a dominant logical direction over the next thirty years (Aigrain et al., 2016a, c). They were named as: i) a "conservative" strategy where technological and geographical changes are limited; ii) a "nomade" strategy where the displacement of vineyards is the main vector of adaptation; iii) an "innovative" strategy where the integration of innovations is fueling the process; and iv) a "liberal" strategy largely open to any kind changes. Then the trajectories conducting to each main strategy were specified by combining seventy hypotheses, collected from literature, surveys in three wine regions, and expertise. These hypotheses are related to general public policies, international and national regulations of the wine industry, to the local and national wine-growing context, in relation with climate change and the innovative dynamic, the structural adaptability of estates and the evolution of consumer attitudes. The consequences on the governance of the sector and the importance of geographical indications of origin were also considered (Aigrain et al., 2017).

Participative forums—The four pre-defined strategies and their corresponding trajectories were presented and discussed with stakeholders in six french wine regions (Bordeaux and South-West, Champagne, Alsace, Burgundy and Beaujolais, Côtes du Rhône, Languedoc) during one-day participative forums. They were used as a tool for attendees to project themselves in 2050, to exchange with others about the stakes and consequences of these strategies and to pronounce themselves about the attractive or repelent character of each one. Each forum was organised in collaboration with local stakeholder representative organisations. Invitations were spread through local bodies with the objective to gather a large diversity of components from the local industry, with the maximal limit of 100 attendees. Each forum was held according to the same protocol. Groups of 6-8 attendees were created according to appartenance of specific categories (growers, winemakers, salers, marketers, extension services, research, administration) requested upon registration, in order to reach the highest diversity in each group. Electronic tablets were provided to each group in order to record interactively participant verbatims and votes which were transmitted in real-time to a central PC for analyses. After a short introduction describing climate change impacts and how the foresight exercise had been implemented, each adaptation strategy and its corresponding trajectory were presented by a member of the prospective team. Each presentation was followed by a 20 min period of exchanges within participant groups about the potential stakes and consequences in 2050 of each strategy. Participants were requested to analyse technical and market issues, but also impacts on stakeholders and territories, as well as on the governance of the industry. They were also asked to qualify the impacts as positive, negative or neutral. Verbatim were recorded and transmitted to a prospective team member in charge of real-time analyses and syntheses. Within 2 hours, all 4 strategies were explored and discussed by all the participants. During the second part of the day, syntheses of the working groups were presented for each strategy and debated among the whole audience. After a short definition of possible strategic attitudes (positive or negative proactivity, anticipated reactivity, watch), participants were asked to pronounce themselves for a strategic attitude for each strategy and to propose some possible actions corresponding to implement the chosen strategic attitude. The proposals were collected for further analyses. Votes were displayed right after and commented by the prospective team. The forum ended by a general debate among participants.

Data analyses – Characteristics of the participants, verbatims about the impacts of each strategy, votes and action proposals, sorted by category, were used to establish a data-base. Statistical analyses of data were performed according to different requirements, especially for defining the main domains of action proposed by the participant, at national or regional scales.

3. Results and discussion

3.1. Participants

Across the 6 forums, 355 participants provide useable data. Among them, one third declared to be involved in production (from 2/3 as person in charge), one third was related to extension, support and scientific services. Ten % belonged to administrative bodies and 8% to industry related organizations. Nurseries and wine traders were largely underrepresented. The duration of the forum prevent probably some interested people to participate.

3.2. Stake and consequence analyses for the different adaptation strategies

Effects of the wine regions: Verbatims recorded in real-time and synthetized during each forum displayed some specificity according to the origins of participants. Although there was a general concern about climate change impacts for the wine production, the feeling of emergency and intensity of the threat was more pronounced in the vineyards located in South of France (Côtes du Rhône and Languedoc). A pessimistic vision prevented a clear distinction among strategies, especially in the Côtes du Rhone where the Appellation system is a majority. More solutions were envisaged in Languedoc characterized by diversified systems. In Champagne where the industry is highly organized, the participants put forward the risk that climate change could affect this specificity which is highly efficient technically and economically. In Burgundy and Beaujolais, threats on land issues were underlined. In Bordeaux and South West, positive aspects of climate change were considered for all strategies. The central role of trade and the evolution of wine quality are noticed. In Alsace, a strong attachment to the current socio-technical model was expressed, with the motivation to modify the practices within the existing framework.

