ORGANIC TARGETS 4EU

TRANSFORMATION SCENARIOS FOR BOOSTING ORGANIC FARMING AND ORGANIC AQUACULTURE TOWARDS THE FARM-TO-FORK TARGETS

Deliverable D3.2
Socio-economic impact assessment of scenarios, at sectoral and focus country level

R - Report/PU - Public

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Executive Summary

In recent years, several studies have examined the impact of organic agriculture and its biophysical effects, such as land use, volumes of production, emissions, and nitrogen surplus. Other studies have also explored economic dimensions, including price effects, trade, consumer welfare, and farmers' income. However, most of these studies assume organic farms to be homogeneous, do not consider the emergence of new future farm types and do not explicitly account for the multiple trajectories of conversion from conventional to organic farming. This report aims to fill this gap by analysing the structural characteristics of both current and future organic and conventional farms across multiple countries and sectors. Then, it assesses the socio-economic impacts of organic agriculture expansion under two future scenarios: Organic on Every Table and Green Public Policy for the agricultural case studies, and Weak EU and Green and Fair for the aquaculture case study. The report considers eight case studies: the dairy sector in France, the broiler sector in France and Denmark, the arable sector in Austria and Romania, the outdoor vegetable sector in Hungary, the wine sector in Italy, and the aquaculture sector in the EU.

The methodology combines qualitative and quantitative approaches to develop both current and future farm typologies. Initial farm types were identified through expert workshops and interviews with farmers, industry representatives, NGOs, and policymakers conducted by the practice partners in the project. These insights were then linked to statistical data from the Farm Accountancy Data Network (FADN) and the Farm Structure Survey (FSS). Future farm typologies were developed by exploring possible sectoral evolutions up to 2035. Experts assessed which farm types are likely to transition, the structural changes required, and the probability of conversion to organic farming.

A modelling simulator, functioning as an input-output calculator, was used to quantify socio-economic impacts. Indicators such as the number of agricultural jobs, farm size, livestock concentration, income levels and other structural changes at the farm level were estimated. Table 1 and show respectively the main indicators at the farm level and the targets for organic production in the agriculture and aquaculture case studies under the two simulated scenarios favourable to organic farming as well as under a business-as-usual scenario called Reference. Additionally, a viability matrix was developed to evaluate the conditions under which transitions to organic farming are feasible, taking into account variables such as price levels, subsidies, intermediate costs, and various depreciation schedules.

The study reveals that organic farms are generally more labour-intensive than conventional farms due to their smaller size, additional farming operations, and alternative marketing channels. This highlights the need for policies that support labour management and workforce expansion, particularly for family-run farms that may resist hiring external labour. Several trends determining future organic farm types were identified, including the development of larger organic farms with economies of scale, highly specialised organic farms focusing on direct sales, and organic livestock farms with enhanced animal welfare standards. Additionally, the integration of crop and livestock activities and the use of Integrated Multi-Trophic Aquaculture (IMTA) in organic aquaculture were noted as potential strategies for sectoral growth.

The targets fixed by practice partners and experts consulted show that the development of organic expansion varies by region and sector. The livestock sector presents greater challenges due to higher price differentials and shifting dietary trends. Moreover, the location of organic expansion plays a crucial role, as some regions may require more tailored policy measures based on existing farm structures and economic conditions.

Simulation results suggest that, in most case studies, expanding organic farming increases agricultural employment and the number of farms compared to the business-as-usual scenario. This effect is most pronounced in the livestock sector, whereas arable case studies show more moderate increases due to smaller differences in farm size and labour intensity between conventional and organic farms. However, despite these increases, overall farm numbers are still projected to decline with respect to the current situation due to structural trends such as farm concentration, specialisation, and productivity improvements. Policymakers should anticipate this decline and support alternative rural employment opportunities such as agro-tourism, direct sales, and value-added processing.

Financially, organic farming appears viable in many cases[1], with income per family farm worker often comparable to or, in some instances, exceeding that of conventional farms. However, this outcome varies depending on farm type, regional conditions, and market dynamics. Even when considering depreciation schedules where path dependence on previous investments is stricter, organic conversion can be financially attractive, though the degree of profitability depends on external factors such as price premiums, subsidies, and production efficiency. Some emerging organic farm types show the potential for higher profitability than current organic farms, indicating that targeted public policies could play a key role in facilitating economically sustainable transitions. Future policies should carefully consider the diversity of organic farm structures, supporting investment in organic farming innovations, enhancing value chain integration, and providing tailored incentives to improve the financial viability of organic farms across different sectors.

In conclusion, organic farming presents significant potential for increasing employment, improving farm incomes, and supporting rural economies. However, a strategic policy approach is essential to ensure its sustainable growth. This includes improving data collection on organic farms, designing region-specific support measures, promoting synergies between organic crop and livestock farming, and addressing labour management challenges.

This report has several limitations. The variability in the quality and quantity of data across case studies affects the robustness of the findings, particularly in regions where organic farming remains uncommon. Additionally, the methodology assumes that “future farms” will emerge from existing but currently marginal farm models, limiting the identification of potential future organic systems to those present in the FADN database. This may be problematic in cases where organic farm representation is low or when experts anticipate future models that do not yet exist. Moreover, the modelling simulator functions as a central planning tool for scenario analysis, allowing for expert-driven foresight but not optimising economic agent behaviour or assessing impacts of scenarios on product prices, farmers' remuneration, wages, or social welfare. Despite these limitations, **the findings provide valuable insights for policymakers seeking to facilitate the transition toward more sustainable and economically viable organic farming models**.

1 Based on 2020 data, which is particularly favourable for organic farming compared to more recent years (for which we lack data access in this project).

Table 1 Main indicators in the Initial situation (2020), Reference, Organic on Every Table and Green Public Policy scenarios for each agriculture case study

Case Study	Indicator	Initial situation	Reference	Organic on Every Table	Green Public Policy
Dairy France	Evolution of the number of dairy cows		-10%	-15%	-15%
	Evolution of the number of dairy cows (*)			-6%	-6%
	Organic share of dairy cows	8%	9%	20%	20%
	Change in the number of farms (*)			-4%	8%
	Change in the number of agricultural workers (*)			-2%	2%
	Change in the number of organic farms (*)			80%	155%
	Change in the number of agricultural workers in organic farms (*)			120%	132%
Broiler France	Evolution of the number of broilers		10%	0%	0%
	Evolution of the number of broilers (*)			-9%	-9%
	Organic share of broilers	2%	2%	8%	8%
	Change in the number of farms (*)			14%	25%
	Change in the number of agricultural workers (*)			15%	37%
	Change in the number of organic farms (*)			193%	295%
	Change in the number of agricultural workers in organic farms (*)			127%	245%
Broiler Denmark	Evolution of the number of broilers		6%	0%	0%

	Evolution of the number of broilers (*)			-6%	-6%
	Organic share of broilers	2.8%	0.5%	5%	7%
	Change in the number of farms (*)			not simulated	not simulated
	Change in the number of agricultural workers (*)			not simulated	not simulated
	Change in the number of organic farms (*)			not simulated	not simulated
	Change in the number of agricultural workers in organic farms (*)			not simulated	not simulated
Arable Austria	Evolution of the agricultural area of arable farms		0%	0%	0%
	Evolution of the agricultural area of arable farms (*)			0%	0%
	Organic share of UAA in arable farms	24%	24%	24%	38%
	Change in the number of farms (*)			0%	3%
	Change in the number of agricultural workers (*)			0%	4%
	Change in the number of organic farms (*)			0%	54%
	Change in the number of agricultural workers in organic farms (*)			0	56%
Arable Romania	Evolution of the agricultural area of arable farms		0%	0%	0%
	Evolution of the agricultural area of arable farms (*)			0%	0%
	Organic share of UAA in arable farms	2%	11%	17%	14%
	Change in the number of farms (*)			-1.0%	-0.7%
	Change in the number of agricultural workers (*)			-0.8%	-0.5%
	Change in the number of organic farms (*)			56%	27%
	Change in the number of agricultural workers in organic farms (*)			53%	27%

Outdoor vegetable Hungary	Evolution of the agricultural area destined to vegetable production of outdoor vegetable farms		4% (**)	19% (**)	19% (**)
	Evolution of the agricultural area destined to vegetable production of outdoor vegetable farms (*)			14% (**)	14% (**)
	Organic share of UAA for vegetable production	6%	6%	15% (***)	15% (***)
	Change in the number of farms (*)			0%	0%
	Change in the number of agricultural workers (*)			2%	2%
	Change in the number of organic farms (*)			not applicable	not applicable
	Change in the number of agricultural workers in organic farms (*)			154%	154%
Wine Italy	Evolution of the agricultural area destined to wine production		0%	0%	0%
	Evolution of the agricultural area destined to wine production (*)			0%	0%
	Organic share of UAA for wine production	18%	25%	50%	30%
	Change in the number of farms (*)			0%	0%
	Change in the number of agricultural workers (*)			0.8%	0.6%
	Change in the number of organic farms (*)			100%	20%
	Change in the number of agricultural workers in organic farms (*)			100%	20%
(*) compared to the Reference scenario; (**) 0% for total UAA in the sector; (***) 28% for total UAA in the arable sector					

Table 2 Main indicators in the Initial situation (2020), Reference, Organic on Every Table and Green Public Policy scenarios in the aquaculture case study

Case Study	Indicator	Initial situation	Reference	Weak EU	Green and Fair
Aquaculture EU	Evolution of aquaculture production		0%	0%	0%
	Evolution of aquaculture production (*)			0%	0%
	Organic share of aquaculture production	Mussels: 10%	Mussels: 10%	Mussels: 8%	Mussels: 27%
		Sea bass/ Sea bream: 2%	Sea bass/ Sea bream: 2%	Sea bass/ Sea bream: 1%	Sea bass/ Sea bream: 8%
		Trout: 2%	Trout: 2%	Trout: 2%	Trout: 13%
	Change in the number of farms (*)			0%	8%
	Change in the number of aquaculture workers (*)			0%	5%
	Change in the number of organic farms (*)			-24%	242%
	Change in the number of aquaculture workers in organic farms (*)			-24%	229%

(*) compared to the Reference scenario

1. Introduction

In recent years, several studies have examined the impact of the spread of organic agriculture, both within the EU and globally (Muller et al., 2017; Poux and Aubert, 2018; Billen et al., 2021). These studies primarily focus on the biophysical effects of organic farming, such as changes in land use, volumes of production, emissions, and nitrogen surplus. However, some also explore the economic impacts, including effects on prices, trade, consumer welfare, and farmers' income (Barreiro-Hurle et al., 2021; Kremmydas et al., 2023; Schiavo et al., 2023). In all these cases, organic farms have been treated as a homogeneous group, often modelled without significant internal differentiation. Similarly, the trajectories of conversion from conventional to organic farming are often only implicitly addressed or treated in a simplistic manner. These studies typically overlook the potential emergence of new types of organic farms or how existing organic farms may evolve. This oversight becomes especially important when considering that future farm types may differ significantly from those of today, particularly in scenarios where organic agriculture undergoes substantial growth.

Against this backdrop, this report begins by describing the structure of current organic and conventional farms across several countries and sectors. Next, it envisions how these farms may evolve under two future scenarios involving the spread of organic farming in the EU. Then, it analyses the impact of these scenarios through an input-output analysis. This analysis examines key socio-economic indicators (such as the number of holdings, farm exits, agricultural jobs, and annual capital investment) and the evolution of the structural characteristics of farms (including farm size, livestock concentration, the share of grass, legumes, or vegetables in crop rotation, milk yield, meat production, etc.). Finally, where data is available, it analyses and quantifies the conditions, such as prices and subsidies, under which certain transitions toward organic agriculture are feasible.

The report includes eight case studies: the dairy sector in France, the broiler sector in France and Denmark, the arable sector in Austria and Romania, the outdoor vegetable sector in Hungary, the wine sector in Italy, and the aquaculture sector in the EU. The analysis was conducted in close collaboration with the project's practice partners[2] and national experts. In addition to a business-as-usual scenario called Reference, two future scenarios favourable to the organic sector were tested: Organic on Every Table (OET) and Green Public Policy (GPP) for the agricultural case studies, and Weak EU (WEU) and Green and Fair (G&F) for aquaculture. These scenarios were developed within the framework of the project under WP2 (Participatory foresight and scenario analysis). Summarised description of these scenarios can be found in the Annex.

The report is structured as follows: Chapter 2 outlines the methodology used to establish the farm typologies, to assess the impact of the scenarios on the socio-economic and structural characteristics of farms, and to evaluate the viability of transitions toward organic agriculture. Chapter 3 describes the farm typologies, how the future scenarios take form in each case study and provides the results. Chapter 4 discusses the results and offers policy recommendations. Finally, Chapter 5 highlights the main limitations of our analyses and concludes the report.

[2] ITAB for France, ICOEL for Denmark, LKNÖ for Austria, USH for Romania, ÖMKI for Hungary, CIHEAM Bari for Italy, CIHEAM Bari, Naturland and AUTH for aquaculture (EU).

2. Methods

This chapter presents the methodology used to establish the current and future typologies of farms, to assess the impact of scenarios on key socio-economic and structural indicators, and to evaluate the viability of transitions toward organic agriculture.

The current farm typology was developed using both qualitative and quantitative approaches. As a first step, a series of workshops and interviews were held between September 2023 and July 2024 to identify and describe the main farm types involved in production for each case study. These farm types are characterised by a combination of agronomic and socio-economic factors, based on the farming systems analysis perspective (Cochet and Devienne, 2006; Cochet, 2011). Participants in these workshops and interviews included farmers, members of technical institutes, extension services and organic certifiers, industry representatives, retailers, NGOs, government officials and researchers. In a second step, we translated the qualitative results of these workshops and interviews into statistical farm groups based on the Farm Accountancy Data Network (FADN) and the Farm Structure Survey (FSS), complemented by additional data sources specific to each case study. The year 2020 was chosen as the reference year for the calibration of the initial typology of farms.

A similar approach was used to develop the future farm typology. Experts were asked to explore the potential evolution of organic and conventional farms up to 2035, drawing on past trends, drivers of organic conversion, literature reviews, and their own knowledge. This process took place through a series of workshops and expert interviews between August 2024 and February 2025. Due to the challenge participants faced in overcoming the current pessimistic outlook for the organic sector, which is experiencing a difficult period in some European countries, including those studied in this report, we decided to extend the time horizon for the future scenarios from 2030 to 2035. As with the initial farm typology, a statistical analysis of the FADN and FSS databases was then conducted to identify as “future farms” existing groups of farms that are currently marginal or not widespread but that align with the potential evolution of farms identified by experts during the workshops and interviews, and that might become the norm in the future.

After establishing the future farm typology, experts were asked to identify the future population of farms based on the targets of each future scenario. In addition to a business-as-usual scenario, called the Reference, two scenarios favourable to the organic sector were tested: Organic on Every Table (OET) and Green Public Policy (GPP) for agricultural case studies, and Weak EU (WEU) and Green and Fair (G&F) for aquaculture. Each scenario includes specific targets related to the total agricultural area, the total number of animals, and the share of organic production for each case study (Figure 1).

Then, a backcasting approach was used to determine the transition pathways of each initial farm type, including the exit and entry of new farms to the market (Figure 2). The backcasting approach involves working backward from future farm types to identify the transition pathways followed by current farm types. To determine these pathways, several key questions are posed to experts in each case study: Which initial farm types are most likely to evolve into specific future farm types? Which transition pathways from initial farm types to future farm types are not feasible? Which pathways are most probable? What structural changes such as adjustments in production factors and their allocation are necessary for the transition from initial farm systems to future farm systems? Additionally, what is the likelihood that an initial farm system will convert to organic farming?

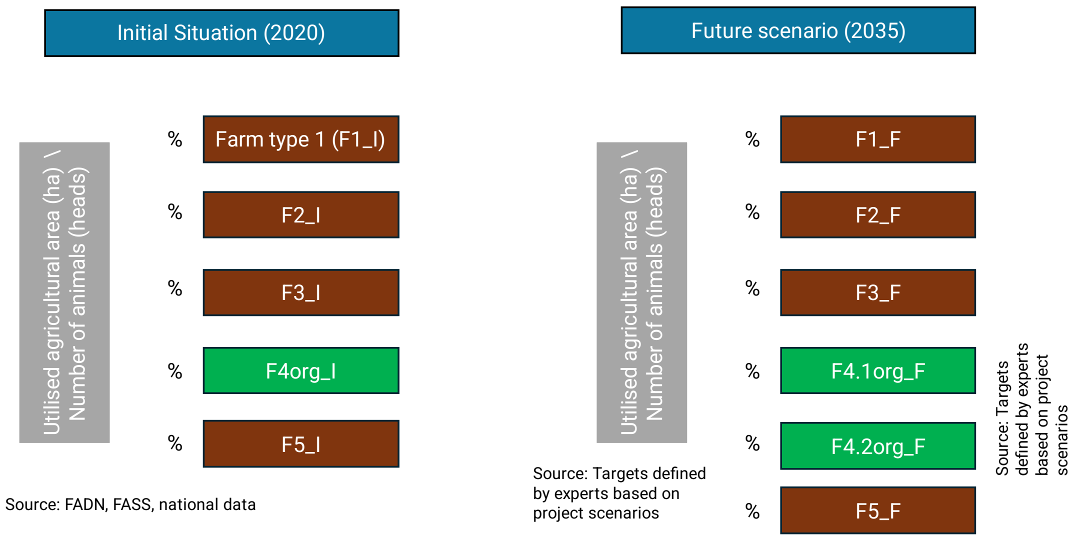

Figure 1 Graphical representation of the current and future population of farms (I= Initial farm type; F= Future farm type; org = organic farm type)

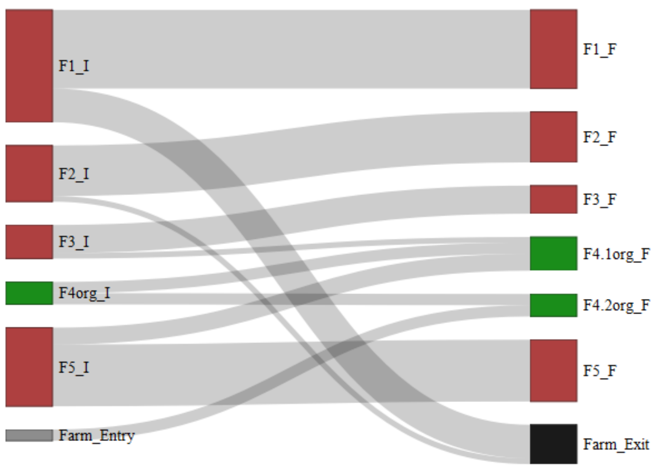

Figure 2 Example of transition pathways of current farms in a future scenario

Once the initial and future farm populations are defined, we calculated key socio-economic and structural indicators using a modelling simulator that functions similarly to an input-output calculator (Martínez et al., 2013; Bâ et al., 2016; Wang et al., 2019; Saget et al., 2020; Aubert et al., 2021; Fan & Liu, 2021). The functioning of the simulator is straightforward. To calculate the indicators which represent the sum of variables from different farms within a case study (such as the number of agricultural jobs or holdings), we use Equation 1. To calculate indicators which represent a mean (such as the average share of legumes in crop rotations or the average livestock concentration per ha) we use Equation 2.

$$I_s = \sum_f (X_{f,s}\ \theta_f) \quad (1)$$

$$I\_mean_s = \frac{\sum_f (X_{f,s}\, \lambda_f)}{\sum_f (X_{f,s})} \quad (2)$$

In these equations, s represents the future scenario and f the type of farm. I_s and I_mean_s are the indicators, $X_{f,s}$ is the agricultural area or the number of animals and θ_f and λ_f are coefficients calculated from FADN and FSS data for each type of farm (e.g., labour intensity expressed in annual work unit (AWU)/ha, or the share of legumes in the agricultural area).

Finally, where data is available, we analysed the conditions under which the transition to organic agriculture is viable for the most significant cases. To do this, we built a matrix, as shown in Figure 3. This matrix evaluates how family farm income per family work unit evolves when transitioning from the current farm f_i to the future farm f_f. The matrix considers three different levels of prices (P) for the future farm f_f, three levels of subsidies (S), and three levels of intermediate consumption (IC), which include wages and social security charges. In the matrix, a green cell indicates that family farm income per family work unit increases after the transition, meaning the future farm is more profitable than the initial farm. Conversely, a red cell signifies a decrease in income, making the transition less favourable.

Additionally, the matrix incorporates two different depreciation schedules. In the first schedule (D), we assume that the future farm f_f is not constrained by past investments made by the current farm f_i. This means that previous investments are either fully amortised or remain compatible with the transition. In the second depreciation schedule (D*), the future farm f_f may still need to pay off certain past investments that are no longer usable. These could include assets that exceed the farm's new requirements (e.g., if a large farm reduces its size) or assets incompatible with the transition (e.g., livestock buildings from a conventional farm that cannot be repurposed for organic use). Equation 3 shows how the depreciation schedule D* is calculated for the future farm f_f.

$$D^*_{f_f} = D_{f_f} + PI_{f_f} \quad (3)$$

In this equation, D_{ff} is the level of annual depreciation of the future farm and PI_{ff} is the annual depreciation of past investments that the future farm can no longer use. PI_{ff} is calculated based on Equation 4.

$$PI_{f_f} = D_{f_i}\, \omega_{f_f} + \beta_{f_f} \quad (4)$$

In this equation, D_{fi} is the level of annual depreciation of the initial farm f_i, ω_{ff} is the share of the assets of the initial farm that are incompatible with the transition and β_{ff} is the annual depreciation of assets of the initial farm f_i that exceeds the needs of the future farm f_f. β_{ff} is calculated based on Equation 5 where σ_{ff} is the share of the assets of the future farm that must be purchased brand new.

$$if\ D_{f_f} > D_{f_i}\left(1 - \omega_{f_f}\right) \quad (5)$$

AND $if\ D_{f_i}\left(1 - \omega_{f_f}\right) - D_{f_f}\left(1 - \sigma_{f_f}\right) > 0 \rightarrow \beta_{f_f} = D_{f_i}\left(1 - \omega_{f_f}\right) - D_{f_f}\left(1 - \sigma_{f_f}\right)$

$$si\ D_{f_f} > D_{f_i}\left(1-\omega_{f_f}\right)$$

$$\text{AND } if\ D_{f_i}\left(1-\ \omega_{f_f}\right)-\ D_{f_f}\left(1-\ \sigma_{f_f}\right) \leq 0 \rightarrow \beta_{f_f}\ =\ 0$$

$$if\ D_{f_f}\ \leq\ D_{f_i}\left(1-\omega_{f_f}\right) \rightarrow\ \beta_{f_f}\ =\ D_{f_i}\left(1-\ \omega_{f_f}\right)-\ D_{f_f}\left(1-\ \sigma_{f_f}\right)$$

Figure 3 Example of a transition matrix for a current farm type

3. Case studies

The following chapter presents the eight case studies analysed in the report: the dairy sector in France, the broiler sector in France and Denmark, the arable sector in Austria and Romania, the outdoor vegetable sector in Hungary, the wine sector in Italy, and the aquaculture sector in the EU. For each case study, the first and second sections describe respectively the current and future typologies of farms. The third section examines how the project scenario narratives are interpreted in the case study. Finally, the fourth section presents the modelling results.

