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Title¹: Analysis of practice change in vineyard farms according to their engagement in the agroecological transition

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Conference topic: Theme n°1 Transition Pathways: Changing systems of farming, support and governance

Short abstract (200 words):

Viticulture is facing numerous challenges such as the reduction of pesticide use, and agroecology is increasingly being presented as a solution. However, there is a lack of knowledge about how winegrowers design innovations to foster the principles of agroecology. This study aims to analyze the innovations implemented by a range of farmers who are more or less committed to the agroecological transition. Special attention is given to the systemic approach and the scale of reflection when developing these innovations. To assess the level of agroecology on each farm, a grid structured by 7 main principles divided into 20 indicators was developed. Agronomic logics were formulated to analyze the systemic reasoning behind these innovations. The analysis of the grid showed a wide diversity in the progress of the agroecological transition among the surveyed farms. The agroecology principles that most explained the differences between farms with low and high agroecological global scores were synergy, efficiency, and social and solidarity-based economy. A comparison of the agronomic logics of two farms showed that the farm with the highest agroecology score employed systemic reasoning and mobilized several resources when changing its practices, in contrast to the farm with a low agroecology score. A method will be developed to conduct this analysis on all the farms surveyed.

1. Purpose

Viticulture, as all current agricultural systems, is facing numerous challenges such as reducing pesticide use, adapting to climate change, or limiting biodiversity erosion, while maintaining a sufficient economic return for the farmers (Prost et al., 2017). These current challenges require an urgent renewal of vineyard systems (Mailly et al., 2017). Agroecology is increasingly presented as a process-based solution that can steer food systems transformation towards the improvement of their sustainability (HLPE, 2019).

Agroecology is based on several main principles: limiting the use of synthetic inputs, fostering natural regulation of pests, weeds and diseases, enabling nutrient recycling (Altieri, 1995). Agroecology also promotes new approaches: sharing and hybridize scientific and expert knowledge, enhance bundles of consistent innovations, stimulate individual and collective learning (Meynard, 2017). It is no longer defined only by environmental scope but also cover social, human, economic, and political dimensions (Gliessman, 2006). It extends beyond the plot to the food system (Francis et al., 2003). Some innovations are mentioned in the literature as agroecological (Wezel et al., 2014), but there is a lack of knowledge about how winegrowers implement and adapt these innovations. To transform farms, deep changes and redesign are awaited. This kind of change is also more likely to

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impact the farm resources (land, equipment, economic) and the agroecosystem components, as (Merot et al., 2020) have demonstrated in the context of the conversion to organic agriculture in viticulture. Agroecology requires the mobilization (and therefore design) of levers, with a systemic rationale that considers the interactions between practices and their indirect effects (Meynard, 2017).

Farm transition to agroecology, as conceptualized by (Prost & Martin et al., 2023), is a path starting from an unsatisfactory initial situation with (or without) some agroecological principles implemented, through a transitional phase characterized by gradual changes that lead to a specific point where agroecological principles are more widely implemented. The trajectories have mainly been described for some particular practices, as the use of pesticides (Fouillet et al., 2023), the use of all types of inputs (Chantre & Cardona, 2014) from plot and cropping systems (Mawois et al., 2019) to farm scale (Dupré et al., 2017). (Teixeira et al., 2018) have developed a farm typology to assess farm diversity and its implications for the development of strategies to promote agroecological transitions. This work aims to characterize the level of agroecological transition in 25 farms and understand the contribution of innovations, specifically in studying the systemic approach and the consideration of the farm scale in developing their innovations.

2. Design/Methodology/Approach

Surveys: A range of 20 farmers in four French wine-growing regions was surveyed, chosen to encompass a broad spectrum of pedoclimatic conditions, economic contexts and farming practices, including both traditional and disruptive practices. Each survey consisted of one semi-structured interview, conducted in order to gather information on the current situation of the farm and any changes in farming practices and production systems that had occurred since the beginning of the farmer's activities. The reasons (farmer's motives, characteristics of the situation) that drove and explained the changes, the expected results, the farmers' satisfaction criteria were identified.

Analytical framework: A grid structured by 7 main principles and divided into 20 indicators, was built (table 1) to characterize the degree of advancement in agroecological transition in vineyard farms. The grid is inspired by the grid developed by the FAO (Barrios et al., 2020) to consider agroecology throughout agri-environmental and socio-economic dimensions. Only seven principles were retained, those that directly concern the production context of winegrowing countries. Each indicator is defined by qualitative modalities scored from 0 to 3, and built from the IDEA4 method (Zahm et al., 2023) to make them more specific to viticulture. The scores for each indicator were then summed up by principles and in a global score to determine the level of agroecology of each farm. The concept of agronomic logic (Salembier et al., 2021) is employed to analyze the systemic approach and farm reasoning.