Variable perceptions according to the trajectories:

The **conservative trajectory** has been perceived as positive because it requires maximizing the existing options: the diversity of clones and varieties (with new rootstocks), the vintage effects, the range of wines and channels of distribution. It allows the reconnection with consumers by highlighting the environmental issues and services (oenotourism, fight against fires, CO₂ storage) and the proximity. It requires professionalization of the industry and initiatives from wine organizations to ensure some extension services and monitoring of vine health and climate change. It should rely on the local-community work. Negative consequences have also been considered, as lower yields and the increase of wine quality variability that would affect the sustainability of many estates (with regional differences). Links to research are perceived as weakening with only few technical advances and conditions increasingly constrained for irrigation. According to this trajectory, the French industry would remain a reference for premium local wines, highly expensive. Consequently markets will shrink and the French sector would lose its importance, its competitiveness and its jobs.

The **nomadic trajectory** echoed the media vision of climate change such as "the production of sparkling wines in Sweden or England". This strategy was seen as favoring the exploration of new combinations of soil / climate / plant material / practices, as a possible "return" to polyculture, or even stimulating the invention of new forms of viti-ecology. New ways of combining quality and territory are envisaged: new vineyards extending the wine offer and opening up new markets. With new players (investors, farmers, urban), the sector would oscillate between dynamism and risk taking in new territories. In this way, irrigation could develop, even with strong competition for access to water and space. However this trajectory would lead to the progressive disappearance of current vineyards and local know-how, oenotourism, landscapes, links to gastronomy. The risks would be accentuated for those who did not "move" and would undergo an increased variability of wine characteristics. The new vineyards are imagined as both "industrial" and, more marginally, "small producers of elitist wines". This trajectory would result in the end of the current appellations (PDO, IGP) and their governance (ODG, grower associations, INAO) with a concentration of operators around brands and a strong development of private consulting and control activities.

The **liberal trajectory** questioned even more strongly the characteristics of the French industry. Nevertheless, a number of positive points have been identified. Extension would be supported by the private sector, rather seen as being able to seize opportunities responsively in close connection with the expectations of consumers and investors. Hence a potential proliferation of novelties: grape varieties, irrigation, robotization, chemistry, all stabilizing qualities and yields, and also new "wines", markets, consumers and professions, investors, etc..., all in one context of reduction of administrative burden. Negative aspects would be considered as dominant: the privatization of extension would exclude small units unable to finance it. This would lead to a 2-speed viticulture with niche wines vs. industrial wines. This industrialization would result to a loss of diversity and typicity. With the reduction of standards and controls the disappearance of AOPs and IGPs would be inevitable. The hillside vineyards would be abandoned, the production would concentrate. Producers would lose power in favor of industrial and trading global players. Globally, the sector would be disorganized.

The **innovative trajectory** appeared as more attractive. New grape varieties and rootstocks, "corrective" oenology, new technologies would authorize the maintenance of existing vineyards. The coexistence of several models of viticulture would be permitted: precision viticulture, organic agriculture / agroecology, innovative AOP, new products. Innovation would also be related to packaging, marketing, service (insurance, big data...). The specifications of the geographical indications would be modified accordingly. The role of grower associations would increase in parallel with an opening of governance. Innovation would benefit from public support, and the management of land / heritage would become a central issue (protection, resources ...). However risks were also identified: this trajectory would be accompanied by financing needs (investment, insurance), which would lead to higher costs. Consequently innovation may be limited for some stakeholders. It would require new investors and new actors and lead to the marginalization of several small units. Robots, NICT, oenological innovation could reduce the diversity and reference to the history. The adoption of innovations could weaken current AOPs in favor of IGPs or even VSIGs.

3.3. The strategic attitudes

After the analyses of stakes and consequences, the participants were asked to express themselves on the strategic attitudes that they wish to adopt according to the following definition: "positive

proactivity" means to act today to promote the future of this strategy; "negative proactivity" means to act today to avoid the arrival of this strategy; "anticipated reactivity" means to consider today several further actions in case this strategy could occur in the future; "watch" indicates that this strategy should just be under surveillance;

"no attitude" means that this strategy is not particularly interesting.

The results of these votes (Table 1) should be considered with caution: i) the participants may be more concerned by the CC than all actors of the industry, resulting for their voluntary participation to the forum; ii) they were often already engaged in the development of solutions with a priori positive or negative visions of some trajectories; iii) we also noted possible positive or negative influence of the naming of the strategies. But the results being very marked, we can assume that they express a real tendency.