3.1.The dairy sector in France

3.1.1.Current typology

In 2020, the French dairy sector consisted of 50,000 farms with at least 10 dairy cows, collectively raising 3.5 million cows. Farm sizes have been steadily growing, now averaging 70 dairy cows per farm. Large herds of 100 or more cows are becoming the norm, making up over a third of all dairy cows (French Agricultural Survey, 2020). This concentration is also happening geographically in an area known as the “dairy arc” or “crescent” (Figure 4). While most farms remain family-run, salaried employment is on the rise. Although nine out of ten cows are still grazed, this practice—along with the use of mountain pastures—is gradually declining. In addition to grass, fodder maize is a common component of cattle feed. While dairy farms are largely self-sufficient in forage production, they rely more on external sources for concentrated feed.

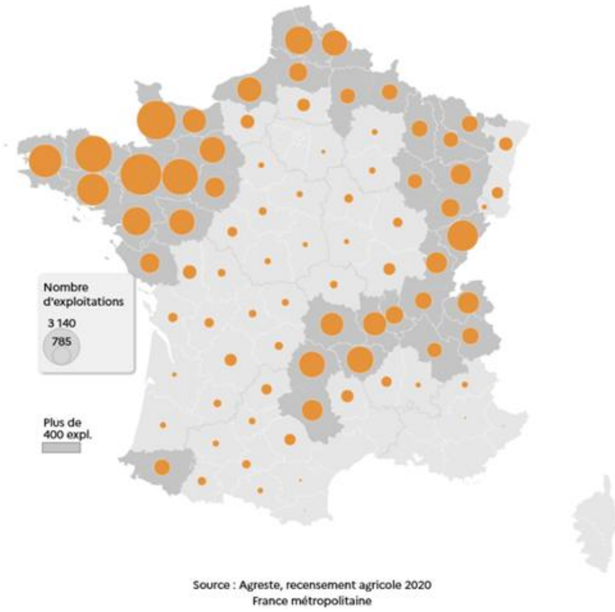

Figure 4 The French "dairy arc" (number of dairy farms by department)

Dairy farms are classified as holdings that fall under specific farming categories—4500, 4700, 7310, 7410, 8310, and 8320—and have either more than five dairy cows or at least eight bovine livestock units (LU). This classification includes over 90% of France's dairy cows.

Next, farms are categorised based on their geographical location: lowland or mountainous regions. In lowland areas, conventional dairy farms are further divided into mixed crop-livestock (MCL) farms or specialised dairy farms, depending on the proportion of forage area within their total agricultural land. According to the Casdar project Red Spyce (IDELE, 2016), a farm is classified as MCL if its forage area makes up less than 67% of its utilised agricultural land, while those exceeding this threshold are considered specialised. Conventional lowland dairy farms are then categorised as either maize-based or mixed, based on the proportion of forage maize within their total forage area. Farms where forage maize covers more than 30% of the forage area are classified as maize-based (intensive), while those with 30% or less are considered mixed (extensive). In mountainous areas, conventional farms are distinguished based on whether they produce milk under PDO-PGI (Protected Designation of Origin, Protected Geographical Indication) quality labels.

Finally, organic dairy farms are classified by geographic location—lowland or mountainous. Lowland organic dairy farms are further divided into two types: organic pasture-based farms, where maize accounts for less than 10% of forage, and organic mixed dairy farms, where maize makes up more than 10% of the forage (Figure 5).

The characteristics of each of the current farm types are presented below. The capitalised words in italics are the criteria used to sort the farms in the data.

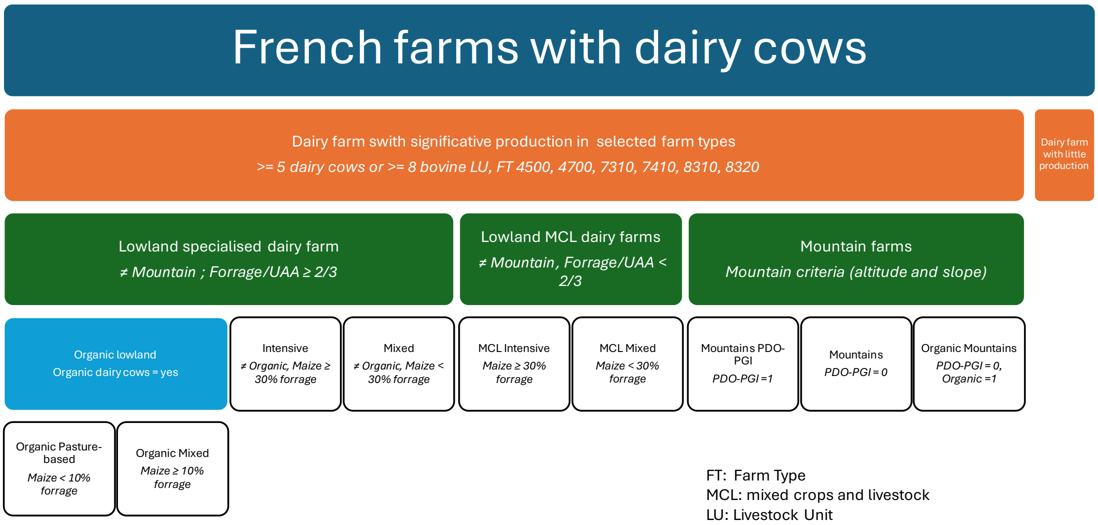

Figure 5 The typology tree for the current typology of dairy farms in France

- **Lowland Specialised Intensive**. Dairy cattle system characterised by a high proportion of maize silage. With a high milk yield per dairy cow, this system is the most important in terms of milk production. The farms are mainly located in the western region, which benefits from a soil and climatic context that is particularly favourable to livestock farming and a favourable economic fabric with organised sectors and a strong dairy tradition. *NOT MOUNTAIN AND FORAGE/UAA > 2/3 AND MAIZE > 30% FORAGE AREA AND NOT ORGANIC*
- **Lowland Specialised Mixed**. Dairy system based on both pasture and a lower proportion of silage maize compared to the intensive system. The farming system is located in a region with sufficient water for large areas of grassland and sufficient summer sunshine to enable the cereals needed to feed the cattle to be grown. *NOT MOUNTAIN AND FORAGE/UAA > 2/3 AND MAIZE < 30% FORAGE AREA AND NOT ORGANIC*
- **Lowland MCL Intensive**. A mixed livestock farming system based on the complementary nature of livestock production, mainly dairy, and arable crop production. A large proportion of the fodder is produced on the farm, and the livestock activity produces organic matter that is spread on the arable land. This dairy system is characterised by a high proportion of maize silage and a high milk yield per dairy cow. *NOT MOUNTAIN AND FORAGE/UAA < 2/3 AND MAIZE > 30% FORAGE AREA AND NOT ORGANIC*
- **Lowland MCL Mixed**. A mixed livestock farming system based on the complementary nature of livestock production, mainly dairy, and arable crop production. A large proportion of the fodder is produced on the farm, and the livestock activity produces organic matter that is spread on the arable land. This dairy system is characterised by a mixed feeding strategy with grassland and maize and a medium milk yield per dairy cow. *NOT MOUNTAIN AND FORAGE/UAA < 2/3 AND MAIZE < 30% FORAGE AREA AND NOT ORGANIC*
- **Mountains PDO-PGI**. PDO-PGI mountain dairy systems benefit from higher milk prices because their certification ensures that every stage of production takes place within a specific geographic region, following recognised techniques and strict quality standards. These systems rely heavily on permanent grasslands and grazing dairy cows. Due to the

challenging terrain, with high altitudes and steep slopes, cultivating crops is difficult, making grasslands essential for animal feed. As a result, these farms are largely self-sufficient in forages. Their concentrate feed costs are generally lower than those of other dairy systems. Primarily located in the Jura, the Alps, and certain parts of the Massif Central, these farms receive an additional milk premium, which helps sustain a stable income for farmers. *MOUNTAIN AND PDO-PGI AND NOT ORGANIC*

- **Mountains**. The specialised mountain dairy cattle system relies heavily on permanent grasslands and grazing dairy cows. Due to the high altitude and steep slopes, cultivating crops is challenging, making grasslands essential for animal feed. On average, mountain dairy farms are smaller than those in lowland regions. Unlike PDO-PGI systems, they have fewer opportunities to benefit from high value-added markets. *MOUNTAIN AND NOT PDO-PGI AND NOT ORGANIC*
- **Organic Lowland Mixed**. Lowland organic system based on both pasture and other fodder. Milk yield per cow is higher than in the pasture-only system, while benefiting from good value added. NOT *MOUNTAIN AND FORAGE/UAA > 2/3 AND ORGANIC AND MAIZE > 10% FORAGE AREA*
- **Organic Lowland Pasture-based**. Pasture-based organic dairy farms located in regions that have sufficient water to support extensive grassland. Farmers in this system rely primarily on grazing temporary grass and legume meadows for feed. Their meadow and livestock management focus on maximising grass production, prioritising grazing fodder, and maintaining the long-term health and stability of pastures. Although these farms produce lower milk volumes, they compensate through the added value of organic products and efforts to keep costs low. NOT *MOUNTAIN AND FORAGE/UAA > 2/3 AND ORGANIC AND MAIZE < 10% FORAGE AREA*
- **Organic Mountains**. The specialised organic mountain dairy system shares key characteristics with other mountain dairy systems, relying primarily on grazing permanent grasslands for animal feed. Although milk production is lower, the added value from organic certification helps compensate for the reduced volume. *MOUNTAIN AND ORGANIC*

The main characteristics of the current farm types are presented in Table 3. Organic farms account for 8% of total dairy cows.

Table 3 The main structural characteristics of current farm types in the dairy sector in France

Farm type	Number of farms	Share of dairy cows [%]	Dairy cows per farm	Milk Yield [litres/dairy cow]	Livestock concentration [LU/ha]	Utilised Agricultural Area [ha/farm]	Share of grass in UAA [%]	Share of forages in UAA [%]	Share of maize in forages [%]	AWU	Labour intensity [AWU/100 dairy cows]	Per farm depreciation [€/farm]
Lowland Spe Intensive	13,311	30%	78	7611	1.69	99	43%	79%	43%	2.0	2.57	49,259
Lowland Spe Mixed	10,872	19%	59	6452	1.21	117	72%	87%	15%	1.9	3.15	38,432
Lowland MCL Intensive	9,779	21%	73	7980	1.18	134	23%	47%	47%	2.3	3.10	60,412
Lowland MCL Mixed	5,270	9%	58	7227	0.76	163	36%	51%	22%	2.3	3.95	50,718
Mountains PDO-PGI	5,260	7%	49	6132	0.96	92	89%	93%	3%	1.8	3.76	40,584
Mountains	5,062	7%	47	6372	1.06	87	75%	84%	10%	1.7	3.67	33,790
Organic Lowland Mixed	1,152	2%	74	5777	1.22	99	70%	90%	15%	2.6	3.54	45,343
Organic Lowland Pasture-based	2,150	4%	65	4185	1.08	103	85%	92%	2%	2.3	3.48	43,088
Organic Mountains	1,114	1%	45	5190	0.83	88	80%	85%	2%	2.2	4.97	46,752

3.1.2.Future typology

When developing the future typology of organic dairy systems, we focused on the main drivers identified by experts during the workshops. The first driver is the trend toward larger, more intensive farms, with a higher number of cows, increased labour productivity and milk yield. The second driver is the appearance of organic dairy farms that combine livestock and crop production or that specialise in direct sales.

In the future typology, we assume the emerge of three additional new organic farm types: Organic Lowland Large scale, Organic Lowland MCL, and Organic Lowland Direct Sale.

All current farm types are expected to grow in size and productivity, except for the current organic farms which do not evolve towards the new systems and for mountain farms. In this latter case, the specific soil and climate conditions of mountain farms make expansion and development more challenging, so they are likely to remain as they are in the current typology.

- **Lowland Specialised Intensive**. Dairy system based on intensification of production and significant increase in the size of the structure. This system is emerging in lowland areas through the concentration of existing farms already based on a volume strategy with a feed ration containing a high proportion of maize. *NOT MOUNTAIN AND FORAGE/UAA > 2/3 AND MAIZE > 30% FORAGE AREA AND NOT ORGANIC AND DAIRY COWS > 150 AND MILK YIELD > 8000 L/COW*
- **Lowland Specialised Mixed**. Medium-scale lowland dairy system based on a steady increase in production volumes, while integrating a small number of constraints to differentiate the milk produced (e.g., GMO-free milk, grass-fed milk, low-carbon milk, etc.). This system is developing in lowland areas, with the evolution of existing lowland systems that integrate certain environmental constraints without changing the overall organisation of dairy farms. *NOT MOUNTAIN AND FORAGE/UAA > 2/3 AND MAIZE < 30% FORAGE AREA AND NOT ORGANIC AND DAIRY COWS = 70-90 AND MILK YIELD 7000-8000 L/COW*
- **Lowland MCL Intensive**. Large mixed crop and dairy farm. Farms in this category belong to collective agricultural groups (GAEC) with a division of labour between crops and livestock in order to optimise farm management with the aim of maintaining a high level of milk and crop production. This system is developing in areas with good production potential, with the possibility of exploiting lower potential areas of the farm through livestock production. *NOT MOUNTAIN AND FORAGE/UAA < 2/3 AND MAIZE > 30% FORAGE AREA AND NOT ORGANIC AND DAIRY COWS 80-120 AND MILK YIELD > 7000 L/COWS*
- **Lowland MCL Mixed**. A mixed farming system based on the complementary nature of livestock production, mainly dairy, and field crop production. A large part of the forage is produced on the farm, and the livestock activity produces organic matter which is spread on the arable land. This system develops grazing and integrates certain environmental constraints to differentiate the milk produced. *NOT MOUNTAIN AND FORAGE/UAA < 2/3 AND MAIZE > 30% FORAGE AREA AND NOT ORGANIC AND DAIRY COWS 60-80 AND MILK YIELD = 5500 – 8000 L/COWS*
- **Mountains PDO-PGI**. Same farm type as the current Mountains PDO-PGI farm type.
- **Mountains**. Same farm type as the current Mountains farm type.
- **Organic Lowland Mixed**. Same farm type as the current Organic Lowland Mixed farm type.
- **Organic Lowland Pasture-based**. Same farm type as the current Organic Lowland Pasture-based farm type.
- **Organic Mountains**. Same farm type as the current Organic Mountains farm type.
- **Organic Lowland Large scale**. Large organic dairy farm with more than one hundred dairy cows. The aim of this system is to maximise the volume of organic milk produced on the farm to meet the growing demand for differentiated products in the market. *NOT MOUNTAIN AND ORGANIC AND FORAGE/UAA > 2/3 AND DAIRY COWS > 100 NOT DIRECT SALES*

- **Organic Lowland MCL**. A mixed farming system based on the complementary nature of an organic dairy cow production, and field crop production. Much of the forage is produced on the farm, and the livestock activity produces organic matter which is spread on the arable land. The milk produced is sold under organic certification to increase value added. *NOT MOUNTAIN AND ORGANIC AND FORAGE/UAA < 2/3 AND NOT DIRECT SALES*
- **Organic Lowland Direct Sale**. Organic dairy farm with a processing plant to transform the milk produced into dairy products sold through the farm shop or local distribution channels. The low volume of milk produced on the farm is compensated by the added value of the production. *NOT MOUNTAIN AND ORGANIC AND FORAGE/UAA > 2/3 AND DIRECT SALES*

The main characteristics of the future farm types are presented in Table 4.

Table 4 The main structural characteristics of future farm types in the dairy sector in France

Farm type	Dairy cows per farm	Milk Yield [litres/dairy cow]	Livestock concentration [LU/ha]	Utilised Agricultural Area [ha/farm]	Share of grass in UAA [%]	Share of forages in UAA [%]	Share of maize in forages [%]	AWU	Labour intensity [AWU/100 dairy cows]	Per farm depreciation [€/farm]
Lowland Spe Intensive	200	9,047	2.10	204	33%	76%	52%	4.8	2.41	133,266
Lowland Spe Mixed	76	7,364	1.12	144	76%	82%	16%	2.5	3.30	51,538
Lowland MCL Intensive	97	8,436	1.09	191	26%	48%	47%	3.0	3.13	86,223
Lowland MCL Mixed	69	6,987	0.87	158	43%	58%	25%	2.7	3.88	55,006
Mountains PDO-PGI	49	6,132	0.96	92	89%	93%	3%	1.8	3.76	40,584
Mountains	47	6,372	1.06	87	75%	84%	10%	1.7	3.67	33,790
Organic Lowland Mixed	74	5,777	1.22	99	70%	90%	15%	2.6	3.54	45,343
Organic Lowland Pasture-based	65	4,185	1.08	103	85%	92%	2%	2.3	3.48	43,088
Organic Mountains	45	5,190	0.83	88	80%	85%	2%	2.2	4.97	46,752
Organic Lowland Large scale	114	5,307	1.21	175	69%	89%	13%	3.9	3.41	68,085
Organic Lowland MCL	48	6,267	0.57	155	34%	42%	5%	2.0	4.18	31,278
Organic Lowland Direct Sale	66	4,455	1.08	101	82%	88%	2%	3.8	5.66	57,622

3.1.3.Simulated scenarios

In the Reference scenario, we assume that the number of dairy cows (organic and conventional) falls by 10%. We apply the observed trend for 2010-2020 (source: FSS data) to a 15-year period. In contrast, in Organic on Every Table and Green Public Policy, we assume that the decrease is greater and reaches 15% as consumer choices or public policies promote livestock reduction.

Reference. In the Reference scenario, the share of organic dairy cows is expected to increase slightly from 8% to 9%. Although organic production has recently declined, trends over the last decade indicate that the industry can recover and gradually expand its share of total production. In this scenario, all farms continue the observed trends of specialisation (all MCL farm types reduce their market share) and concentration of dairy production. They increase in size, increase their milk yield and become more and more specialised. Some conventional mixed systems move towards intensive systems in order to increase milk yields and develop economies of scale. For organic dairy farms the situation is similar. Pasture-based and mountains dairy farms decrease the share in production, while some organic large dairy farms appear in the market.

Organic on Every Table. In Organic on Every Table, driven by favourable market conditions, the share of organic dairy cows increases and reaches 20%. Conventional farms continue the ongoing trend of specialisation and concentration as in the Reference Scenario. However, some of them, driven by favourable market conditions, convert to organic farming. Mixed lowland conventional farms are those most likely to convert since their initial production methods are those more similar to organic production. MCL mixed farms also convert driven by the increasing trend of specialisation and new opportunities on the organic market.

The localisation of livestock remains fairly concentrated in the country, favouring economies of scale and agglomeration and the emergence of large organic farms, mostly located in the west. These farms are directly linked to large retailers and processors and produce products that are rather standardised (organic milk, cheese, yoghurts and other dairy products with a relatively low price, intended for mass consumption and with similar organoleptic qualities and nutritional composition). At the same time, alternative models such as e-commerce, farmers' markets, and direct sales also flourish and new types of organic farms specialising in direct sales emerge.

Green Public Policy. In the Green Public Policy scenario, supportive policies encourage the growth of the organic dairy herd, allowing it to expand to 20% of the total dairy population. The trends of specialisation of dairy production continue but to a lesser extent than in the Reference scenario. New green public policies encourage grasslands preservation and extensive dairy production, with localised feed source, and feed autonomy on the farm. For this reason, conventional extensive dairy systems maintain their share of production, while some conventional intensive systems convert to organic.

Livestock is partly relocated in the country to reduce pressure especially in the west. Some new organic dairy farms appear mixing livestock and crops activities. These farms are former conventional MCL farms, former conventional specialised farm which reduce the volume of livestock in their economic activities, and former conventional cereal farms located in arable areas which reintroduce livestock in their farm.

Organic pasture-based dairy farms increase their share of production as well as organic farms in the mountains. New types of organic farms specialising in direct sales emerge as well as some large-scale organic dairy farm. However, since in this scenario economies of agglomeration and vertical integration do not play a decisive role, the number of large organic dairy farms remains lower than in Organic on Every Table.

Table 5 and Table 6 show respectively the changes in the allocation of dairy cows, and the final share of dairy cows for the different future farm types in the three simulated scenarios.