3. Findings

Agroecological scores: The 20 farms surveyed were ranked according to their overall agroecological score (figure 1). The average scores of the farms ranged from 5.5/20 to 17/20, with a median score of 10.7/20, showing the large diversity on transition progress. No general trend can be observed for the **Diversity** scores, except that the highest agroecological farms have a high diversity within vineyard plots (fruit trees, market gardening) whereas the least agroecological farms have a high product diversity in addition to vine. The **Synergies** scores are low for the least agroecological farms, which can be explained by large field and little connectivity and no animals. The **Efficiency** scores are low for the least agroecological farms, due to the use of synthetic pesticides and non-organic fertilizers. Intermediate farms have the highest scores for the **Recycling** indicator, partly because they apply green manure on their plots and produce renewable energy. The **Social and Solidarity-based Economy** scores are higher for the most agroecological farms, as the social link with the



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consumer and the share of local products in marketing methods is greater. The **Resilience** scores tend to be higher for the intermediate farms, as these farms are considered economically viable. However, regardless of their agroecology score, winegrowers are not satisfied with their yields.

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Table 1. Grid to characterize the level of agroecological transition of vineyard systems (synthesized version)

Principes	Indicators	Score : 0	Score: 1	Score: 2	Score: 3
Diversity	Diversity of productions	Viticulture only	Viticulture and 1 plant or livestock production	Viticulture and several crops or livestock productions	-
	Genetic diversity	Low : < 3 varieties	Medium : Between 4 and 7 varieties	High: > 8 varieties	-
	Diversity of products	Wine (or grapes)	Wine (or grapes) and 1 other product (from the vine or not)	Wine (or grapes) and 2 or more products (from the vine or not)	-
Synergies	Connectivity between agrosystem and landscape	Low	Medium	High	-
	Integration of livestock	No grazing of vineyard plots	Grazing of animals or animal-drawn, animals owned by a shepherd	Grazing of animals or animal-drawn, animals owned by the winegrower	-
	Management of soil-plant system	Herbicides used	Tillage of rows and inter-rows	1/2 row maintained during the season and tillage of the other inter-row	All inter-rows permanently grassed, with or without tillage of rows
	Integration of trees or associated crops	No trees or associated crops on vineyard plots	Trees or associated crops on less than 10% of the vineyard area	Trees or associated crops on more than 10% of the vineyard area	-
Efficiency	Management of soil fertility	Synthetic or organic-mineral fertilizers	Organic amendments		-
	Management of pests and diseases	Prevalence of synthetic products	Copper and biocontrol only (low quantity of copper)	Use of copper and biocontrol only (high quantity)	-
	Management of water	Irrigation on more than 10% of the vineyard area	Irrigation on less than 10% of the vineyard area	No irrigation	-
Recycling	Recycling of biomass and nutrients	No	Green manure or compost produced on the farm	-	-
	Water saving	No	Yes, a device but not significant	Yes, a device and significant	-
	Production or use of renewable energy	No	Yes, produced or consumed	-	-
Co-creation and sharing of knowledge	Interest of producers in agroecology	Low	Medium	High	-
	Participation of producers in networks	No	Participation in few networks	Active participation (trials, trainings) or passive participation in several networks	-
Circular and solidarity economy	Products marketed locally or through direct sales	< 5% of wine through direct sales	[5% ; 50%] of wine through direct sales	> 50% of wine through direct sales	-
	Valorization of local resources	No	Supply of inputs (fertilizer, vineyard equipment, etc.) from local businesses	Recovery of by-products from the local community (urban compost, manure,...)	-
	Relationship with consumers	No links with the consumers	On-farm sales (store, by appointment)	On-farm sales and group hosting (wine tourism, educational activities, etc.)	-
Resilience	Yields stabilisation	Target yields not always achieved	Target yield mostly achieved	-	-
	Economic viability	Farm considered financially unsustainable	Farm is currently considered financially unsustainable (temporary)	The farm is currently viable	-

Agronomical logics, systemic reasoning and farm scale. In this part, we propose a focus on two farms, PACA_1 (highest agroecology score) and OCCIT_2024_7 (one with the lowest scores) and two principles: crop diversification and reducing the use of pesticides. To reduce pesticide use, PACA_1 involved systemic reasoning on several compartments of the system: the vine, by using natural biostimulants to stimulate the plant's defenses, but also by raising the trellising of some vines to limit the influence of the soil (humidity, splashing) ; the soil, by leaving grass cover to limit splashing ; and the inter-row, by planting species of interest (Aliaceae which produce blown molecules, etc.). For OCCIT_2024_7, the reasoning is less systemic because the main focus was reduced to herbicide reduction, with mechanical weed management. Diversification for PACA_1 mixed plot and farm reasoning. It was both in the activities and within vineyard plots with market gardening and fruit trees (planted or spontaneously). It meets several sub-objectives, to maximize the use of land, to plant species of interest to the vine (beneficial or repellent plants). Fruit trees also provide multiple services to the vine, including root mycorrhization, shading, and staking for some vines. Both products are sold locally, thus enhancing the farmer selling of his wine locally. This diversification was made possible because the winegrower changed his production system: he has teamed up with a market gardener, increased his working time in the vineyard, and reduced the number of mechanical interventions on the vineyard plots. For OCCIT_2024_1, diversification was more limited: truffle oaks and olive trees were planted on the edge of vineyard plots to provide a few complementary products with no precise production target. These crops require little maintenance and do not compete with