In general, the "balanced" votes for the conservative trajectory express the questioning on the current situation and its resilience vis-à-vis the CC. It depends on the regions (more or less impacted and competitive: Alsace and Champagne more favorable), categories of actors (winemakers more favorable) and the level of satisfaction with regard to the current state of the activity. The nomadic trajectory is rejected but it questions, and must be "monitored": is it possible? Can new vineyards really develop? The rejection of the liberal path is very strong, because associated with a loss of influence of wine producers, coupled with a redefinition of wine and a disruption of many norms and standards. The vote in favor of the innovative trajectory expresses a key message. Innovation is a necessity to stay in place, to preserve individual and collective investments made at the territorial level (historic heritage, image, other activities, social links ...) and that create the value of wine. Nevertheless innovation to what limits?

Data analyses by region highlight several orientations (data not shown). If all the regions put forward the innovative strategy, northern regions (Alsace and Champagne) reject less the conservative one. Contrary to the common thoughts, regions such as Bordeaux and Burgundy / Beaujolais are more in favor of the innovative strategy, joining in this a southern region (Montpellier). Alsace is original in its strategic attitude to the innovative strategy by putting forward a significant share of anticipated reactivity. Regarding the nomadic strategy, northernmost regions (Alsace and Champagne) want to do everything possible to prevent it from becoming a reality, while the other regions adopt a shared attitude with higher proportion of "watch". The rejection of the liberal strategy is general, but it is a little less in Bordeaux, Burgundy and Languedoc than elsewhere.

3.4. Analyses of the levers proposed to implement the strategic attitudes

After voting, participants were requested to make some proposals corresponding to each selected strategic attitude. 2222 proposals were collected and further characterized per domain or level. A quarter of them can be considered as very general comments or guidance, such as "to defend the AOCs", "to strengthen the role of the unions" or "to put flexibility in the system". Three quarters correspond to more concrete actions, supported by collective action (62%), public intervention (42%) or combining collective action and public intervention (31%). 19% refer directly to an individual action, often proposed by a winegrower considering for example to "plant late varieties" or "develop a new wine". Twelve % of actions invoke public action alone, especially for regulatory or basic research issues.

Over the 6 regions and the 4 strategies (Table 2), the domains of action were related (i) research and experimentation, ii) regulatory aspects, iii) economic issues (primarily related to the definition and valorization of wine), iv) the introduction of technical innovation or v) training and advice (mainly to winemakers). A more detailed categorization put forward the organization or the defense of "terroirs", the changes of grape varieties, or the quality of the wine. Although extension was generally cited first, there was a variety of policy areas, reflecting the lack of a "single solution" and the importance of combining actions in different areas.

3.5. From prospective to strategic prospective

Once one or even two major strategic attitudes were identified per adaptation strategy, the main levers to be activated were selected in order to support decision-makers to define an action plan. Over all participative forums, we mainly retained two opposite attitudes towards the conservative strategy, a large majority in favor of the innovative strategy seen as a way to maintain an industry related to terroirs and organized as today, a rejection of the nomadic strategy because it may contribute to destroy the concept of "terroir", typicity and viticultural heritage, and finally an opposition to the liberal strategy perceived as challenging the basics of French wine industry.

To promote the conservative strategy, proposed levers involved the development of extension services on environmental and soil issues, the experimentation of agro-ecological practices, the valorization of local know-how and diversity, the development of forgotten or extra-regional grape varieties and the communication about current wines, links to terroir, climatic effects. To avoid it, it was proposed to promote extension and innovation among wine growers and decision-makers, to inform about vineyard vulnerabilities to climate change, to support the technical changes and the revision of the specifications.

To favor the innovative strategy, the main cited levers were related to the general promotion of extension services, training and watch activities. All sectors of innovations were cited as resistant grape varieties, irrigation, de-alcoholization, mechanization, new products. The local adaptation of innovations appeared as essential. The renewal of varieties, the development of precision viticulture and oenology, dry-farming and irrigation, organic farming should be supported. Communication, information and education, mainly of consumers, in relation with the acceptance of climate change impacts and the need of new technologies appeared to be some pillars of the strategy. Finally, strengthening the collective organizations to support innovation, maintain vineyards in place and the family model, control concentrations and external investors seemed essential.

To avoid the nomadic strategy, it was suggested to strengthen the Appellations management structures (ODG) and to study the existing terroirs and their surroundings, to support the collective, union, political actions to defend the concept of terroir, the identity of the products, to avoid deregulation, to sensitize consumers and develop a communication around the origins and contributions of the wine sector to local economy and heritage, to develop research and innovations to maintain the current location (grape varieties and rootstocks, irrigation ...).