Table 5 Allocation of dairy cows for each category of farm types in the initial situation and in three simulated scenarios in the dairy sector in France

	Initial situation	Reference	Organic on Every table	Green Public Policy
Percentage change				
Number of dairy cows (total)	0%	-10%	-15%	-15%
Number of dairy cows in mountain dairy farms (total)	0%	-15%	-15%	-15%
Share				
Share Organic dairy cows	8%	9%	20%	20%
Share Organic dairy cows in mountain dairy farms	9%	6%	12%	20%
Conventional Lowland				
Specialised	62%	70%	70%	65%
MCL	38%	30%	30%	35%
Conventional Lowland Specialised				
Intensive	62%	70%	70%	58%
Mixed	38%	30%	30%	42%
Conventional Lowland MCL				
Intensive	70%	75%	75%	62%
Mixed	30%	25%	25%	38%
Conventional Mountains				
Mountain PDO-PGI	52%	60%	60%	100%
Mountain without PDO-PGI	48%	40%	40%	0%
Organic Lowland				
Organic Lowland	0%	0%	0%	0%
Organic mixed lowland	38%	10%	19%	0%
Organic pasture-based lowland	62%	48%	0%	60%
FT Organic Large scale	0%	42%	71%	15%
FT Organic MCL	0%	0%	0%	15%
FT Organic Direct Sale	0%	0%	10%	10%

Table 6 Share of dairy cows for the different farm types in the initial situation and in three simulated scenarios in the broiler sector in France

Farm type	Initial situation	Reference	Organic on Every table	Green Public Policy
Lowland Spe Intensive	30%	38%	32%	25%
Lowland Spe Mixed	19%	16%	14%	18%
Lowland MCL Intensive	21%	17%	15%	15%
Lowland MCL Mixed	9%	6%	5%	9%
Mountains PDO-PGI	7%	8%	8%	13%
Mountains	7%	6%	6%	0%
Organic Lowland Mixed	2%	1%	3%	0%
Organic Lowland Pasture-based	4%	4%	0%	10%
Organic Mountains	1%	1%	2%	3%
Organic Lowland Large scale	0%	3%	13%	3%
Organic Lowland MCL	0%	0%	0%	3%
Organic Lowland Direct Sale	0%	0%	2%	2%

3.1.4.Modelling results

In the **Reference** scenario, the effect of concentration of farming activities forces 38% of current farms out of the market (Figure 6). The farm types that suffer the greatest decline are Lowland Spe Intensive, Lowland MCL Mixed, and Organic Mountains. In the first case, this is due to the high increase in the size of future Lowland Spe Intensive farms, in the second and third cases the effect is related to the lower presence of these farm types in the market. In the organic sector, in addition to the already mentioned organic mountain farms, some organic lowland pasture farms also leave the market. The increase in the size of holdings has the effect of reducing the number of holdings in the sector by 38% (Figure 7). The number of agricultural workers also falls by 13%, as a result of the decline in the dairy herd and the increase in labour productivity on the farms. Looking at average structural characteristics (Figure 8), dairy farms increase in size in terms of hectares and number of cows, in the volume of their annual capital depreciation and in the concentration of livestock, expressed in livestock units per hectare. Finally, as cows in future farm types have a higher milk yield, total milk production remains stable despite a lower number of cows, while organic milk production increases slightly (2%).

In the **Organic on Every Table** scenario, a higher number of conventional farms convert to organic farm types, such as some lowland mixed farms that decide to become large organic farms. The bigger decline in the number of dairy cows (6% compared to the Reference scenario) increases the number of exits. The total number of farms in the sector declines by 4%. In this scenario, the number of organic dairy cows increases by 110% compared to the Reference scenario, while the number of conventional cows decreases by 17%. The total number of agricultural workers in the sector also decreases (with 2%) as large relatively low labour-intensive organic farms enter in the market. On the other hand, the number of organic holdings increases by 80%, as does the total number of agricultural workers employed on these holdings (120%). In the organic farm group, the large-scale farm type is the more represented accounting for 50% of total organic holdings.

As the increase in the organic dairy herd remains moderate, this scenario does not imply major differences with respect to the Reference scenario in terms of the structural characteristics of the average dairy farm except for the lower purchase of pesticides and fertilisers. However, in contrast to the Reference scenario, total milk production in the Organic on Every Table scenario decreases by 9% compared to the 2020 levels, as the decrease in the dairy herd is higher and the higher share of organic production implies a lower average milk yield. Finally, organic milk production increases by 134% and represents 14% of total milk production.

In the **Green Public Policy** scenario, the proportion of farms leaving the market is 33%. The exits only concern conventional farm types, especially intensive systems. As the average farm size is lower in this scenario due to the higher presence of organic and mixed conventional systems, the total number of farms increases by 8% compared to the Reference scenario, despite a lower number of dairy cows. In this scenario, the number of organic dairy cows increases by 110% compared to the Reference scenario, while the number of conventional cows decreases by 17%. The number of organic holdings more than doubles (155%) reaching almost 10,000 holdings. In the organic farms group, the Organic Lowland Pasture-based farm type is the more represented accounting for 48% of total organic holdings. In contrast to Organic on Every Table, in Green Public Policy the number of people employed in the dairy sector increases by 2% compared to the Reference scenario as relatively more high intensity organic farm types enter in the market. In the organic sector, the total number of agricultural workers employed on these holdings also increases much more than in the Organic on Every table (132%), reaching around 24,000 work units. The presence of more extensive farm types implies a lower livestock concentration compared to the initial situation and a higher share of grass in the UAA of dairy farms, which goes from 52% in the initial situation to 58% in the Green Public Policy. The average size, the average number of employees and the annual capital depreciation remain higher than in the Initial situation, but lower than in the other two simulated scenarios. In contrast the purchase of pesticides and fertilisers declines and reaches similar levels as the Organic on Every Table Scenario. Finally, as organic and mixed dairy farms have a lower milk yield, the decline in milk production is higher than in the Organic on Every Table scenario, decreasing with 12% from the initial level. Organic milk production increases by 111% and represents 13% of total milk production.

In the French dairy case study, we analysed two possible transition pathways for farms, which we consider to be meaningful for the sector. In both transitions, we took as a starting point the current Lowland Specialised Intensive farm type, as this is currently the most widespread farm type in French dairy sector. This farm type as an average family farm income per family work unit of €28,017.

In the first transition, the current Lowland Specialised Intensive farm remains the same type but with future characteristics (intensification of production, significant increase in the size of the structure, higher milk yield). In the second, it converts to an Organic Lowland Large scale farm. In the first case, we assume that the share of the assets of the initial farm that are incompatible with the transition is 0% (ω_{ff}), and that the share of the assets of the future farm that must be purchased brand new (σ_{ff}) is also 0%. The value of β_{ff} (the annual depreciation of assets of the initial farm that exceeds the needs of the future farm) is also zero meaning that the depreciation schedule D is equal to D*. In the second case, we assume that the conversion to organic may render some machinery used for spreading synthetic fertilisers and chemical pesticides unnecessary. This leads to consider that the share of the assets of the initial farm that are incompatible with the transition, amounts to 13% (ω_{ff})[3]. In addition, as after conversion to organic the farm has to purchase some new machineries for mechanical weeding, σ_{ff} is fixed to 14%. In this transition, β_{ff} value is 0 as the depreciation of the future farm is largely higher than the depreciation of the current farm.

Figure 9 shows that, all things being equal, the family farm income per family work unit is higher in both cases than in the initial situation. However, the conversion to the Organic Lowland Large farm type allows a higher performance than the transition to the future Lowland Specialised Intensive farm type in all possible situations. Conversion to organic farming can still bring in more money than the initial situation for the current lowland specialised intensive farm if the total subsidies decrease by 20%, all other things being equal. On the other hand, any reduction in prices or increase in intermediate consumptions that is not accompanied by a positive shock will cause the family farm income per family work unit to fall below the initial level. Finally, as the value of ω_{ff} is not very large and the value of β_{ff} is 0, depreciation schedule D and D* are comparable and yield similar results.

3 The estimate of ω_{ff} and σ_{ff} is based on the value of machineries with a depreciation period of 10 years, as published by the French CUMA (machinery cooperative)

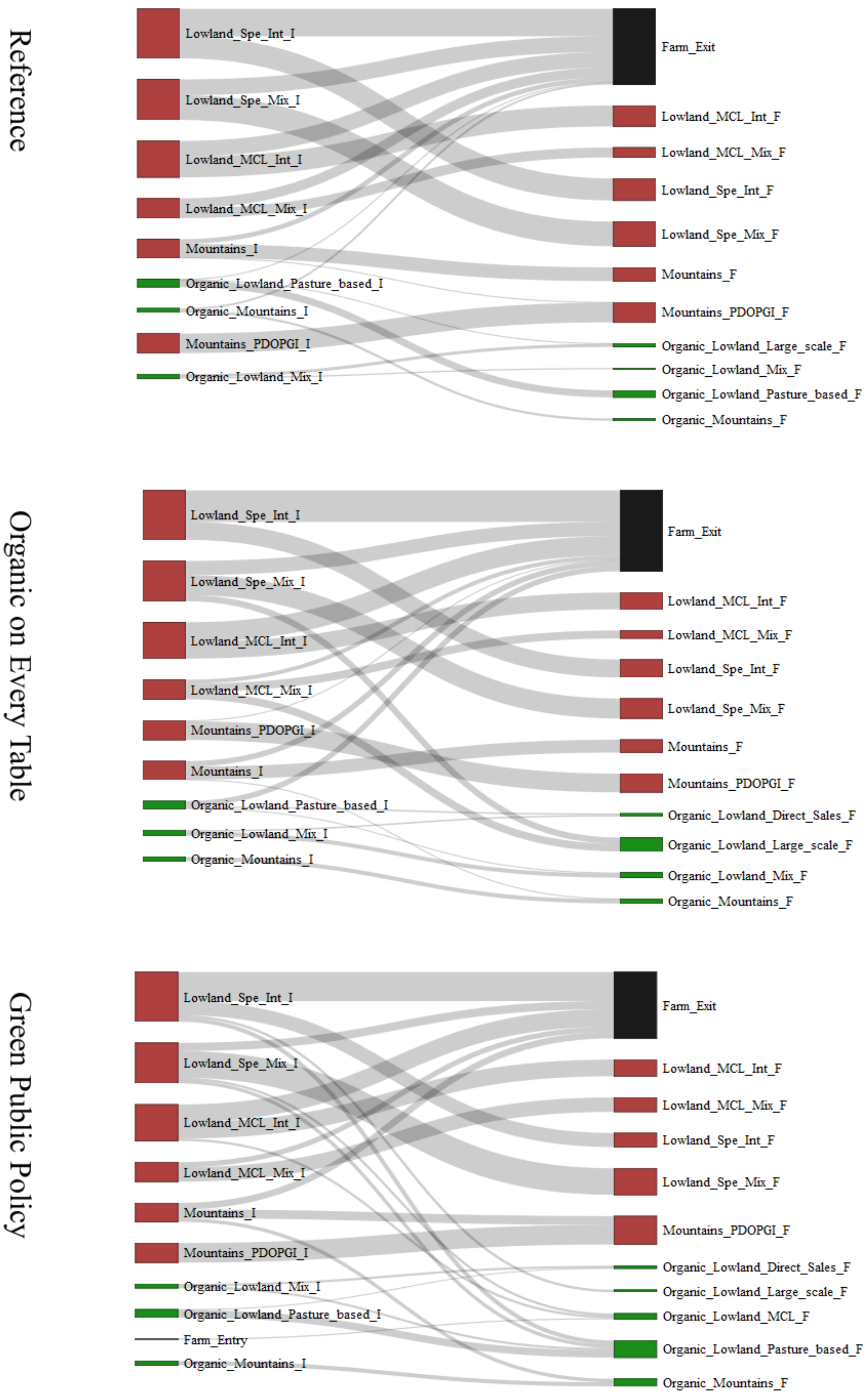

Figure 6 Transition pathways of current farms in the three simulated scenarios in the dairy sector in France (I= Initial farm type; F= Future farm type)

Figure 7 Number of farms and Agricultural Working Unit (AWU) in the Initial situation and in the three simulated scenarios in the dairy sector in France

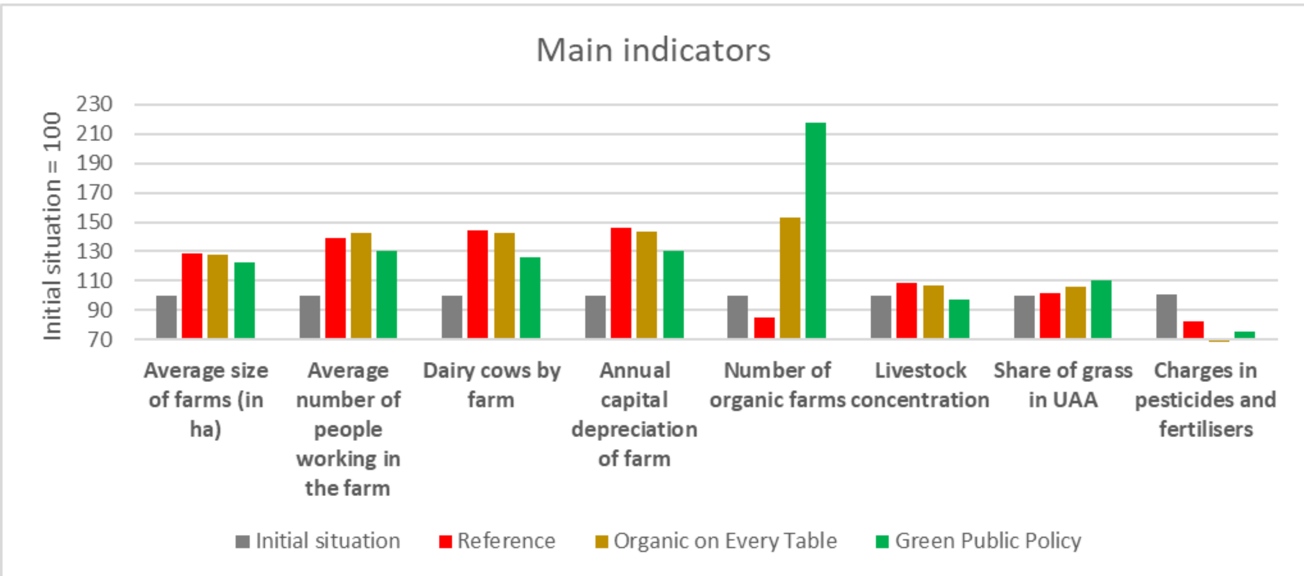

Figure 8 Main structural indicators of dairy farms in France in the Initial situation and in the three simulated scenarios

a			D			D*		
			IC-20	**IC**	**IC+20**	**IC-20**	**IC**	**IC+20**
Lowland Spe Intensive (Future type)	**P-20**	**S-20**	17 507	- 16 862	- 51 231	17 507	- 16 862	- 51 231
		S	21 544	- 12 825	- 47 194	21 544	- 12 825	- 47 194
		S+20	25 581	- 8 788	- 43 157	25 581	- 8 788	- 43 157
	P	**S-20**	70 066	35 697	1 328	70 066	35 697	1 328
		S	74 103	39 734	5 365	74 103	39 734	5 365
		S+20	78 140	43 771	9 402	78 140	43 771	9 402
	P+20	**S-20**	122 625	88 256	53 886	122 625	88 256	53 886
		S	122 625	88 256	53 886	122 625	88 256	53 886
		S+20	130 699	96 330	61 961	130 699	96 330	61 961

b			D			D*		
			IC-20	**IC**	**IC+20**	**IC-20**	**IC**	**IC+20**
Organic Lowland Large scale	**P-20**	**S-20**	28 653	7 708	- 13 237	25 902	4 956	- 15 989
		S	35 050	14 105	- 6 840	32 298	11 353	- 9 592
		S+20	41 447	20 502	- 444	38 695	17 750	- 3 196
	P	**S-20**	62 460	41 515	20 569	59 708	38 763	17 818
		S	68 857	47 911	26 966	66 105	45 160	24 214
		S+20	75 253	54 308	33 363	72 502	51 556	30 611
	P+20	**S-20**	96 266	75 321	54 376	93 515	72 569	51 624
		S	102 663	81 718	60 773	99 911	78 966	58 021
		S+20	109 060	88 115	67 169	106 308	85 363	64 417

Figure 9 Transition matrix from a current Lowland Specialised Intensive farm type to a future Lowland Specialised Intensive farm type (a) and to an Organic Lowland Large scale farm type (b). **Current income € 28,017.**

3.2. The broiler sector in France

3.2.1. Current typology

The broiler sector in France is highly concentrated, particularly in the western region, with Brittany alone accounting for a third of the country's production (Figure 10). Its proximity to ports makes it a key location for importing raw materials and supplying feed. The sector's trend toward geographic concentration and intensification is evident in the sharp decline in the number of farms, which dropped by 67% from 2000 to 2010, while the average farm size increased from 1,010 to 3,440 birds per farm (French Agricultural Survey, 2020). Despite this, France still has a significant number of medium-sized farms; over 50% of broiler farms have between 1,000 and 10,000 birds. This is largely due to the prominence of "Label Rouge" and organic production, which make up 15% and 1% of national production, respectively.

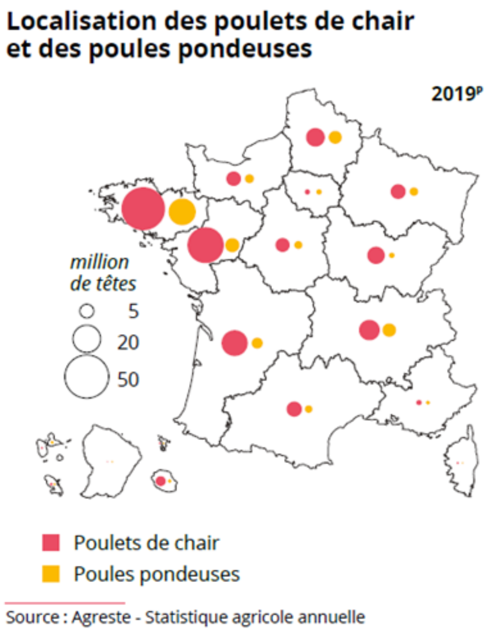

Figure 10 Location of broilers (orange) and laying hens (yellow) in France by region

Broiler farms vary widely based on factors such as breed type, housing, feed, production specifications, and sales channels. According to the experts consulted during workshops, the key factors that differentiate current broiler farms include breed type (fast growing vs. slow growing), specialised vs. mixed systems, farm size, and the type of quality certification (Figure 11). Location is not a major factor in distinguishing between broiler farming systems, as most farms operate in buildings regardless of the local climate and soil conditions. To reduce variation, only farms with significant production capacity (more than 200 fattening places) were selected.

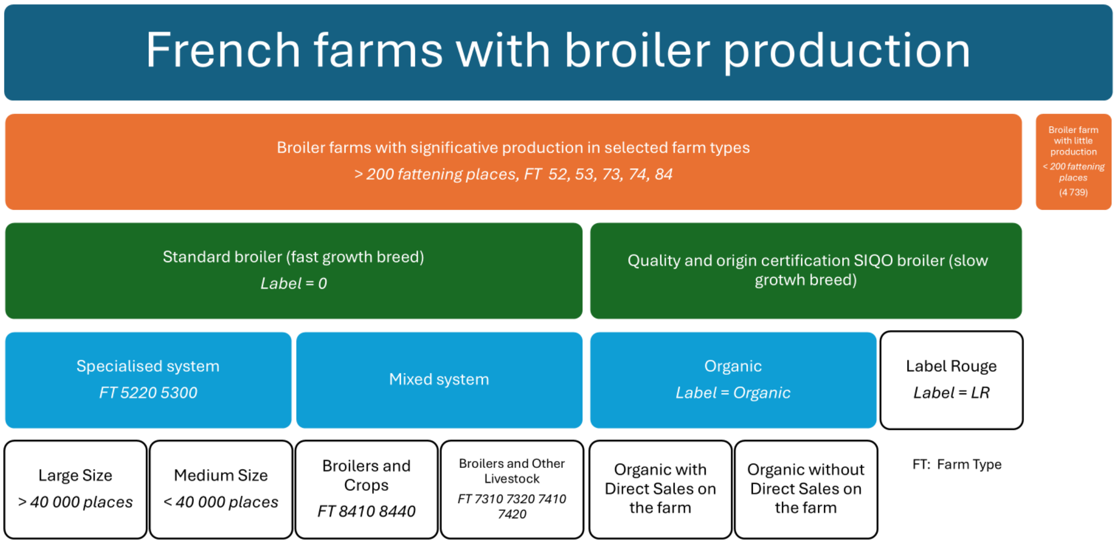

Figure 11 The typology tree for the current typology of broiler farms in France

- **Specialised Large Size**. Specialised large-scale conventional farm subject to the IED Directive on industrial emissions[4] (2024/1785) that aim to reduce emissions into air, water and land from intensive livestock farms (over the threshold of 40,000 places or 280 LU). Indoor rearing, approximately 20-22 chickens/m2 (maximum of 42 kg chickens/m2). *FARM CLASSIFICATION 5220 OR 5300 AND NOT ORGANIC AND FATTENING PLACES > 40000*
- **Specialised Medium Size**. Specialised medium-scale conventional farm having between 200 and 40,000 places. Indoor rearing, approximately 20-22 chickens/m2 (max of 42kg chicken/m2). *FARM CLASSIFICATION 5220 OR 5300 AND NOT ORGANIC AND FATTENING PLACES < 40000*
- **Broilers and Crops**. Mixed crops and livestock farm with production of conventional broilers and significant arable crop production. *FARM CLASSIFICATION 8410 OR 8440 AND NOT ORGANIC*
- **Broilers and Other Livestock**. Poly-breeding farm with conventional broiler production and significant herbivore production (mainly cattle). *FARM CLASSIFICATION 7310 OR 7320 OR 7410 OR 7420 AND NOT ORGANIC*
- **Organic without Direct Sales (DS)**. Specialised broiler farm complying with organic farming specifications: outdoor access, 10 chickens m2, minimum slaughter age of 81 days, organic feed etc. *FARM CLASSIFICATION 5220 OR 5300 AND ORGANIC AND NOT DIRECT SALES*
- **Organic Direct Sales (DS)**. Specialised broiler farm complying with organic farming specifications: outdoor access, 10 chickens m2, minimum slaughter age of 81 days, organic feed etc. Broilers are sold directly on the farm or locally to maximise value added. *FARM CLASSIFICATION 5220 OR 5300 AND ORGANIC AND DIRECT SALES*
- **Label Rouge**. Specialist broiler farm meeting Label Rouge specifications: access to the outdoors, max of 4 buildings of 400 m2, 11 chickens/m2, minimum slaughter age of 81 days. *FARM CLASSIFICATION 5220 OR 5300 AND LABEL ROUGE*

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[4] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ%3AL_202401785

The main characteristics of the current farm types are presented in Table 8. Organic farms account for 2.1% of broilers sold.

Table 7 The main structural characteristics of current farm types in the broiler sector in France

Farm type	Number of farms	Share of broilers sold [%]	Broilers sold per farm [100 heads]	Number of places [100 heads]	Number of batches	Broilers per m2	Livestock concentration [LU/ha]	Utilised Agricultural Area [ha/farm]	AWU	Labour intensity [AWU/100000 broilers sold]	Per farm depreciation [€/farm]
Specialised Large Size	885	45%	3,530	710	5	20	2,923	43	1.7	0.47	66,771
Specialised Medium Size	1,212	21%	1,191	254	5	13	1,404	37	1.4	1.17	26,747
Broilers and Crops	1,135	4%	270	45	6	10	172	58	1.8	6.71	22,273
Broilers and Other Liv	809	9%	807	140	6	13	347	115	2.2	2.75	52,921
Organic without DS	433	2%	252	73	3	7	235	57	1.3	5.35	9,832
Organic DS	246	0.5%	138	42	3	4	189	124	4.5	32.52	58,250
Label Rouge	2,930	18%	427	105	4	7	352	75	1.6	3.67	36,367

3.2.2.Future typology

When developing the future typology of broiler systems, we focused on the main drivers identified by experts during the workshops. The first driver is the trend toward larger farms, with increased housing capacity and higher broiler production in existing systems. The second driver is the rise of new, medium-growth breeds designed to meet new animal welfare regulations, such as the European Chicken Commitment[5]. The third driver is the appearance of organic broiler farms that combine livestock and crop production.