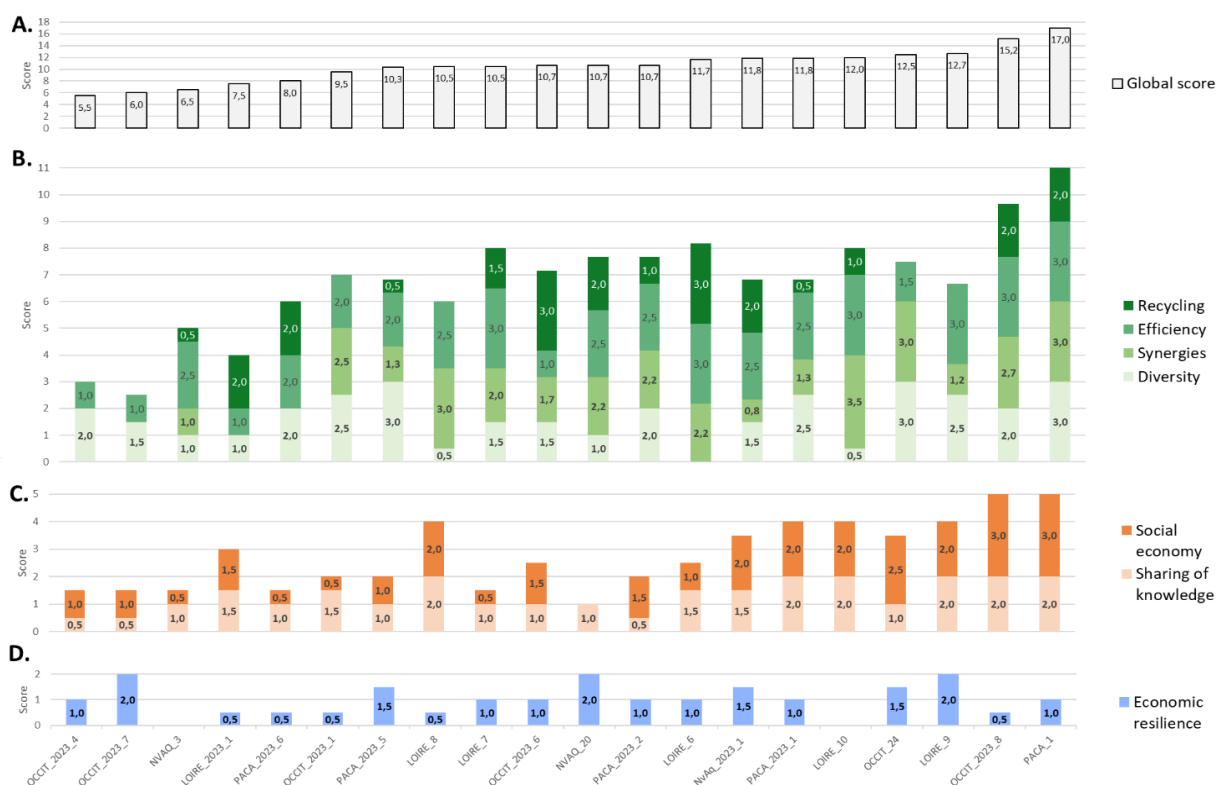


Figure 1. Agroecology scores of 20 farms surveyed : standardization of the score of each indicator and summation of all scores (A). B. Scores for agroecosystem principles C. Scores for social principles D. Scores for economic principle the vine's work schedule.

4. Practical Implications

This grid is user-friendly for farmers or advisors, serving as a tool to manage the farm's transition and assess its progress in agroecological transition. Moreover, it enables to highlight systemic practices that impact various agroecological principles. These practices could be recommended as priorities for farms looking to advance in the agroecological transition.

5. Theoretical Implications

This is the first time that vineyards are characterized by their degree of advancement in agroecological transition. One innovative research path identified by (Prost et al., 2023) to support farm transition to agroecology is improve the understanding of what happens on farm during transition.

This work contributes to improving this knowledge at the farm level, which has not been done much to date. The next step will be to define a method for analyzing the systemic reasoning and the mobilization of farm resources of all the farms surveyed.

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