To prevent the occurrence of the liberal strategy, it was proposed to increase the involvement of winemakers and their organizations in extension services, vineyard management, economic tools and governance of the sector, to safeguard the definition of the wine and its anchoring to a territory through trade union and political actions, communication and international lobbying, to create strong brand leaders in Appellations, to have a more aggressive marketing around terroirs, to communicate on links to landscapes and culture, and finally to maintain regulations to guarantee products, manage access to land and resources, and to support the establishment of (young) winegrowers and makers.

4. Conclusions: from prospective to a real strategy for the industry

The French wine industry is characterized by complex governance that defends the interests of the various socio-economic actors and acts as an intermediary with the French State and the European Union. With such a model, governance plays a major role in guiding the sector as a whole and enabling it to meet the challenges for the future. This is why, in the end, an operational approach was set up with national representatives of the sector on the basis of the results collected during the participative forums. The objective is to design a collective strategy for adapting the vine and wine sector to climate change at the national level. The vision endorses a combination of orientations jointly satisfying several strategic attitudes corresponding respectively to the four "trajectories". They expressed the wish that the national strategy should be globally coherent and take into account adaptations specific to the different wine regions. It could include an action plan with points of vigilance and ideally key indicators of success and failure. The variation by segment (AOC, IGP, VSIG) is also envisaged. The work is under process.

Adaptation to climate change is a complex issue for a vine and wine industry. Because of its specificities and particular links to geographical space and innovation, this sector also represents a model system for studying adaptation. In France since 2012, the LACCAGE project has created a national scientific dynamic, one of the objectives of which was to support the professional sector on the path of adaptation. A systemic conception of adaptation has been developed and made it possible to build a foresight exercise which proved to be a key tool for the mobilization of actors and the strategic reflection on this issue. This approach can serve as examples for other viticultural regions in the world.

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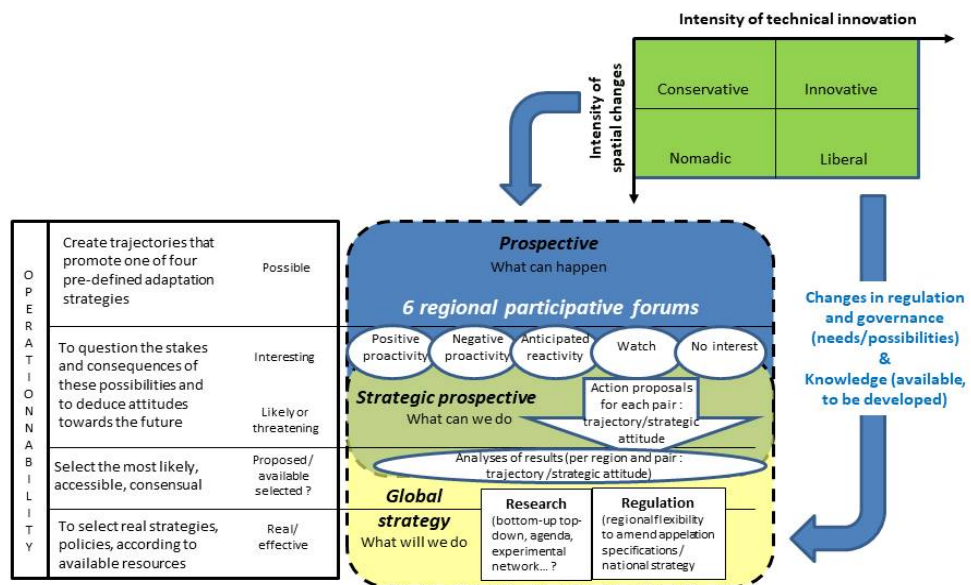


Figure 1: Schematic description of the method to go from prospective to the definition of an adaptation strategy to climate change by the wine industry using a participative approach with stakeholders.

Table 1 : Pourcentage of votes for each strategic attitude (342 voters)

Strategies/trajectories	Positive proactivity	Negative proactivity	Anticipated reactivity	Watch	No interest
conservative	20	32	28	16	4
innovative	72	2	23	2	1
nomadic	3	39	28	28	2
liberal	4	57	17	20	2

Table 2 : Categorization of proposals made by forum participants in order to promote the strategic attitude they have selected for each trajectory.

Action Domains	Actor number	% Actors	Proposal number	% Proposal
Extension services	271	83	660	30
Training	245	75	579	26
Régulation	157	48	288	13
Economy	279	85	747	34
Social	150	46	257	12
Technics	260	79	662	30
« Terroir »	201	61	384	17
Environnement	87	27	154	7
Wine quality	151	46	236	11
Varieties	122	37	179	8
Irrigation	69	21	95	4
Enology	63	19	79	4
AOC	101	31	160	7