In the future typology, we assume that all current farm types increase in size, except for the following farm types: Specialised Medium size, Organic without DS, and Organic DS. In addition, we also assume the emerge of three additional new farm types: Organic Large scale, Organic MCL, and ECC.

- **Specialised Large Size**. Specialised large-scale conventional farm following an intensification of production and a significant increase in the size of the structure (almost two time bigger than the current Specialised Large size farm type). *FARM CLASSIFICATION 5220 OR 5300 AND NOT ORGANIC AND FATTENING PLACES > 80000*

[5] https://www.betterchicken.org.uk/better-chicken-commitment/?_gl=1*dt62n2*_ga*NDIxMjc2MTA3LjE3MzYzMjg1MTI.*_ga_RMC05PGGT7*MTczNjMyODUxMS4xLjEuMTczNjMyODU0MC4zNC4wLjA.*_gcl_au*MTI5NzcyNjIxOS4xNzM2MzI4NTE0

- **Specialised Medium Size**. Same farm type as the current Specialised Medium size farm type.
- **Broilers and Crops**. Mixed crops and livestock farm with production of conventional broilers and significant arable crop production increasing its size. *FARM CLASSIFICATION 8410 OR 8440 AND NOT ORGANIC AND FATTENING PLACES > 15000*
- **Broilers and Other Liv**. Poly-breeding farm with conventional broiler production and significant herbivore production (mainly cattle). *FARM CLASSIFICATION 7310 OR 7320 OR 7410 OR 7420 AND NOT ORGANIC AND FATTENING PLACES > 20000*
- **Organic without DS**. Same farm type as the current Organic without DS farm type.
- **Organic DS**. Same farm type as the current Organic DS farm type.
- **Organic Large Scale**. Large scale organic broiler farm doubling having a double size compared to the current Organic without DS farm type. The aim of this system is to maximise the volume of organic broiler meat produced on the farm to meet the growing demand for differentiated products in the market. *FARM CLASSIFICATION 5220 OR 5300 AND ORGANIC AND NOT DIRECT SALES AND SALES OF BROILERS X2 COMPARED TO ORGANIC WITHOUT DS*
- **Organic Mixed Crops and Livestock (MCL)**. Mixed organic farm based on the complementary nature of an organic broiler production, and field crop production. A large part of the forage is produced on the farm, and the livestock activity produces organic matter that is spread on the arable land. The broilers produced are sold under organic certification to increase value added. *FARM CLASSIFICATION 8410 AND ORGANIC*
- **Label Rouge**. Large size specialised broiler farm meeting Label Rouge specifications. *FARM CLASSIFICATION 5220 OR 5300 AND LABEL ROUGE AND FATTENING PLACES 10000-17500*
- **European Chicken Commitment (ECC)**. Conventional broiler farms where environmental and animal welfare standards have led to changes in production methods to comply to European chicken criteria. Chickens have more space (30kg/m² (up to 20 animals/m²)), they grow less rapidly (around 43 fattening days) and their feed is better sourced. *FARM CLASSIFICATION 5220 OR 5300 AND ANIMAL WELFARE LABEL*

The main characteristics of the future farm types are presented in Table 8.

Table 8 The main structural characteristics of future farm types in the broiler sector in France

Farm type	Broilers sold per farm [100 heads]	Number of places [100 heads]	Number of batches	Broilers per m2	Livestock concentration [LU/ha]	Utilised Agricultural Area [ha/farm]	AWU	Labour intensity [AWU/100000 broilers sold]	Per farm depreciation [€/farm]
Specialised Large Size	5,546	1238	4	25	6,364	34	1.8	0.32	85,053
Specialised Medium Size	1,191	254	5	13	1,404	37	1.4	1.17	26,747
Broilers and Crops	1,121	192	6	18	403	82	1.6	1.40	25,646
Broilers and Other Liv	1,603	263	6	16	502	134	2.8	1.77	77,331
Organic without DS	252	73	3	7	235	57	1.3	5.35	9,832
Organic DS	138	42	3	4	189	124	4.5	32.52	58,250
Organic Large Scale	522	151	3	11	242	62	1.5	2.91	19,509
Organic MCL	97	31	3	2	76	79	2.3	24.20	40,066
Label Rouge	456	119	4	9	390	69	1.4	2.97	35,089
ECC	2,215	399	6	16	403	72	1.2	0.53	27,287

3.2.3. Simulated scenarios

Specific modelling assumptions for each simulated scenario are outlined below.

Reference. The number of broilers (organic and conventional) increase by 10%. We apply the observed trend for 2010-2020 (source: FSS data) to a 15-year period. We assume that the share of organic broilers remains unchanged (2%). Favoured by a positive economic environment (increase of national broiler production), all farms continue the observed trends of specialisation and concentration of broiler production. They increase in size and become ever more specialised. Some conventional mixed systems move towards specialised systems in order to increase broiler production and develop economies of scale. Label Rouge production is partly replaced by the new European Chicken Commitment label, which guarantees lower prices for the consumer. For organic dairy farms the situation is similar. Current organic systems maintain their market share, while some organic large broiler farms appear in the market.

Organic on Every Table. In Organic on Every Table, the number of broilers remains stable. This means that the current increase in broiler production stops and that the reduction in meat consumption in the more plant-based diets of the population is mainly done at the expense of beef and pork. Driven by a favourable market demand, the share of organic broilers reaches 8%. In this scenario, conventional farms continue the ongoing trend of specialisation and concentration as in the Reference scenario leading many small farms to leave the market. Some conventional broiler farms convert to organic farming, driven by favourable market conditions. The localisation of livestock remains fairly concentrated in the country, favouring networks and concentration processes leading to economies of scale and agglomeration, and the emergence of large organic farms, mostly located in the west. These farms are vertically integrated to large retailers and processors. However, organic farms specialised in direct sales continue to exist in the market, offering alternative consumption models based on farmers' markets and internet sales. Label Rouge production is partly replaced by the new European Chicken Commitment label, which guarantees lower prices for the consumer and by organic production.

Green Public Policy. In Green Public Policy, as in Organic on Every Table, the number of broilers remains stable. In this scenario, the trends of concentration and specialisation of broiler production continue, but to a lesser extent than in the Reference scenario. New green public policies favour then organic production which reaches a share of 8% in the sector. These policies also encourage the de-specialisation of production areas in the country and the reduction of synthetic fertilisers. Livestock is partly relocated within the country to reduce pressure, especially in the west. For this reason, the number of large conventional broiler farms mostly present in the west areas of the country declines, while most medium-sized farms are maintained, especially in arable areas where they can provide manure to the other farming systems. In this scenario, broilers farms with localised feed source and increasing feed autonomy on the farm become more numerous. Some of these are organic.

Most of conversions regards initial medium-size broiler farms since their initial size is more compatible to that of organic farms. Some new organic broiler farms appear in cereal areas mixing livestock and crops activities. As agglomeration economies and vertical integration do not play a decisive role in this scenario, large organic dairy farms do not appear on the market. Finally, green public policies also favour higher standards in terms of animal welfare. New ECC farms appear in the market, more numerous with respect to the Reference scenario, while the share of Label Rouge declines because of the competition from ECC and organic broilers.

Table 9 and Table 10 show respectively the changes in the allocation of broiler production and the final share of broiler production for the different future farm types in the three simulated scenarios.

Table 9 Allocation of broiler production for each category of farm types in the initial situation and in three simulated scenarios in the broiler sector in France

	Initial situation	Reference	Organic on Every Table	Green Public Policy
Conventional				
Specialised	86%	89%	89%	87%
MCL	14%	11%	11%	13%
Specialised Conventional				
Specialised Large size	54%	65%	65%	57%
Specialised Medium Size	25%	13%	13%	21%
Label Rouge	22%	15%	15%	10%
ECC	0%	7%	7%	12%
MCL Conventional				
Broilers and crops	32%	32%	32%	36%
Broilers and other liv	68%	68%	68%	64%
Organic				
Organic without DS	76%	66%	65%	75%
Organic DS	24%	24%	10%	15%
Organic Large scale	0%	10%	25%	0%
Organic MCL	0%	0%	0%	10%

Table 10 Share of broiler production for the different farm types in the initial situation and in three simulated scenarios in the broiler sector in France

Farm type	Initial situation	Reference	Organic on Every Table	Green Public Policy
Specialised Large Size	45%	57%	53%	46%
Specialised Medium Size	21%	12%	11%	17%
Broilers and Crops	4%	3%	3%	4%
Broilers and Other Liv	9%	7%	7%	8%
Organic without DS	2%	1%	5%	6%
Organic DS	0%	0%	1%	1%
Organic Large Scale	0%	0%	2%	0%
Organic MCL	0%	0%	0%	1%
Label Rouge	18%	13%	12%	8%
ECC	0%	6%	6%	10%

3.2.4.Modelling results

In the **Reference** scenario, the trend towards specialisation and concentration in broiler production results in 33% of current farms exiting the market with conventional mixed systems being those experiencing the highest exits (Figure 12). As the average size of farms increases, the total number of holdings in the broiler sector drops (by 33%) despite the increase of broiler production (Figure 13). At the same time, higher labour productivity reduces the number of agricultural workers in the sector (by 34%). The situation is different in the organic sector. As the size of holdings and labour productivity increase, but at a slower rate than for non-organic holdings, the total number of organic holdings and the agricultural labour force employed on these holdings increase by 5% and 8% respectively, driven by the increase in total broiler production, which also drives up organic production.

Looking at average structural characteristics (Figure 14), the sales of broilers per farm increase as well as the annual capital depreciation and livestock concentration. In contrast, pesticide and fertiliser costs in the sector decrease as broiler farms reduce crop production and increase feed purchases. Finally, broiler meat increases at the same rate as the broiler flock (10%).

In the **Organic on Every Table** scenario, the higher presence of organic farms rearing a lower number of broilers than non-organic farm types reduce the exits from the market at only 23% of initial farms. Many mixed conventional systems convert to organic farm types, especially Organic without DS, while some specialised conventional systems convert to large organic farms. Despite the stagnation of total broiler production, the total number of farms increases compared to the Reference scenario (14%) driven by the growth in the number of organic farms (193%). In the same way, the total number of workers increases by 15% for the whole sector, and by 127% for organic farms reaching more than 4,000 AWU. The average levels of number of broilers sold per farm, annual capital depreciation, livestock concentration and pesticide and fertiliser costs decrease compared to the Reference scenario as a result of the introduction of the smaller, more extensive organic farms. Finally, despite the stagnation of the broiler flock, meat production increases slightly (1%) because organic broilers are heavier than conventional ones.

In the **Green Public Policy** scenario, the proportion of initial farms leaving the market is even lower than in the Organic on Every Table scenario (18%), as the higher presence of small organic farms allows more non-organic farms to convert rather than leave the market. Conventional and Label Rouge specialised systems convert relatively more to organic specialised systems, while some conventional mixed systems convert to the new organic farm type Organic MCL. The total number of farms and the total number of agricultural workers employed in broiler farms increase much more than in the Organic on Every Table scenario, by 25% and 37% respectively compared to the Reference scenario. However, this increase does not allow to reach the initial levels. The increase in the total number of holdings and agricultural workers is driven by the increase in the number of mixed conventional holdings and, above all, by the increase in the number of organic holdings (295%) and the number of agricultural workers employed on these holdings (245%). This growth is higher than in the Organic on Every Table scenario because in the Green Public Policy scenario there are no large, highly productive organic farms (in terms of number of broilers per AWU), and there is a higher proportion of small organic farms involved in direct sales and also cropping activities. In terms of average structural characteristics, this scenario is similar to the Organic on Every Table scenario. However, there is a lower level of broiler sales per holding, annual capital depreciation per holding, and livestock concentration. Finally, as in the Organic on Every Table scenario, despite the stagnation of the number of broilers, meat production increases slightly (1%) because organic broilers are heavier than conventional ones.

In the French broiler case study, we analysed two possible transition pathways for farms, which we consider to be meaningful for the sector. In both transitions, we took as a starting point the current Specialised Medium Size farm type, as we consider that these type holdings may have in a near future a strategic decision to make. The first option is to increase in size, develop economies of scale to reduce fixed costs to remain competitive in the market, thus becoming a future Specialised Large Size farm type. The second option is to reduce the size of the farm, and adopt the organic production methods, thus becoming an Organic without DS farm type. The current Specialised Medium Size farm type has an average family farm income per family work unit of € 24,233.

In the transition to the organic farm type, the buildings of the conventional farms have to be adapted to the new production methods, which require higher spaces, access to the outside and smaller dimensions. For this reason, we assume that the share of the initial farm's assets that are incompatible with the transition (ω_{ff}) and the share of the future farm's assets that have to be purchased brand new (σ_{ff}) is equal to the share of buildings in the initial farm's assets, estimated at 28% (Chambre agriculture du Lot, 2018). In addition, the initial level of annual depreciation is higher than that of the final organic farms. This leads to a value of β_{ff} (the annual depreciation of the initial farm's assets in excess of the future farm's needs) that is greater than zero for the transition to the Organic without DS farm type, which means that the depreciation schedule D is different from D*. On the other hand, for the transition to the future Specialised Large Size farm type, (ω_{ff}) and (σ_{ff}) are equal to 0 and β_{ff} is equal to 0. As a result, depreciation schedule D is equal to depreciation schedule D*.

Figure 15 shows that in depreciation scheme D, the transition to organic farming is, all things being equal, less profitable than the transition to the future Specialised Large Size farm type. Moreover, the transition to Organic without DS farm type is even less profitable than the initial situation if subsidies, sales prices or prices of intermediate consumption remain unchanged. As expected, the depreciation schedule D* makes the transition to organic farming even less profitable, as the initial farm has to bear the burden of old investments that exceed the needs after the transition and that cannot be partly used to finance the new buildings. For this reason, the organic farm can only achieve a higher family farm income per family work unit than in the initial situation in a scenario where sales prices increase or prices of intermediate consumption fall.

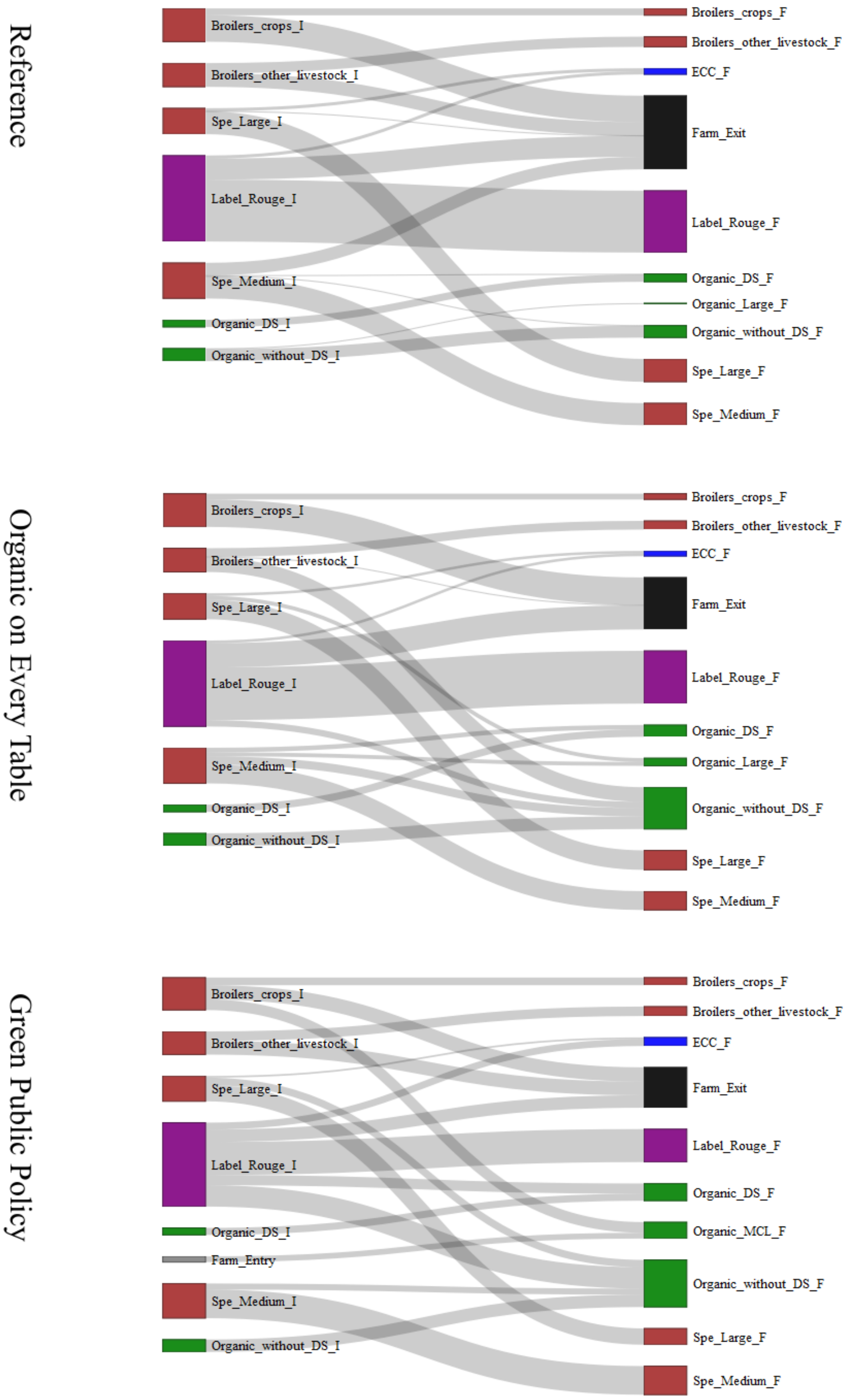

Figure 12 Transition pathways of current farms in the three simulated scenarios in the broiler sector in France (I= Initial farm type; F= Future farm type)

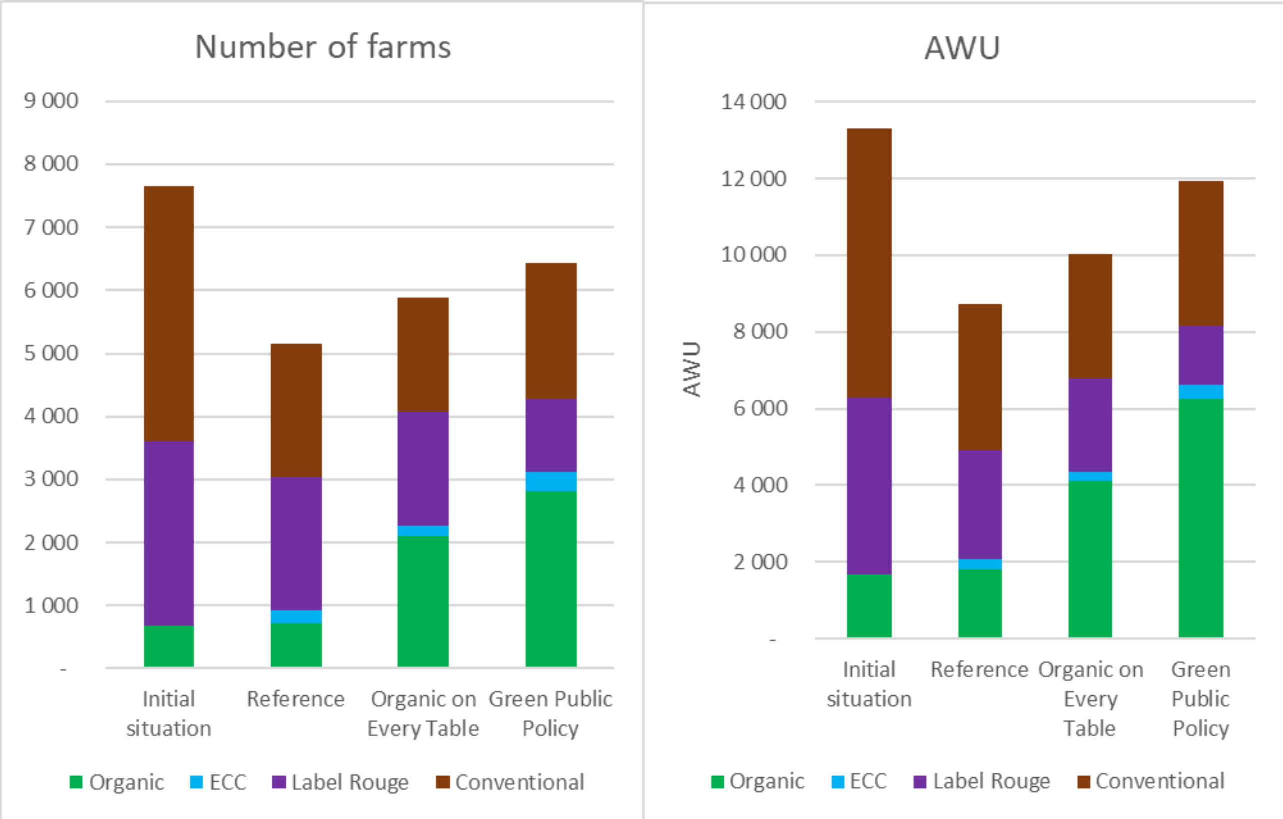

Figure 13 Number of farms and Agricultural Working Unit (AWU) in the Initial situation and in the three simulated scenarios in the broiler sector in France

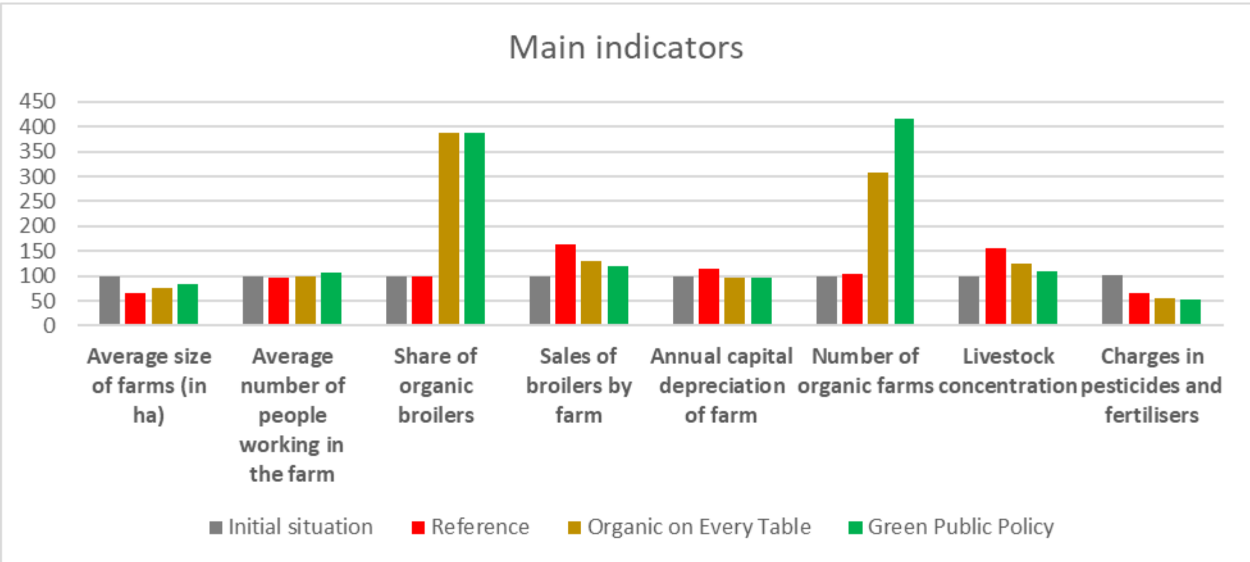

Figure 14 Main structural indicators of broiler farms in France in the Initial situation and in the three simulated scenarios

a			D			D*		
			IC-20%	IC	IC+20%	IC-20%	IC	IC+20%
Specialised Large Size (Future type)	P-20%	S-20%	- 3 100	- 76 051	- 149 002	- 3 100	- 76 051	- 149 002
		S	- 1 689	- 74 641	- 147 592	- 1 689	- 74 641	- 147 592
		S+20%	- 279	- 73 230	- 146 181	- 279	- 73 230	- 146 181
	P	S-20%	110 356	37 404	- 35 547	110 356	37 404	- 35 547
		S	111 766	38 815	- 34 137	111 766	38 815	- 34 137
		S+20%	113 177	40 225	- 32 726	113 177	40 225	- 32 726
	P+20%	S-20%	223 811	150 860	77 908	223 811	150 860	77 908
		S	223 811	150 860	77 908	223 811	150 860	77 908
		S+20%	226 632	153 681	80 729	226 632	153 681	80 729

b			D			D*		
			IC-20%	IC	IC+20%	IC-20%	IC	IC+20%
Organic without DS	P-20%	S-20%	7 168	- 22 754	- 52 677	- 10 590	- 40 513	- 70 436
		S	10 177	- 19 746	- 49 668	- 7 582	- 37 504	- 67 427
		S+20%	13 186	- 16 737	- 46 660	- 4 573	- 34 496	- 64 419
	P	S-20%	44 457	14 535	- 15 388	26 699	- 3 224	- 33 147
		S	47 466	17 543	- 12 379	29 707	- 215	- 30 138
		S+20%	50 475	20 552	- 9 371	32 716	2 793	- 27 129
	P+20%	S-20%	81 747	51 824	21 901	63 988	34 065	4 142
		S	84 755	54 832	24 910	66 996	37 074	7 151
		S+20%	87 764	57 841	27 918	70 005	40 082	10 160

Figure 15 Transition matrix from a current Specialised Medium Size farm type to a future Specialised Large Size farm type (a) and to an Organic without DS farm type (b). Current income **€ 24,233**.

3.3.The broiler sector in Denmark

3.3.1.Current typology

From 2012 to 2022, the Danish poultry industry experienced significant growth. Egg production increased by 32.7% (from 67.0 million kg to 88.9 million kg), while broiler production grew by 1.8% (from 152.5 million kg to 155.2 million kg) [6]. This indicates that poultry remains a popular animal product, even as overall meat demand declines.

In 2022, organic eggs accounted for around 33% of total egg sales in Denmark. On the other hand, organic chicken made up only about 2.8% of the total chicken produced in Denmark in 2020 (FADN data). The growth of organic broiler production is primarily concentrated in the northern and southern parts of Jutland[7].

The first criteria used to create the current farm typologies in the Danish broiler sector is the separation between conventional and organic farms. Conventional farms are further divided into closed systems and free-range systems. Organic farms are divided into three groups according to the presence of highly extensive broiler systems, and the degree of farm specialisation in broiler production (Figure 16).

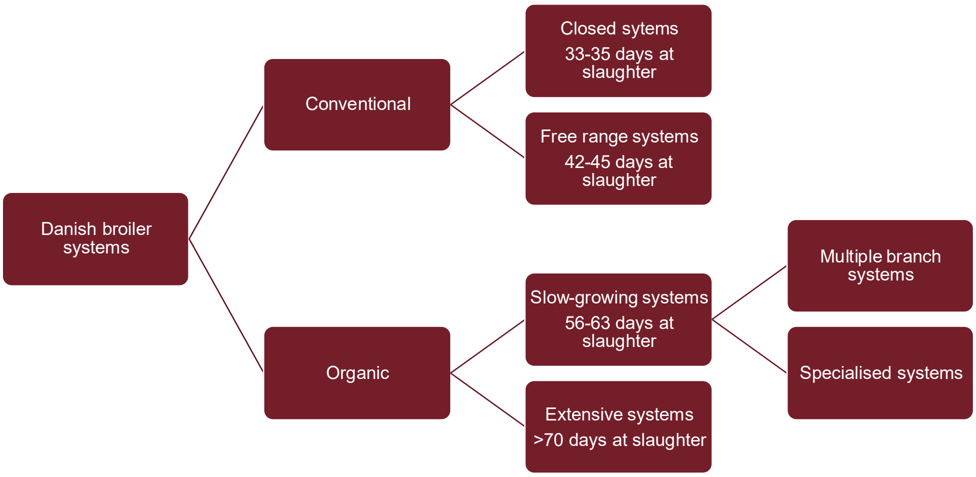

Figure 16 The typology tree for the current typology of broiler farms in Denmark

- **Closed System**. Conventional broiler system that can accommodate both slow-growing producers and fast-growing production. Almost all broilers in Denmark are raised in this type of farming system**.**
- **Free-range System**. Conventional broiler system that allows chickens to roam outdoors for at least part of the day, in contrast to conventional systems where they are kept in confined spaces. These systems aim to provide a more natural living environment, promoting animal welfare and typically offering better access to fresh air and natural light.
- **Organic Multiple Branch System**. Organic broiler system part of a large corporation with other production types mostly located in the North of the country. In recent years, it has

[6] Årsstatistik for Den Danske Fjerkræproduktion 2022, Landbrug & Fødevarer, Sektor for Fjerkræ.
[7] Danmarks Statistik.

expanded its production due to increased production of convenience products which are becoming popular in Denmark.

- **Organic Specialised System**. Large, specialised organic broiler system mostly located in the South of Jutland. Producers of this farm type mainly exports to the German market. The recent outbreak of avian influenza in German flocks has been beneficial for the sales of this farm type.
- **Organic Extensive System**. Farm system that follows an extensive organic approach with its own trading model. Unlike broilers in other organic farm types, broilers in this system spend a larger portion of their lives outdoors. In more intensive organic systems, producers cannot allow outdoor access until the birds develop contour feathers, which provide better insulation than their initial down feathers. Organic regulations require broilers to be outside for at least one-third of their lives, leading some producers to delay outdoor access until the birds are around 35 days old. As a result, broilers in non-extensive systems use only a small part of the available land, as they do not have enough time to acclimate to outdoor conditions. This leads to significant land waste, requiring maintenance since the birds primarily forage near the barn. To make better use of the land, some farmers experiment with growing grain strips (e.g., winter rye) for personal use. Others are exploring the possibility of installing solar panels on the far end of the run, though it remains unclear whether this is legally permitted.

In the Danish broiler sector, there is no open access to data on production, slaughter, and distribution, as this information is owned by individual producers and butcheries. The mix of fast-growing and slow-growing broilers in conventional closed systems makes it difficult to distinguish between these types in annual statistics since there are no publicly available statistics on the market share of slow-growing broilers. Although a lower growth rate typically leads to a higher feed conversion ratio, this trend isn't clearly reflected in the annual Danish data.

Regarding organic production, this is often overlooked in annual overviews for the organic sector due to its small scale, with only 53 producers. As a result, there is no specific data on acreage use for broiler producers. Additionally, the FADN database does not differentiate between organic and conventional broiler production in Denmark. For these reasons, unlike the other case studies, the main characteristics of the future farm types presented in Table 11 are based on a combination of expert judgment and FADN and national data.

Table 11 The main structural characteristics of current farm types in the broiler sector in Denmark

Farm type	Share of broilers sold [%]	Degree of specialisation	Husbandry system	Live weight at slaughter (kg/head)	Feed conversion ratio (kg feed/kg chicken)	Number of batches yearly	Type of other production	Fodder production	Sales
Closed system	95.9%	Specialised	Traditional housing	2.2	1.5	8.1		None	Supermarket
Free-range System	1.4%	Specialised	Traditional housing	NA	NA	5.8		NA	Supermarket
Organic Multiple Branch System	2.3%	Mixed	Traditional housing + out-door access	2.2	2.5	5.2	Other poultry and livestock animals	Crop cultivation for fodder	Supermarket, restaurants
Organic Specialised System	0.3%	Specialised	Traditional housing + out-door access	2.2	2.5	5.2		Crop cultivation for fodder	Supermarket, restaurants
Organic Extensive System	0.3%	Mixed	Mobile housing + outdoor access	2.4	4.2	3	Other poultry and livestock animals	None	Supermarket, restaurants

3.3.2.Future typology

The outlook for the organic broiler sector in Denmark is currently quite pessimistic. Given the rising costs, it is highly likely that farms operating under Organic Multiple Branch systems will transition to conventional production to remain financially viable. Meanwhile, producers using Organic Specialised systems have shifted almost entirely to the German market, where consumer demand is stronger. Organic Extensive system farms, however, seem less affected by market pressures. Their business model—focused on direct sales, smaller production volumes, and strong branding—ensures a stable customer base. Notably, despite requiring fewer resources to produce, high-welfare chickens from Organic Extensive systems are sold at the same price in supermarkets as those from Organic Multiple Branch systems. This suggests that the supply chain is significantly inflating prices.

Additionally, a report from 2023 highlights declining welfare conditions in Organic Multiple Branch systems, with more chickens showing reduced mobility (Årsstatistik for den Danske Fjerkræproduktion, 2023). This issue is linked to fast-growing breeds, high feed efficiency, and increased final weights. As a result, organic chicken may soon disappear from supermarkets altogether. In fact, many supermarkets have already reduced their supply. If this trend continues, consumers may only be able to purchase organic chicken from small independent markets, on-farm shops with their own abattoirs, or high-end restaurants.

Based on these considerations, it is assumed that the current farm types will remain the same in the future scenarios, even though an increase in farm productivity and an increase in size can be expected. It is also expected that two additional types of farms will emerge. The first is a conventional system explicitly following the European Chicken Commitment (ECC) Regulation. The second is an organic system combining broiler production and agroforestry.

- **Closed System**. Same farm type as the current Closed system. Size enlargement and increase in labour productivity can be expected. This system may increase the share of slow growing broilers in its product-mix.
- **Free-range System**. Same farm type as the current Free-range system. Size enlargement and increase in labour productivity can be expected.
- **Organic Multiple Branch System**. Same farm type as the current Organic multiple branch system. Size enlargement and increase in labour productivity can be expected.
- **Organic Specialised System**. Same farm type as the current Organic specialised system. Size enlargement and increase in labour productivity can be expected.
- **Organic Extensive System**. Same farm type as the current Organic extensive system.
- **European Chicken Commitment (ECC).** Conventional broiler farms where environmental and animal welfare standards have led to changes in production methods to comply to European chicken criteria. Chickens have more space (30kg/m² (up to 20 animals/m²)), they grow less rapidly (around 43 fattening days) and their feed is better sourced.
- **Organic Broiler and Agroforestry System**. This system combines organic broiler production with agroforestry practices. Under Denmark's new green law, a significant portion of the country's land will need to be converted into forest. Since poultry are less disruptive to young trees compared to larger livestock, they may be well-suited for mobile housing in agroforestry systems. However, for optimal land use, this law should be accompanied by efforts to relax regulations on poultry production within agroforestry systems.

3.3.3.Simulated scenarios

Specific assumptions for each simulated scenario are outlined below.

Reference. The Reference scenario does not paint an optimistic future for organic broiler production in Denmark. Total broiler production increases following the same trend observed during the 2010-2020 period (source: FSS data) applied to a 15-year period (by 6%), but the share of organic production is reduced at 0.5% as this share is already currently declining. In 2023, the Danish government, along with key political parties, decided to phase out state procurement of fast-growing chickens and instead promote slower-growing breeds with proven welfare benefits. Experts believe this decision is driving more broiler producers to adopt the European Chicken Commitment (ECC) standards. Denmark now leads Europe with the highest number of food companies that have signed the ECC agreement. For instance, Rokkedahl, one of the major broiler producers, has already started slaughtering chickens according to these standards in 2024. As a result, competition is growing in the market between broilers raised with high welfare standards under the ECC and those produced organically. Consumers are increasingly opting for chicken meat that offers high welfare ratings at a better price, rather than organic meat.

Given this shift, experts predict that the number of broilers raised under Organic Extensive System remain stable in the Reference scenario, as these systems have a loyal customer base that ensures farm stability. However, production from Organic Multiple Branch System farms is expected to decline, with some producers transitioning to slow-growing broiler systems. The Organic Specialised System farms, which are currently uncertain, are likely to follow the same trend, moving toward slow-growing broilers.

Conventional producers in closed systems continue with fast-growing broilers, though a reduction in production is anticipated, as some producers shift to slow-growing broiler systems and implement ECC standards. Meanwhile, some Free-range systems continue their current practices, while others transition to the ECC guidelines.

Organic on Every Table. In the Organic on Every Table scenario, the increase of broiler production stops and production stagnates as consumers start substituting meat with plant-based products. In this scenario, all three current organic farm types increase their production in response to higher market demand and reach a share of 5% in the market. Some extensive producers also adopt agroforestry systems, driven by regulations encouraging the creation of more forested areas.

In the conventional sector, some closed systems transition to Organic Specialised Systems due to favourable regulatory conditions. A similar shift occurs within conventional free-range systems. As the market share for organic chicken grows and consumers increasingly reject industrial conventional farming, even former non-poultry producers begin to see the potential in poultry production. This trend helps boost organic farm types.

Green Public Policy. In the Green Public Policy scenario, total broiler production stagnates as in the Organic on Every Table scenario, while the share of organic production increases to 7%. In this scenario, poultry production systems shift toward more localised feed sourcing, reduced competition between food and feed, and ultimately less intensive systems.

For conventional closed systems, this scenario leads to a reduction in production, with some farms transitioning to specialised organic production, thanks to strong support for organic farming from the Common Agricultural Policy (CAP). Some free-range broiler producers also make the switch to organic farming, while others either maintain their current practices or begin producing under the European Chicken Commitment (ECC) standards.

Increased CAP support for organic farming and agri-environmental measures further boost the growth of Organic Extensive Systems, which are less intensive, more inclined to implement sustainable and animal welfare practices, and already have an established customer base. Additionally, stronger public policies promoting biodiversity conservation help farms transition toward broiler production in agroforestry systems. In a scenario where competition between food and feed is reduced, Organic Extensive Systems become more significant due to their ability to use lower-quality feed, such as crop residues and industrial by-products.

In order to implement this scenario, two major barriers still hinder the establishment of extensive broiler production. The first is the lack of local slaughterhouses and the ability to process smaller, more varied batches of poultry. Subsidies for small, possibly mobile, abattoirs would be highly beneficial. The second barrier is the complexity of current regulations on animal welfare, biosecurity, feed handling, medications, registrations, and organic farming. With very few organic poultry advisors in Denmark, farmers often lack the support they need and are sometimes forced to abandon the process.

Table 12 and Table 13 show respectively the changes in the allocation of broiler production and the final share of broiler production for the different future farm types in the three simulated scenarios.

Table 12 Allocation of broiler production for each category of farm types in the initial situation and in three simulated scenarios in the broiler sector in Denmark

	Initial situation	Reference	Organic on Every Table	Green Public Policy
Conventional				
Closed System	98.6%	88.6%	98.6%	88.6%
Free-range System	1.4%	1.4%	1.4%	1.4%
ECC	0.0%	10.0%	0.0%	10.0%
Organic				
Organic Multiple Branch System	82%	46%	72%	14%
Organic Specialised System	9%	5%	8%	47%
Organic Extensive System	9%	49%	15%	30%
Organic Broiler and Agroforestry System	0%	0%	5%	10%

Table 13 Share of broiler production for the different farm types in the initial situation and in three simulated scenarios in the broiler sector in Denmark

	Initial situation	Reference	Organic on Every Table	Green Public Policy
Closed System	95.8%	88.1%	93.7%	82.7%
Free-range System	1.4%	1.4%	1.3%	1.3%
Organic Multiple Branch System	2.3%	0.2%	3.6%	0.9%
Organic Specialised System	0.3%	0.0%	0.4%	3.1%
Organic Extensive System	0.3%	0.2%	0.8%	2.0%
ECC	0.0%	10.0%	0.0%	9.3%
Organic Broiler and Agroforestry System	0.0%	0.0%	0.3%	0.7%

3.3.4.Modelling results

The impossibility to get access to good quantitative data on organic farms in the broiler sector in Denmark prohibits us from providing modelling results for this case study. Nevertheless, Figure 17 shows the trajectories of transition of current farms based on the three future scenarios[8].

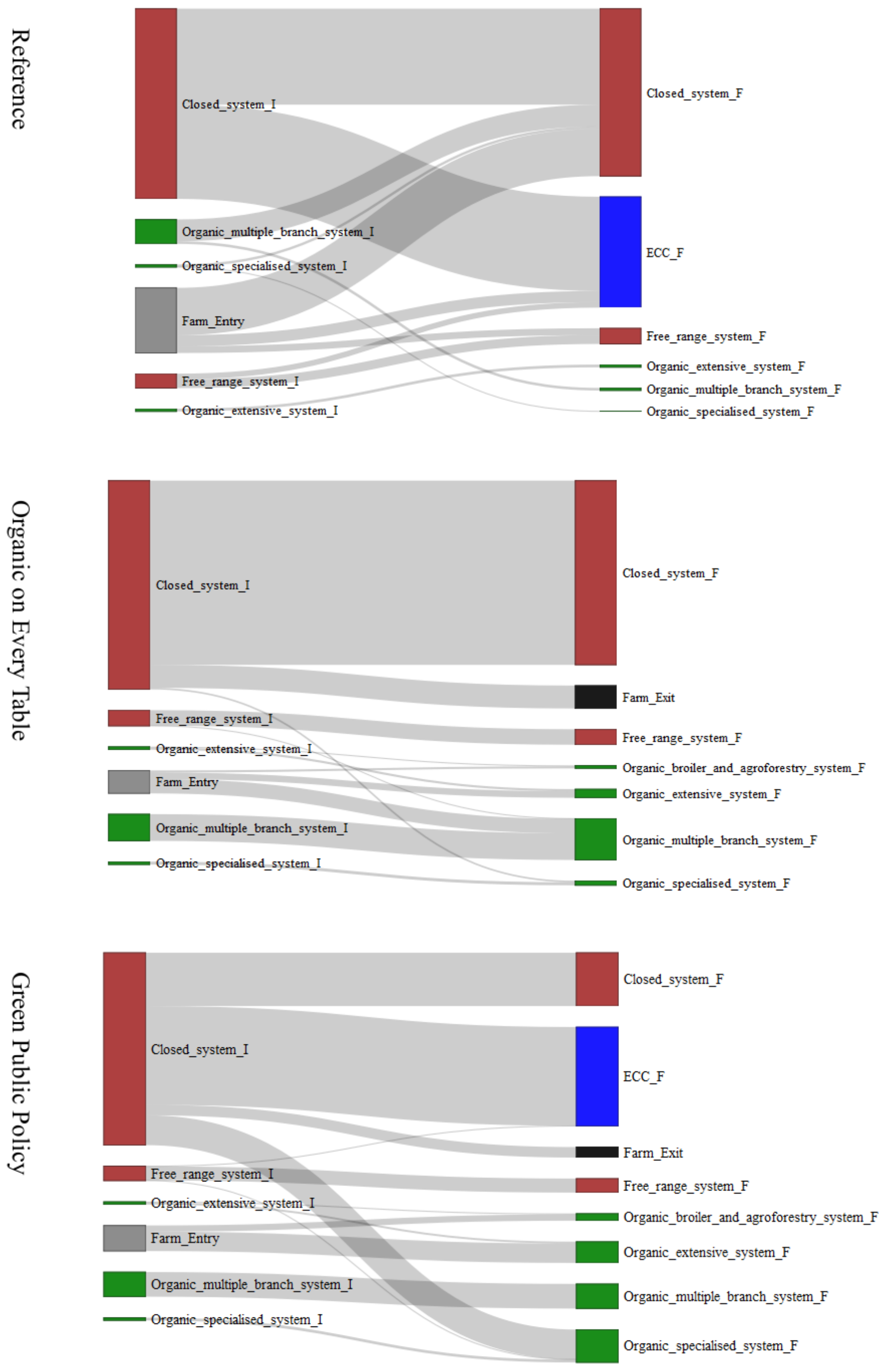

Figure 17 Transition pathways of current farms in the three simulated scenarios in the Danish broiler sector (I= Initial farm type; F= Future farm type)

3.4.The arable sector in Austria

3.4.1.Current typology

In Austria's arable sector, the farm typology was developed based on the concept of production regions. Four distinct regions were identified, each containing both organic and conventional farms. These regions differ significantly in environmental factors such as precipitation, average temperature, soil types, and soil quality, all of which play a key role in plant production potential. The Pre-Alpine region, with its fertile soil and 600-850 mm of annual precipitation, has the highest production intensity. In contrast, the northern region has lower production intensity due to poorer soils and fewer heat units, resulting in lower yields. In the northeast, arable farms are typically stockless, while in the southeast, farms are smaller and primarily focus on pig farming. Organic farming is mainly present in the northern and north-eastern regions. In the Pre-Alpine and south-eastern regions the organic area is lower.

Figure 18 and Figure 19 represent respectively the typology tree in creating the current typology of arable systems and the Austrian “production regions”.

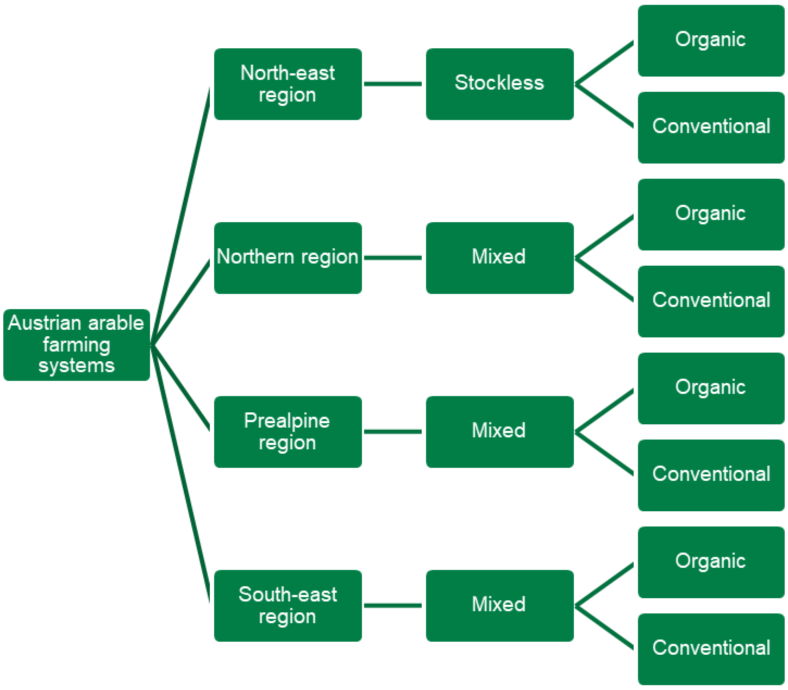

Figure 18 The typology tree for the current typology of arable farms in Austria

[8] Unlike the other case studies, where we have the size of each future and initial type of farm available, in this case study, the figure showing the transition trajectories of the current farms has been made assuming that all farm types have the same size (broilers sold per farm), except for the closed systems which have a larger size in order to make the figure easier to read.

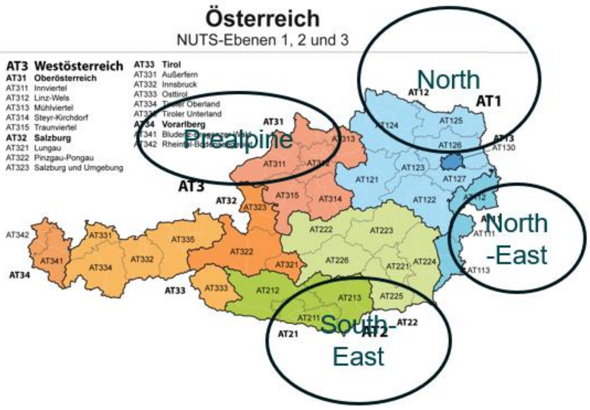

Figure 19 Austrian "production regions"

All farms belong to the FADN farm classification (15 OR 1610 OR 1620 OR 1630 OR 1660 OR 8310 OR 8320 OR 8330 OR 8340 OR 8410 OR 8420 OR 8440). More specific sorting criteria for each farm type are given in italics in the description below.

- **North**. Conventional mixed farm with poor soils and lower heat sums. It combines arable and cattle farming. It has a rather low production intensity. *NUTS2 = AT12 OR AT13 AND NOT ORGANIC*
- **North Organic**. Organic mixed arable farm focusing on winter cereals and oats for human nutrition located in the traditional "potato region". It has no possibility for irrigation and rather low yields. The cattle mainly consist of dairy cows. *NUTS2 = AT12 OR AT13 AND ORGANIC*
- **Northeast.** Conventional stockless arable farm, located in the hilly northern part of Austria. A mixture of good soils and rather poor soils is present there. *NUTS2 = AT11 AND NOT ORGANIC*
- **Northeast Organic.** Organic stockless arable farm, prevailing hilly ground only partly possible to irrigate; yields are mostly limited by water shortage; low yield difference between organic and conventional; in the southern part of the region very good soils are prevailing (chernozem). *NUTS2 = AT11 AND ORGANIC*
- **Pre-Alpine**. Conventional mixed farm with good soils, 600-850mm precipitation per year. It has a high production intensity. *NUTS2 = AT31 AND NOT ORGANIC*
- **Pre-Alpine Organic**. Organic mixed farm, with small scale husbandry in often old, adapted stables, to make use of meadows. It has medium yields because of often suboptimal mechanic weeding. *NUTS2 = AT31 AND ORGANIC*
- **Southeast**. Conventional mixed farm with good soils. Precipitation about 800 mm per year make the best conditions for production, but with high risk of erosion. It has a high concentration of pigs. *NUTS2 = AT21 OR AT22 AND NOT ORGANIC*
- **Southeast Organic**. Organic mixed farm, good soils. The farm focuses on soybean and pumpkin for oil production. It is mostly an arable farm with a secondary fruit production (apple). *NUTS2 = AT21 OR AT22 AND NOT ORGANIC*

The main characteristics of the current farm types are presented in Table 14. Organic farms account for 24% of land use.

Table 14 The main structural characteristics of current farm types in the arable sector in Austria

Farm type	Number of farms	Share of land use [%]	Farm size [ha]	Livestock concentration [LU/ha]	Share of legumes in UAA [%]	AWU	Labour intensity [AWU/100 ha]	Per farm depreciation [€/farm]
North	5,624	41%	66	0.14	5%	1.14	1.73	21,110
North Organic	2,184	14%	60	0.12	24%	1.55	2.61	25,501
Northeast	977	8%	76	0.04	13%	1.00	1.31	21,810
Northeast Organic	678	6%	73	0.01	30%	1.06	1.45	17,740
Pre-Alpine	3,356	14%	36	0.41	9%	0.88	2.40	17,299
Pre-Alpine Organic	626	2%	32	0.38	26%	1.25	3.86	18,170
Southeast	3,985	13%	30	0.69	10%	1.21	4.06	18,246
Southeast Organic	567	2%	26	0.54	19%	1.16	4.49	19,067

3.4.2.Future typology

Based on the discussion of the workshops conducted in Austria, the continued growth of the “cheap organic” sector is expected. One supermarket chain in Austria, REWE, has already begun to establish a new, affordable organic product line called BillaBio, with the slogan “Organic for everyone.” The line contains a high percentage of non-Austrian ingredients, and its prices are lower than those of Austrian organic products. Consumers often find it difficult to identify that these products do not originate from Austria, leading experts to discuss concerns such as greenwashing and false labelling. Despite this, it is likely that the sector of organic sales will continue to grow.

Another significant issue highlighted by the experts is the growing gap between public policy and actual implementation in Austria. For example, public policy has set a goal for 30% of organic ingredients in food provided by federal institutions by 2025. However, in public community kitchens, the actual share is only 1%. This gap between words and deeds is also evident in private consumption. Although consumer surveys show a strong willingness to buy organic, sales volumes do not reflect this intent. Experts predict that these discrepancies between policy and consumer behaviour will persist in the coming years.

A rise in bureaucratic burdens for organic farms is also anticipated. Bureaucracy is already a significant obstacle for the organic sector, with the gap between the additional work required (due to more standards and documentation) and the lack of corresponding benefits (such as higher prices or greater public funding) growing wider. This trend is pushing some farmers to consider returning to conventional farming. Another trend noted is the gradual shift toward vegetarian or vegan diets in Austria, although this remains small. Moreover, the pressure on prices and production costs is intensifying, alongside the globalisation of the organic market. Experts also see a growing importance of the "regional" label, which may compete with the organic label in the future.

In northern Austria, more agricultural land is being converted into nature-protected areas, and an increasing number of farmers are opting to rent or sell their land when the remuneration is higher than the revenue generated from organic production. New crops will become more important due to climate change, and although they currently represent a small percentage of total production, there is a trend of new farmers (career changers) entering the sector of diversified small farms. However, each year, farms are closing as farmers retire without successors.

Overall consequences of these trends on organic arable farms:

- No significant growth in the share of organic farms within the Austrian arable sector is expected.
- Farms will either grow in size—up to twice the size of their arable area by 2035—or remain small and transition to diversified, direct-selling operations. Some farms will cease production and rent out their land. A small percentage of farms will diversify and focus on direct selling.
- Livestock numbers will generally decrease. However, some farms, particularly in the Pre-Alpine and northern regions, may expand their livestock, while others will cease animal husbandry altogether.
- The number of workers on farms will need to decrease to manage rising production costs.
- New climate-adapted crops will be cultivated.

These considerations led to the following typologies of future organic and conventional farms. It is important to note that while almost all current farm types evolve in the future systems, some of them remain still present in the future scenarios (Pre-Alpine org, Southeast, Southeast org).

- **North**. Conventional farm that emerges from the current North farm type larger in size (application of 2010-2020 trends of size increase to a 15-year period). *NUTS2 = AT12 OR AT13 AND NOT ORGANIC AND UAA > 48 ha*
- **North Organic**. Organic farm that emerges from the current North org farm type. The farm has grown in size. Stockless. Grassland and very extensive arable areas are subsidised as “environmental protection areas” in the frame of the “Austrian Environmental Program”. Rotation is coined by a stable high share of potatoes and (for the region) new crops like pumpkins and soybean. *NUTS2 = AT12 OR AT13 AND ORGANIC AND UAA > 50 ha AND LU/UAA <=0 AND Share potatoes and soybeans in UAA > 10%*
- **North Organic Liv**. Organic farm that emerges from the current North org farm type. The farm size remains stable. Livestock activities are intensified to make use of grassland and forage legumes. Fattening cattle is one of the main farm activities. The meat is partly sold in direct sales, partly via retailers. *NUTS2 = AT12 OR AT13 AND ORGANIC AND LU/UAA > 0.6*
- **Northeast**. Conventional farm that emerges from the current Northeast farm type larger in size (application of 2010-2020 trends of size increase to a 15-year period). *NUTS2 = AT11 AND NOT ORGANIC AND UAA > 80 ha*
- **Northeast Organic**. Organic farm that emerges from the current Northeast org farm type. The farm has grown in size. It is managed in a more extensive way (more fallow), which is a consequence of the need to reduce the number of working units; the additional land

comes either from other organic and conventional farmers, who end production. *NUTS2 = AT11 AND ORGANIC AND UAA > 75 ha AND LU/UAA <=0*

- **Pre-Alpine**. Conventional farm that emerges from the current pre-Alpine farm type larger in size (application of 2010-2020 trends of size increase to a 15-year period). *NUTS2 = AT31 AND NOT ORGANIC AND UAA > 33 ha*
- **Pre-Alpine Organic Div**. Organic farm that emerges from the current pre-Alpine org farm type. This farm is diversified and specialises in direct sales. It has an intense cooperation with other producers to keep the amount of workload as low as possible (including exchange of products for direct marketing) and a high share of crops like vegetables, fruits, or wine. *NUTS2 = AT31 AND ORGANIC AND Share permanent crops, legumes, and potatoes in UAA > 0%*
- **Pre-Alpine Organic Large**. Organic farm that emerges from the current pre-Alpine org farm type. It focuses solely on primary agricultural production and has expanded in size. It sees an increase in the share of corn (and possibly sorghum) and soybeans. The barns have been modernised, and the amount of livestock has grown, with laying hens or broilers raised through contract farming for retailers. The farm also shares machinery for arable farming. *NUTS2 = AT31 AND ORGANIC AND UAA > 45 ha*
- **Pre-Alpine Organic**. Same farm type as the current pre-Alpine org farm type.
- **Southeast**. Same farm type as the current Southeast farm type as no size increase during 2010-2020.
- **Southeast Organic**. Same farm type as the current Southeast org farm type. This initial farm type does not evolve in a future farm type as experts stressed the low relevance of this region for the future development of organic arable farming in Austria.

The main structural characteristics of the future farm types are presented in Table 15.

Table 15 The main structural characteristics of future farm types in the arable sector in Austria

Farm type	Farm size [ha]	Livestock concentration [LU/ha]	Share of legumes in UAA [%]	AWU	Labour intensity [AWU/100 ha]	Per farm depreciation [€/farm]
North	96	0.12	6%	1.46	1.53	28,924
North Organic	77	0.00	29%	1.60	2.08	27,524
North Organic Liv	52	1.17	20%	1.94	3.75	40,249
Northeast	124	0.01	13%	1.30	1.05	30,925
Northeast Organic	117	0.00	30%	1.29	1.10	26,724
Pre-Alpine	54	0.45	9%	1.30	2.41	23,107
Pre-Alpine Organic Div	23	0.48	19%	1.33	5.82	17,963
Pre-Alpine Organic Large	48	0.16	24%	1.40	2.92	20,634
Pre-Alpine Organic	32	0.38	26%	1.25	3.86	18,170
Southeast	30	0.69	10%	1.21	4.06	18,246
Southeast Organic	26	0.54	19%	1.16	4.49	19,067

3.4.3.Simulated scenarios

For the sake of simplicity, all simulated scenarios assume that the total agricultural land in Austria and in each production region remains stable. Specific modelling assumptions for each simulated scenario are outlined below.

Reference. In the Reference scenario, the current share of organic area in the arable sector is assumed to stagnate. The distribution of organic area in each production region also remains stable. In the North, 10% of the organic area is allocated to North org Liv and 90% to North org. In the pre-Alpine region, 60% of the organic area is still allocated to Pre-Alpine Organic, 25% to Pre-Alpine Organic Large and 15% to Pre-Alpine Organic Div.

Organic on Every Table. Workshop participants did not consider this scenario to be a realistic outlook for the development of the organic sector in Austria since a decrease in producer prices is expected making organic farming less economically viable. The simulations assume that the current share of organic land in the arable sector will remain stable. However, participants suggested that, in the worst case, this share could fall below 20%. The distribution of organic farms in the north and pre-Alpine regions is assumed to remain the same as in the Reference scenario.

Green Public Policy. In the Green Public Policy scenario, the organic area is expected to reach a share of 38%. The positive development will largely depend on the availability of attractive incentives, including the growth of the organic market and the level of funding in future agri-environmental programmes. If public funding were to increase significantly compared to current levels, there would be less structural change, meaning that medium-sized farms would likely continue to exist. In this scenario, experts expect the organic share to stabilise in the south-eastern region, as this is not seen as a major area for future growth of organic arable farming in Austria. In all other regions, the area of organic farms has the same rate of growth for each organic farm with respect to the Reference scenario.

Table 16 shows the share of land use for the different future farm types in the three simulated scenarios.

Table 16 Share of land use for the different farm types in the initial situation and in the three simulated scenarios in the arable sector in Austria.

Farm type	Initial situation	Reference	Organic on Every Table	Green Public Policy
North	41.0%	41.0%	41.0%	31.5%
North Organic	14.5%	13.0%	13.0%	21.5%
North Organic Liv	0.0%	1.4%	1.4%	2.4%
Northeast	8.3%	8.3%	8.3%	4.7%
Northeast Organic	5.5%	5.5%	5.5%	9.1%
Pre-Alpine	13.6%	13.6%	13.6%	12.1%
Pre-Alpine Organic Div	0.0%	0.3%	0.3%	0.6%
Pre-Alpine Organic Large	0.0%	0.6%	0.6%	0.9%
Pre-Alpine Organic	2.3%	1.4%	1.4%	2.2%
Southeast	13.2%	13.2%	13.2%	13.2%
Southeast Organic	1.6%	1.6%	1.6%	1.6%

3.4.4.Modelling results

In the **Reference** scenario, the concentration of farming activities in larger farms forces 22% of current farms out of the market (Figure 20). Farm exits occur relatively evenly across different farm types, except for those that do not expand in size, such as Pre-Alpine org, Southeast, and Southeast org. The presence of larger farms reduces the total number of holdings in the sector by 22% (Figure 21), with the most significant declines in the northeast (-38%), followed by the northern (28%) and pre-Alpine (27%) regions. In contrast, the number of holdings in the southeast remains stable. The economies of scale achieved by larger farms increase labour productivity, leading to a 7% reduction in total agricultural employment. This decline is concentrated in the northeast (21%) and northern (12%) regions. However, in the southeast and pre-Alpine regions, employment remains stable, as future farm types maintain labour intensities similar to their initial counterparts. In the organic sector, the dynamics are the same. The number of holdings decreases by 17% and the number of people working in organic farms by 11%. Looking at farms average structural characteristics (Figure 22), the average farm size increases by 28%, along with the number of people working on the farm (18%) and annual capital depreciation (21%). In contrast, other indicators remain largely unchanged.

Since workshop participants viewed the **Organic on Every Table** scenario as a rather pessimistic outlook for the development of organic agriculture in Austria, its results remain identical to those of the Reference scenario.

In the **Green Public Policy** scenario, many conventional farms transition to organic production. Since organic farms are slightly smaller than conventional ones, the number of farm exits is lower than in the Reference scenario, reaching 19% of initial farms. Unlike the Reference scenario, these exits affect only conventional farms: 34% of initial conventional farms exit the market in the north, 63% in the northeast, and 28% in the pre-Alpine region. The total number of farms in the arable sector increases by 3% compared to the Reference scenario. This growth mainly occurs in the north and pre-Alpine regions (5% in each), where the size difference between conventional and organic farms is more pronounced. In contrast, the increase is only 2% in the Northeast, while the number of farms remains stable in the Southeast. As organic farms are generally more labour-intensive, particularly those that integrate livestock and crop activities or diversify their production, the total number of workers in the sector increases by 4% compared to the Reference scenario. This growth is mainly concentrated in the north (7%) and pre-Alpine regions (5%), where such diversified organic farms are more prevalent. In the organic sector, the land managed organically increases by 61% compared to the Reference scenario, driving up the number of organic farms by 54%, reaching more than 5,000 units. The number of workers employed in these farms also rises by 56%, almost reaching 8,000 AWU. The average structural characteristics of farms in the Green Public Policy scenario are largely similar to those in the Reference scenario, with two key exceptions. First, the share of legumes in arable farms's land use increases from 12% to 15%, as organic farms rely more on these crops. Second, following the expansion of organic production, pesticide and fertiliser costs decrease by 15% compared to the Reference scenario.

In the Austrian arable sector case study, we analysed two possible transition pathways for farms, which we consider to be meaningful for the sector. In both transitions, we used the current conventional North farm type as the starting point, as this farm type has the highest share of total agricultural land in the arable sector. This farm type has an average family farm income per family work unit of € 39,436. In the first transition, the current North farm remains the same type but with future characteristics (larger size of the farm). In the second, it converts to the North Organic farm type.

In the first case, we assume that the share of the assets of the initial farm that are incompatible with the transition is 0% (ω_{ff}), and that the share of the assets of the future farm that must be purchased brand new (σ_{ff}) is also 0%. The value of β_{ff} (the annual depreciation of assets of the initial farm that exceeds the needs of the future farm) is also zero meaning that the depreciation schedule D is equal to D*. In the second case, we assume that the conversion to organic may render some machinery used for spreading synthetic fertilisers or chemical pesticides unnecessary. This leads to consider that the share of the assets of the initial farm that are incompatible with the transition, amounts to 29% (ω_{ff}). In addition, as after the conversion to organic the farm has to purchase some new machineries for mechanical weeding σ_{ff} is fixed to 34%. In this transition, β_{ff} value is 0 as the depreciation of the future farm is largely higher than the depreciation of the current farm.

Figure 23Figure 37 shows that, all things being equal, the family farm income per family work unit is higher in both cases than in the initial situation. However, the conversion to the North Organicfarm type allows a significant higher performance than the transition to the future North farm type in all possible situations. Conversion to organic farming can still be more financially beneficial for the current North farm compared to its initial situation if total prices decrease by 20%, total subsidies decrease by 20%, or intermediate consumptions increase by 20%, assuming all other factors remain constant. Finally, when comparing depreciation schedules D and D*, schedule D results in higher revenues, approximately €6,000 more. However, given the significant gap in family farm income per family work unit between the future organic and conventional farms, conversion to organic remains more favourable, even with depreciation schedule D*.

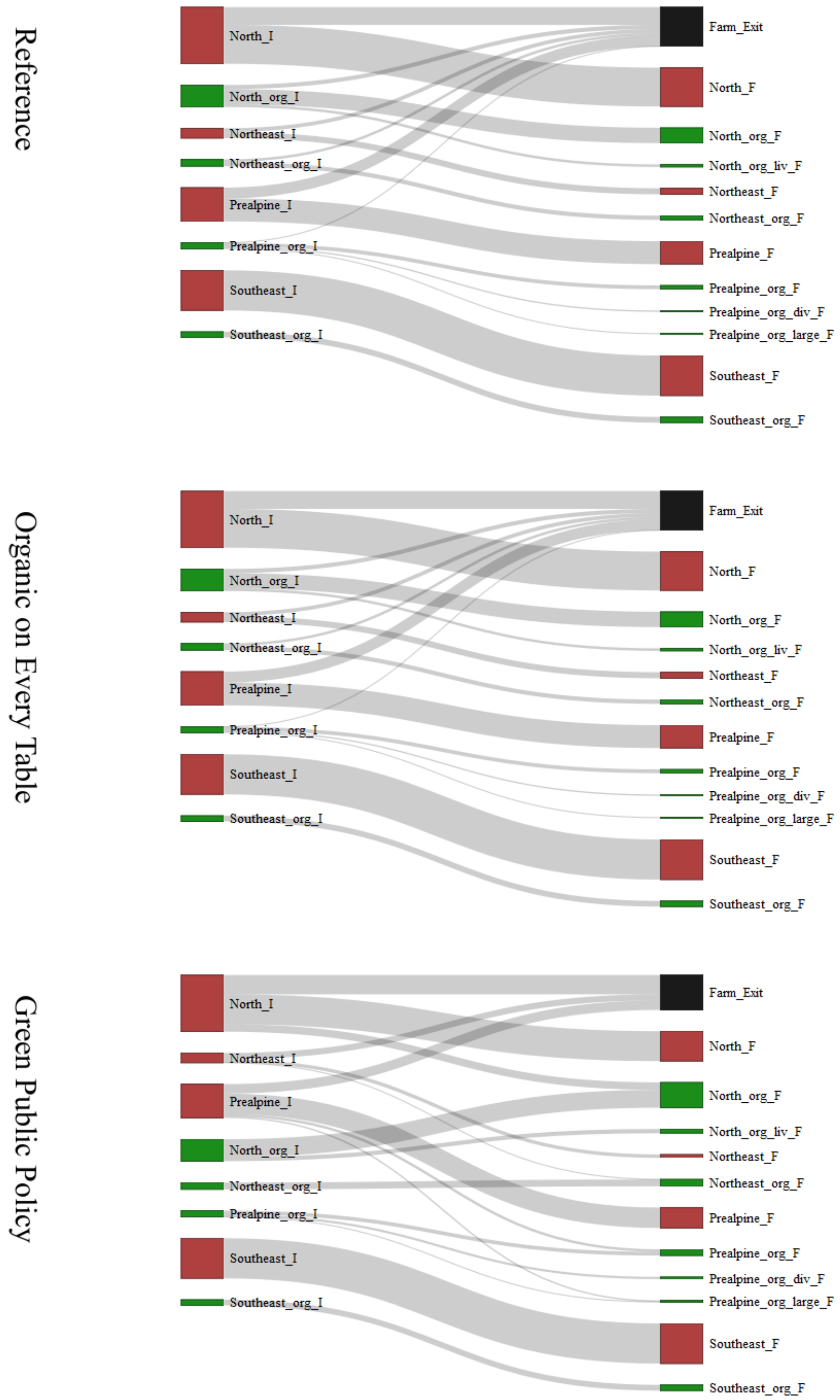

Figure 20 Transition pathways of current farms in the three simulated scenarios in the arable sector in Austria (I= Initial farm type; F= Future farm type)

Figure 21 Number of farms and Agricultural Working Unit (AWU) in the Initial situation and in the three simulated scenarios in the arable sector in Austria

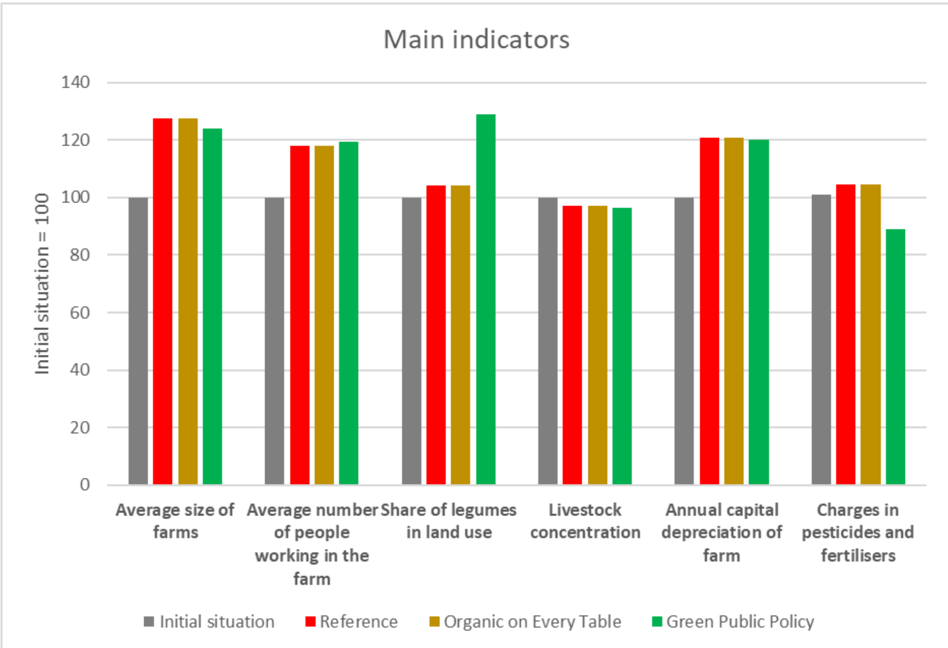

Figure 22 Main structural indicators of arable farms in Romania in the Initial situation and in the three simulated scenarios

a			D			D*		
			IC-20	IC	IC+20	IC-20	IC	IC+20
North (future type)	**P-20**	**S-20**	29 515	14 163	-1 188	29 515	14 163	-1 188
		S	36 207	20 856	5 504	36 207	20 856	5 504
		S+20	42 899	27 548	12 196	42 899	27 548	12 196
	P	**S-20**	55 147	39 795	24 444	55 147	39 795	24 444
		S	61 839	46 488	31 136	61 839	46 488	31 136
		S+20	68 531	53 180	37 828	68 531	53 180	37 828
	P+20	**S-20**	80 779	65 428	50 076	80 779	65 428	50 076
		S	80 779	65 428	50 076	80 779	65 428	50 076
		S+20	94 163	78 812	63 460	94 163	78 812	63 460

b			D			D*		
			IC-20	IC	IC+20	IC-20	IC	IC+20
North - Organic (future type)	**P-20**	**S-20**	56 305	38 342	20 379	50 124	32 161	14 199
		S	66 858	48 895	30 932	60 677	42 714	24 752
		S+20	77 411	59 448	41 485	71 230	53 267	35 305
	P	**S-20**	88 812	70 850	52 887	82 632	64 669	46 706
		S	99 365	81 403	63 440	93 185	75 222	57 259
		S+20	109 918	91 956	73 993	103 737	85 775	67 812
	P+20	**S-20**	121 320	103 357	85 394	115 139	97 176	79 214
		S	131 873	113 910	95 947	125 692	107 729	89 767
		S+20	142 426	124 463	106 500	136 245	118 282	100 320

Figure 23 Transition matrix from a current North farm type to a future North farm type (a) and to a North – org farm type (b). Current income **€ 39,436**.

3.5. The arable sector in Romania

3.5.1. Current typology

In Romania, arable farms vary in size, with the largest conventional farms covering up to 18,000 hectares, while the largest organic farms typically range between 10,000 and 15,000 hectares. The land is often managed through a rent system, where farm managers lease small plots from owners, who are sometimes part of cooperatives. While the majority of these large farms remain conventional, the trend of converting to organic agriculture is gaining some attention, particularly among foreign investors. Farms owned by Arab investors, who primarily focus on conventional cereals, are less likely to convert to organic. However, when such a shift occurs, the impact is significant, especially if the demand for organic products grows. Many of these farms export their produce to countries like Austria, France, and Germany, making them highly dependent on foreign markets, though not overly reliant on international trade.

Cereal production in Romania is export-oriented, with a focus on meeting foreign demand, particularly for wheat. Over 60% of organic production is exported, while conventional production also has a high export rate. However, there is an issue of overproduction, especially in wheat. The South-East and South-West regions of Romania are key areas for organic agriculture, particularly near protected areas of the Danube, which offer natural advantages such as sufficient rainfall and minimal irrigation needs. This makes the region an attractive destination for investors. Organic farming in these areas tends to be more intensive, depending on the share of organic land, while conventional farming is more widespread across the northern and eastern parts of the country.

Organic farmers face several challenges in expanding their operations, such as difficulty accessing capital for growth and investing in processing equipment. Additionally, land market issues hinder progress, as farms must convert all their land to organic in order to sell it, and many conventional farmers are reluctant to make the switch. Despite some incentives to boost local production, they are insufficient. Crop rotation in organic systems often includes legumes, rapeseed, and cereals such as wheat, with a focus on drought-resistant crops, especially in the southern regions where water scarcity is a concern. There is growing demand for drought-resistant seeds and more productive crops, prompting a call for better organic advisory networks and improved research.

The current typology of arable farms in Romania is based on four criteria (Figure 24). The first is the distinction between professional and family farms. In this report, only professional farming is considered, as data on family farms are almost non-existent, especially for organic production. However, according to Eurostat, family farms are numerous in Romania and account for about 25% of the total agricultural area in the arable sector[9]. In order to distinguish between professional and family farms, we used the size of the farm as a proxy. Farms larger than 100 ha were considered as professional farms, while the rest were considered as family farms.

The second criterion used is the geographical location. We have divided Romania into two regions: Hills/Plateau/Moldova (HPM) and South, based on the Romanian NUTS2 (Figure 25). Professional farms in the first region represent 31% of the agricultural land of professional arable farms in Romania. In this region, rainfall is higher, and the landscape is mostly hilly, except in the Transylvanian Plateau and the western part of Moldova. The southern region represents 69% of

[9] https://ec.europa.eu/eurostat/databrowser/view/ef_m_org/default/table?lang=en

the agricultural area of professional arable farms in Romania. It is drought-prone and corresponds to the Danube region. It is important to note that this geographical aggregation is less detailed than the one proposed by the experts during the Romanian workshop. During the workshop, the experts further subdivided the country into two additional areas based on the county division where the presence of organic farming is currently higher[10]. However, this finer level of aggregation was not possible due to the limitations of the FADN data extraction obtained for the project, where farm data are not presented at the county level.

The third criterion used to distinguish Romanian arable farms is the organic versus conventional production method. Finally, conventional farms were further divided into large and medium-sized farms according to their size.

Because of limited data on organic arable farms in Romania, it was not possible to separate organic arable farms according to their size, which constitutes a huge limitation in the analysis of this case study.

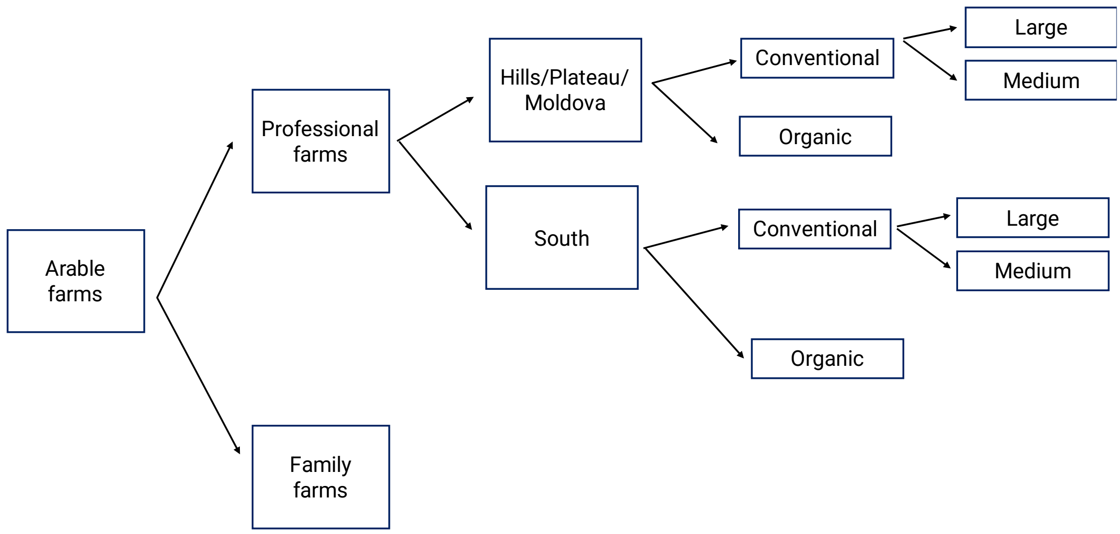

Figure 24 The typology tree for the current typology of arable farms in Romania

[10] The first area which has a relative high presence of organic arable land is composed by the following counties: Dolj, Botoșani, Bistrița-Năsăud, Gorj, Brăila, Ialomița, Brașov. The second area where the presence of organic arable land is even higher is composed by the following counties: Tulcea, Timiș, Constanța, Iași, Cluj, Bucuresti-Ilfov, Arad, Satu Mare, Sălaj, Mureș, Sibiu, Harghita.

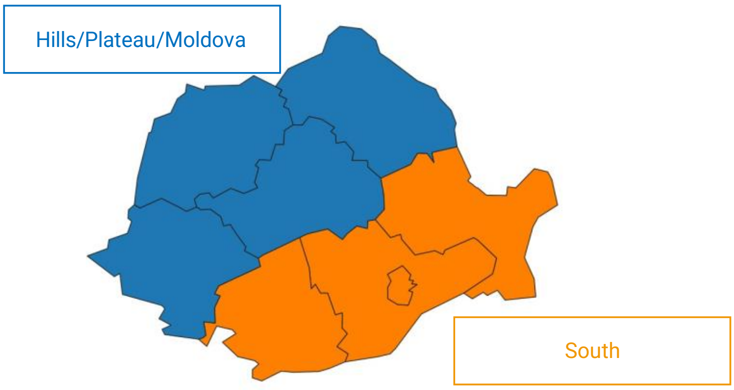

Figure 25 Romanian regions

All farms belong to the FADN type of farming 15. More specific sorting criteria for each farm type are given in italics in the description below.

- **HPM Large**. Large arable conventional farm located in the Hills/Plateau/Moldova region. *NUTS2 = RO11 OR RO12 OR RO21 OR RO42 AND UAA > 1000 ha AND NOT ORGANIC*
- **HPM Medium**. Medium arable conventional farm located in the Hills/Plateau/Moldova region. *NUTS2 = RO11 OR RO12 OR RO21 OR RO42 AND 1000 ha < UAA > 100 ha AND NOT ORGANIC*
- **HPM Organic**. Organic farm located in the Hills/Plateau/Moldova region. *NUTS2 = RO11 OR RO12 OR RO21 OR RO42 AND UAA > 100 ha AND ORGANIC*
- **South Large**. Large arable conventional farm located in the South region. *NUTS2 = RO22 OR RO31 OR RO32 OR RO41 AND UAA > 1000 ha AND NOT ORGANIC*
- **South Medium**. Medium arable conventional farm located in the South region. *NUTS2 = RO22 OR RO31 OR RO32 OR RO41 AND 1000 ha < UAA > 100 ha AND NOT ORGANIC*
- **South Organic**. Organic farm located in the South region. *NUTS2 = RO22 OR RO31 OR RO32 OR RO41 AND UAA > 100 ha AND ORGANIC*

The main characteristics of the current farm types are presented in Table 17. Organic farms account for 1.9% of land use. In HPM and South regions the share of organic arable land is very similar: 1.8% in the first case, 2% in the second.

Table 17 The main structural characteristics of current farm types in the arable sector in Romania

Farm type	Number of farms (2020)	Share of land use [%] (2020)	Farm size [ha]	Share of legumes in UAA [%]	AWU	Labour intensity [AWU/100 ha]
HPM Large	221	9%	1,762	5%	12.1	0.68
HPM Medium	3,582	21%	270	5%	2.9	1.08
HPM Organic	50	0.6%	501	12%	3.8	0.76
South Large	568	22%	1,734	5%	11.8	0.68
South Medium	6,947	46%	300	5%	2.7	0.91
South Organic	130	1.4%	472	12%	3.4	0.72

3.5.2. Future typology

The most practical strategy for large farms in the South is to focus on expansion with minimal diversification, particularly in terms of land, labour, and value-added processes. These farms primarily export bulk cereals, targeting foreign clients who purchase large quantities. With their business model built around large-scale cereal production, expanding output rather than diversifying seems the most logical approach. As a result, their size is expected to grow by 30%.

Medium-sized farms and large farms in the HPM region are more likely to expand and diversify, especially through capital investment, technology upgrades, and value-added production. However, some of these farms may stabilise in size and gradually shift towards more specialised, value-added approaches. Consequently, their size is expected to increase only by 10%.

Organic farms are likely to expand through conversion, with potential for increased specialisation. These farms are expected to either maintain or slightly grow their operations. If market conditions are favourable, they might also explore alternative strategies, such as adopting an "organic plus" model that includes agroecology and climate change mitigation practices. Therefore, their size is projected to grow by 20%.

Finally, across all farms in the arable sector, we anticipate a 10% reduction in labour intensity due to technological advancements.

- **HPM Large**. Same farm type as the current HPM Large farm type with a 10% increase in size and a -10% decrease in labour intensity.
- **HPM Medium**. Same farm type as the current HPM Medium farm type with a 10% increase in size and a -10% decrease in labour intensity.
- **HPM Organic**. Same farm type as the current HPM Organic farm type with a 20% increase in size and a -10% decrease in labour intensity.
- **South Large**. Same farm type as the current South Large farm type with a 30% increase in size and a -10% decrease in labour intensity.
- **South Medium**. Same farm type as the current South Medium farm type with a 10% increase in size and a -10% decrease in labour intensity.

- **South Organic**. Same farm type as the current South Organic farm type with a 20% increase in size and a -10% decrease in labour intensity.

The main structural characteristics of the future farm types are presented in Table 18.

Table 18 The main structural characteristics of future farm types in the arable sector in Romania

	Farm size [ha]	Share of legumes in UAA [%]	AWU	Labour intensity [AWU/100 ha]
HPM Large	1,938	5%	11.9	0.62
HPM Medium	324	5%	3.2	0.97
HPM Organic	551	12%	3.8	0.68
South Large	2,255	5%	13.9	0.61
South Medium	330	5%	2.7	0.82
South Organic	566	12%	3.7	0.65

3.5.3.Simulated scenarios

For the sake of simplicity, all simulated scenarios assume that total agricultural land in Romania and in each region remains stable. Specific modelling assumptions for each simulated scenario are outlined below.

Reference. In the Reference scenario, Romania's organic farming sector is expected to grow at a moderate pace, driven by existing trends without significant changes in policy or consumer demand. This scenario reflects a continuation of current conditions, with organic farming gradually increasing in response to existing market forces and the slow adoption of organic practices by farmers. In this scenario, organic farming is projected to reach approximately 11% of agricultural land. This growth assumes no major shifts in consumer demand or policy interventions. The Ministry of Agriculture's cautious target of 5.7% by 2030 reflects the current political environment, where there is limited political support for a significant push towards organic farming. Based on past trends, this scenario represents an optimistic outlook for Romania's organic sector. In this scenario, we assume a higher decrease in the share of land allocated to medium conventional farms in both regions. In this scenario we also assume that both medium and large size farms are interested in conversion and that the share of organic land is the same in the two regions.

Organic on Every Table. The Organic on Every Table scenario envisions a substantial boom in organic farming, driven by rising consumer demand and increasing exports, particularly within the EU. Large businesses fuel this market growth by expanding the availability of organic products and driving widespread adoption of organic practices. As consumer confidence in organic labels grows, particularly regarding environmental responsibility, animal welfare, and health benefits, supermarkets, restaurants, and schools increase their organic offerings. Major retailers and processors expand their organic product lines, often through partnerships or acquisitions of smaller organic producers in Romania. With more competition in the market, the price gap between organic and conventional products shrinks. Alternative models, like e-commerce, local box schemes, and farmers' markets also flourish, allowing farmers to gain more control over the supply chain and negotiate better deals with processors and retailers. With favourable market conditions and supportive policies, Romania sees a significant rise in organic conversions for both arable and permanent crops. Small organic farmers would benefit from stronger networks, cooperatives, and clusters, with Romania's export potential playing a key role in driving growth. Under this scenario, Romania's organic arable sector expands to 17% of agricultural land by 2035. As in the Reference scenario, we assume that both medium and large size farms are interested in conversion and that there is a higher decrease in the share of land allocated to medium conventional farms in both regions. However, as this scenario is mainly driven by clustering networks, we assume that the Southern region is the region where most of conversion takes place. In this region, 20% of land is converted to organic, while in the HPM region this is the case for only 10% of land.

Green Public Policy. In the Green Public Policy scenario, organic farming growth is more dependent on government support, particularly through the Common Agricultural Policy. While public institutions provide crucial backing, the growth is slower compared to the Organic on Every Table scenario due to the lesser emphasis on consumer-driven demand. However, public support still plays an essential role, helping to stabilize and expand the market for organic products. Romania would benefit from more harmonised EU subsidies, reducing the discrepancies in public support and market development across countries. A key development in this scenario would be the increased purchasing of organic products by public institutions, creating a more reliable and stable market demand for organic goods. Despite the slower pace of growth, the organic sector reaches 14% of agricultural land in this scenario. As in the Reference scenario, we assume that both medium and large size farms are interested in conversion, that the share of organic land is the same in the two regions, and that there is a higher decrease in the share of land allocated to medium conventional farms in both regions.

Table 19 Table 20 show respectively the changes in the allocation of agricultural land, and the final share of agricultural land for the different future farm types in the three simulated scenarios.

Table 19 Allocation of agricultural land for each category of farm types in the initial situation and in three simulated scenarios in the arable sector in Romania

	Initial situation	Reference	Organic on Every Table	Green Public Policy
Family	25%	25%	25%	25%
Conventional	75%	75%	75%	75%
Professional				
HPM	31%	31%	31%	31%
South	69%	69%	69%	69%
Professional HPM				
Conventional	98%	89%	90%	86%
Organic	1.8%	11%	10%	14%
Professional South				
Conventional	98%	89%	80%	86%
Organic	2.0%	11%	20%	14%
Professional HPM Conventional				
HPM Large	29%	31%	31%	31%
HPM Medium	71%	69%	69%	69%
Professional South Conventional				
South Large	32%	34%	34%	34%
South Medium	68%	66%	66%	66%

Table 20 Share of land use for the different farm types in the initial situation and in the three simulated scenarios in the arable sector in Romania

	Initial situation	Reference	Organic on Every Table	Green Public Policy
HPM Large	9%	8%	9%	8%
HPM Medium	21%	19%	19%	18%
HPM Organic	0.6%	3%	3%	4%
South Large	22%	21%	19%	20%
South Medium	46%	41%	37%	39%
South Organic	1.4%	8%	14%	10%

3.5.4.Modelling results

In the **Reference** scenario, the concentration of farming activities forces 14% of the current farms out of the market (Figure 26). As large conventional and organic farms remain in the market, favoured by positive market conditions that favour market concentration and organic production, only medium-sized conventional farms leave the market. Since all large farms remain, a greater proportion of them convert to organic farming compared to medium-sized farms. Specifically, 11% of large farms in the HPM region and 26% in the South region transition to organic production, whereas for medium-sized farms, this share is only 5% in both regions. In this scenario, the increase in farm size reduces the number of farms on the market by 14% (Figure 27). At the same time, the presence of farms with higher productivity, combined with an overall productivity increase across all sector, decreases the number of agricultural workers by 12%. In the organic sector, the area of land managed organically increases by 475%. As farm size and labor productivity also rise among organic farms, the number of organic holdings grows by 379%, while the number of agricultural workers hired on these farms increases by 418%. Looking at farms average structural characteristics (Figure 28), the average size of farms increases by 16%, the average number of workers in the farm only by 2% as an effect of lower labour intensity and the share of legumes of legumes in the land use by 12% passing from 5% to 6%.

In the **Organic on Every Table** scenario, as organic farms are, on average, larger than medium-sized conventional farms, the expansion of organic farming leads to a slightly higher number of medium-sized farms exiting the market, 15% in the HPM region and 17% in the South. In comparison, under the Reference scenario, this share was 15% in both regions. The share of large farms converting to organic is higher than in the Reference scenario in the South region, reaching 33% of the initial farms. In contrast, in the HPM region, this share remains similar to the Reference scenario at 10%. Overall, the total number of holdings and the total number of agricultural workers in the sector decline slightly by 1% and 0.8%, respectively, compared to the Reference scenario. This is because organic farms in the model are slightly larger and less labor-intensive than the average farms converting. In the organic sector, the number of holdings increases by 56% compared to the Reference scenario, with 83% of them located in the South region (compared to 71% in the Reference scenario). The number of workers employed in organic farms also rises by 53%. Finally, examining the average structural characteristics of arable farms, the increase in organic farms leads to a higher share of legumes in land use, reaching 7%.

In the **Green Public Policy** scenario, the increase in organic land and the distribution of organic farms closely resemble those in the Reference scenario, resulting in minimal changes. The number of large farms converting to organic remains higher than that of medium-sized farms, reaching 14% in the HPM region and 29% in the South region. In contrast, the share of medium-sized farms converting is only 7% in both regions. As in the Organic on Every Table scenario, the total number of holdings and agricultural workers in the arable sector declines slightly, by-0.7% and 0.5%, respectively, compared to the Reference scenario. In the organic sector, both the number of holdings and the number of agricultural workers employed on these farms increase linearly with the growth in organic land, rising by +27% compared to the Reference scenario. As in the Reference scenario, 71% of these holdings are located in the South region.

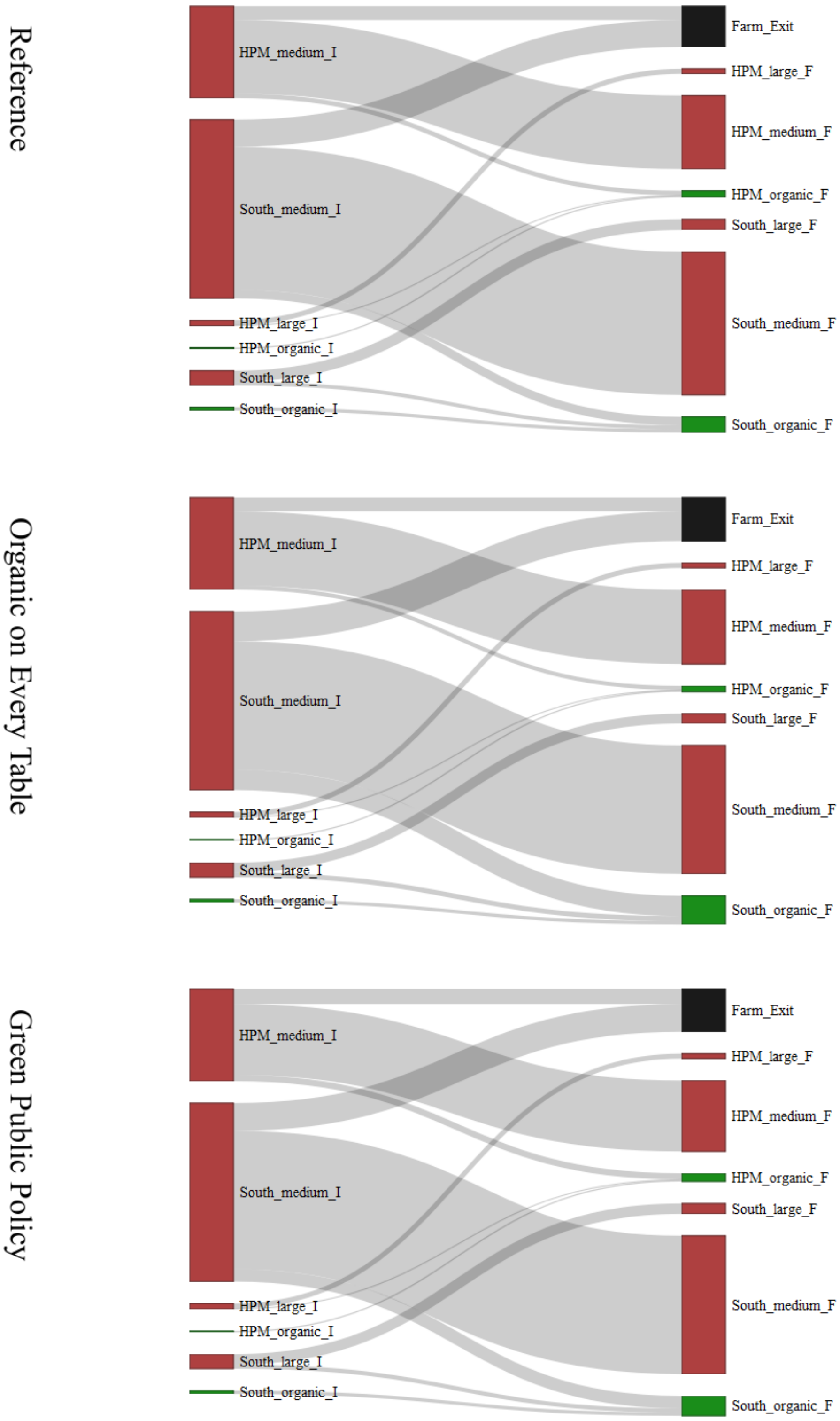

Figure 26 Transition pathways of current farms in the three simulated scenarios in the arable sector in Romania (I= Initial farm type; F= Future farm type)

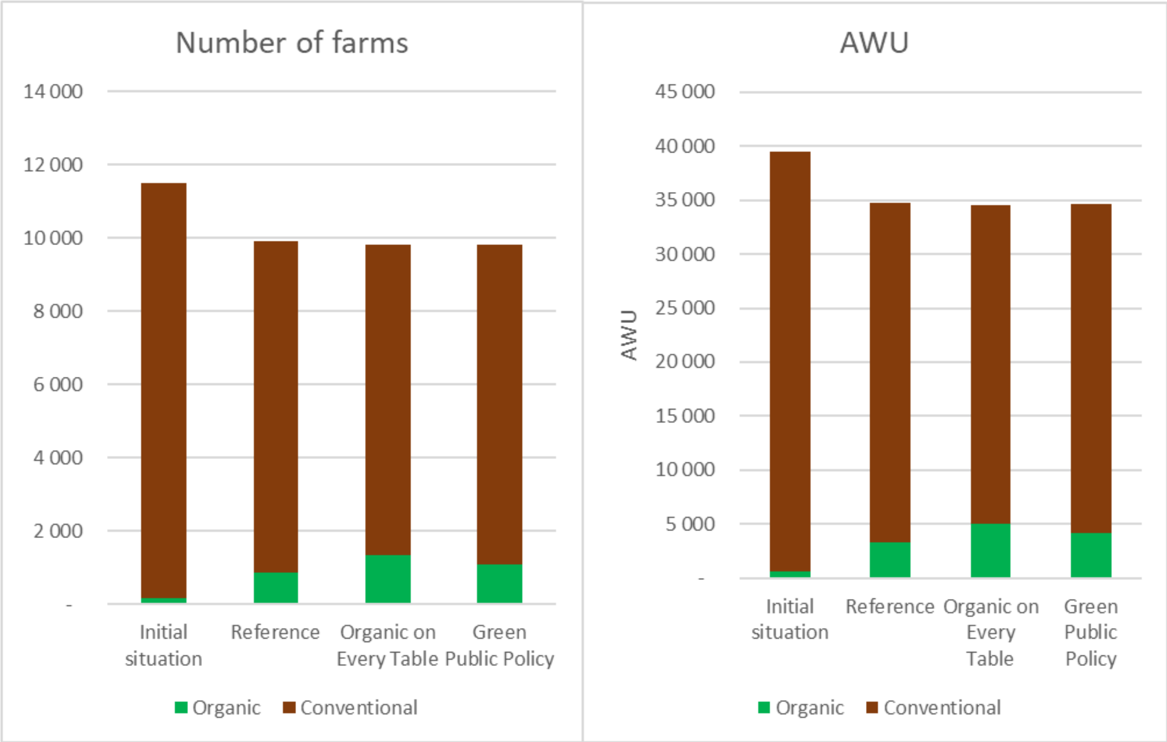

Figure 27 Number of farms and Agricultural Working Unit (AWU) in the Initial situation and in the three simulated scenarios in the arable sector in Romania

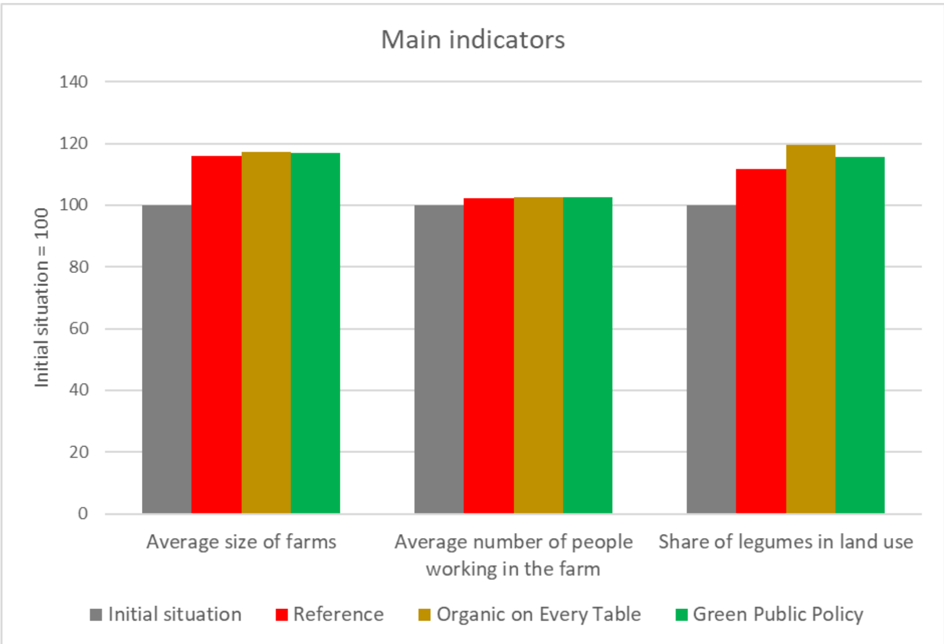

Figure 28 Main structural indicators of arable farms in Romania in the Initial situation and in the three simulated scenarios

3.6.The outdoor vegetable sector in Hungary

3.6.1.Current typology

According to the Hungarian Central Statistical Office, in Hungary, about 45% of the country's land is arable, with the majority used for cereals, oilseeds, and industrial crops. Less than 2% of this arable land is dedicated to vegetable production. Permanent grassland, which accounts for 13% of Hungary's land, is mainly used for livestock grazing, while forests cover 22% of the country. Water bodies make up 2-3%, and built-up areas such as urban and rural settlements cover 8-10%. Despite incentives for organic conversion available since 2009, Hungary has struggled to achieve a 3% conversion rate for arable crops. However, organic vegetable farming shows higher conversion rates (6%). The main organic vegetable crops grown in Hungary include sweet corn, green peas, pumpkins, squashes, and asparagus. These crops are typically produced when farmers have secure markets, whether they are annual or perennial. Despite challenges such as data gaps and outdated practices, there is significant potential for growth in the organic vegetable sector, especially with market-driven production.

Data on organic vegetable farming in Hungary is very limited, with most available information focused on land area rather than specific production details. For the past 20 years, it has been reported that 80-85% of organic agricultural products are exported, both in volume and market outlets. However, data on production quantities, prices, costs, processing methods, and target markets for organic vegetables is scarce. One notable feature of Hungarian organic vegetable farming is the high volume of organic sweet corn, which is a significant player at the European level.

While sweet corn is prominent, the export of fresh organic vegetables such as asparagus and mushrooms is minimal. Most organic vegetables are processed (frozen, canned, or preserved), similar to non-organic vegetables. The domestic market for fresh organic vegetables remains small. Organic farming in Hungary has been primarily supported by area-based subsidies, which have helped farmers transition to organic practices. However, these subsidies have also led to challenges, particularly in sectors as perennial crops, where low-yielding plantations are sometimes maintained through organic conversion. In the case of arable crops, some producers may focus more on securing subsidies than on actual production, although this issue remains poorly documented.

About two-thirds of Hungarian organic farms, excluding small ones, are partially converted, meaning they operate both organic and non-organic units. Organic farms tend to be larger than non-organic ones, and farm managers are generally younger and better educated. **Due to the very limited availability and poor quality of data on organic and mixed farms, we are unable to create a clear typology that distinguishes organic (or mixed) farms from conventional ones in this case study. As a result, for the typologies and model simulation, we simplify the approach by considering all farms as mixed.** If a farm converts part of its land to organic production, we assume that this change does not affect its overall structure or work organisation. This constitutes a huge limitation in the analysis of this case study.

In Hungary, outdoor vegetable systems are classified based on the specialisation of farming activities (Figure 29). There are four main categories: highly specialised vegetable production systems, field crop systems, mixed crop systems, and mixed crop and livestock systems. The field crop systems are further divided into smaller categories: small farms, small farms specialising in vegetable production, medium-sized farms, medium-sized farms specialising in vegetable production, and large farms.

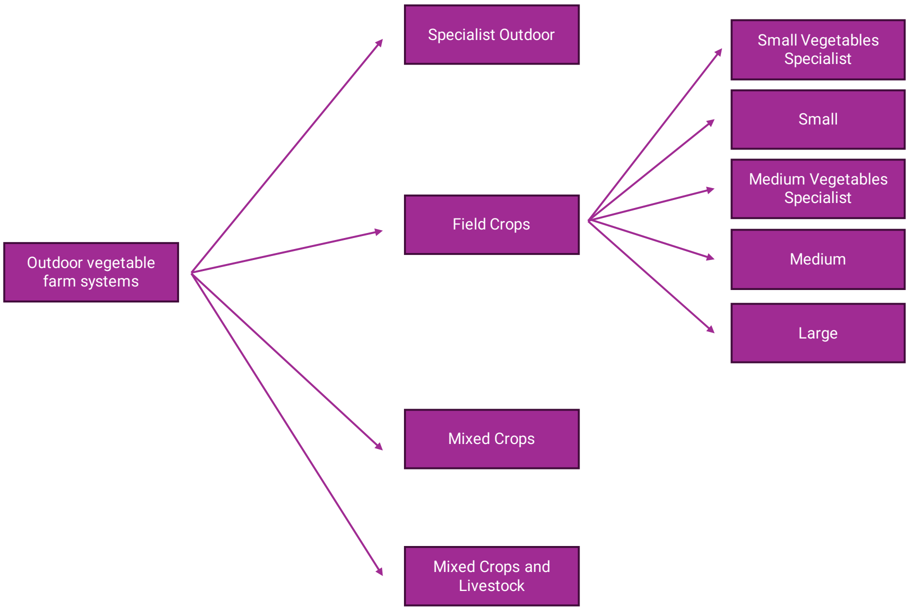

Figure 29 The typology tree for the current typology of outdoor vegetable farms in Hungary

- **Specialist Outdoor**. Farm highly specialised in outdoor vegetable production. It has small size a high labour intensity as much workforce is required to grow a high share of vegetables. *FARM CLASSIFICATION 221*
- **FC Small Vegetable Specialist**. Small field crops farm that combines to the main arable crops a high production of vegetables. Farms of this type are present in all pedoclimatic regions in Hungary. *FARM CLASSIFICATION 163 AND UAA < 150 ha*
- **FC Small**. Small field crops farm having a very low production of vegetables mostly located in the Great Plain and Transdanubia regions. *FARM CLASSIFICATION 151 OR 166 AND UAA < 150 ha*
- **FC Medium Vegetable Specialist**. Medium field crops farm that combines to the main arable crops a high production of vegetables. *FARM CLASSIFICATION 163 AND 150 ha < UAA < 1000 ha*
- **FC Medium**. Medium field crops farm having a very low production of vegetables. *FARM CLASSIFICATION 151 OR 166 AND 150 ha < UAA < 1000 ha*
- **FC Large**. Large field crops farm having a low production of vegetables mostly located in the Great Plain and the Transdanubia region. Farm of this type are less involved in agri-environmental climate measures than the farms in the other groups. *FARM CLASSIFICATION 151 OR 163 OR 166 AND UAA > 1000 ha*
- **Mixed Crops**. Farm having a heterogeneous mix of crops grown (field crops, vegetable, and permanent crops) and quite small size. Farms of this type are mostly located in the Great Plain region. *FARM CLASSIFICATION 612 OR 613 OR 614*

- **Mixed Crops and Livestock**. Farm that combines crop and livestock production. Vegetables are always grown as part of an arable crop rotation, with good mechanisation and minimal manual labour. Farms in this category typically have a relatively high proportion of grassland, where they raise ruminants and/or pigs. Organic farms in this category are more likely to keep cattle, providing access to organic manure for the farm. *FARM CLASSIFICATION 831 OR 832 OR 844*

The main characteristics of the current farm types are presented in Table 21. Organic vegetables account for 6% of the land used for vegetable production.

Table 21 The main structural characteristics of current farm types in the outdoor vegetable sector in Hungary

Farm type	Number of farms (2020)	Share of vegetables area [%] (2020)	Share of organic vegetables area [%]	Share of vegetables in farm UAA [%]	Farm size [ha]	Livestock concentration [LU/ha]	Share of permanent grassland in farm UAA [%]	AWU	Labour intensity [AWU/100 ha]	Per farm depreciation [€/farm]
Specialist Outdoor	4,138	44%	7%	44%	20	0.02	2%	2.6	13.2	6,798
FC Small Vegetable Specialist	947	7%	5%	35%	18	0.01	10%	1.2	6.8	2,055
FC Small	41,553	6%	5%	0%	32	0.04	9%	0.6	1.8	2,720
FC Medium Vegetable Specialist	44	5%	7%	32%	289	0.00	1%	9.7	3.3	43,508
FC Medium	4,233	8%	20%	1%	312	0.03	5%	4.1	1.3	39,907
FC Large	222	16%	40%	5%	1345	0.10	2%	23.3	1.7	164,248
Mixed Crops	3,071	8%	7%	5%	47	0.10	7%	2.2	4.8	11,612
Mixed Crops and Livestock	1,572	6%	9%	2%	138	0.67	15%	6.6	4.8	27,890

3.6.2.Future typology

In 2024, FruitVeb published a detailed evaluation of Hungary's fruit and vegetable sector, highlighting several challenges faced since the country's EU accession in 2004 (FruitVeb, 2024). Vegetable production has declined, with a shift towards less labour-intensive crops such as sweetcorn, green peas, and industrial tomatoes, which now dominate around two-thirds of the area. Despite efforts to mechanise production, Hungarian producers still lag behind more advanced countries. High investment costs and substantial annual input requirements have narrowed the sector, leaving only those with significant mechanisation and storage capacity.

Climate change has exacerbated these challenges, with heatwaves and droughts in recent years severely affecting agriculture. The Carpathian Basin, particularly central, southern, and eastern Hungary, has been hit by extreme weather, including late spring frosts, storms, and a decline in water resources. Only 2% of Hungarian agricultural land is irrigated, with the majority of this concentrated in the Great Plain region. The limited irrigation infrastructure, mostly reliant on sprinkler systems, is insufficient to combat droughts and atmospheric heat during growing seasons. As a result, more resilient crops such as white beans, lentils, and chickpeas are expected to replace traditional crops such as sweetcorn and green peas in the near future. Experts identify climate change, labour shortages, and market demand as the primary factors shaping the future of agriculture in Hungary. The Great Plain, once transformed through drainage and river regulation in the 19th century, is now facing sustainability issues. Water retention measures, such as adapting inland water channels and constructing reservoirs, are discussed as potential solutions but are delayed due to high investment costs and legal obstacles. Farmers are already experiencing significant losses due to rising input costs, market collapse, and water scarcity, which have particularly impacted livestock farming and summer crop cultivation.

A shift towards extensification is evident, particularly on smaller farms where traditional crops are being replaced by fallow land or abandoned areas. Livestock farms are also reducing production due to water shortages and increased heat-related risks. The future may see a decrease in the area dedicated to arable crops, especially summer crops such as maize and sunflower, while the number of animals in livestock farms may also decline. The government aims to increase the irrigated land area to 350,000 hectares, but this will require significant investment in irrigation infrastructure. Projection suggests that for non-specialist farms, larger holdings may absorb smaller ones due to funding challenges. On irrigated land, higher-value vegetables may increase in production. Taking these factors into account, along with the lack of significant changes in the main structural parameters of each farm type between 2010 and 2020 and the limited sample of farms in the FADN database (especially for specialist farm types), we assume that the current farm types will remain the same in future scenarios. Consequently, any overall changes in the sector will be driven solely by shifts in the relative share of each initial farm types.

3.6.3.Simulated scenarios

For the sake of simplicity, all simulated scenarios assume that the total agricultural land of the outdoor vegetable sector in Hungary remains stable. Specific modelling assumptions for each simulated scenario are outlined below.

Despite the different storylines, the experts in this case study see no difference in the outcome of the Organic on Every Table and Green Public Policy scenarios for the outdoor vegetable sector in Hungary in terms of the area devoted to vegetable production, the share of organic production, and the future farm population.

Reference. In the Reference scenario, the share of organic vegetable production remains stable, while total vegetable production increases slightly (4%) as the irrigated area grows. The distribution of vegetable land use between farm types remains unchanged, except for non-specialist smaller farms. This is because some of them are absorbed by larger farms and exit the market due to financial problems.

Organic on Every Table. In Organic on Every Table, consumer demand for healthy, sustainable food drives a 19% increase in vegetable production. This trend is also beneficial to the organic sector, which is increasing its production share to reach 15% in the vegetable sector. While there is significant growth in the domestic market, Western Europe remains the primary market for Hungarian organic vegetable farms. As sales in these markets continue to rise, we anticipate greater demand for organic vegetables from the Hungarian processing industry. All farm types experience the same increase in the share of land managed organically. As the specialist vegetable farm types have a lower initial organic share, the non-specialist farm types increase their organic area relatively more in absolute terms. This leads to a share of 28% of the area converted to organic production for the whole arable sector. Small non-specialist farms and mixed crops farms are the farm types that reduce their share of production due to strong market competition. In contrast, farms specialising in vegetable production become more profitable and grow their share. Finally, large farms, such as those specialising in arable crops and mixed crops with livestock, maintain their market presence and keep their production share stable.

Green Public Policy. In Green Public Policy, CAP measures significantly enhance the sustainability of both arable and livestock production. While alternative private standards continue to emerge, public procurement remains the dominant market for organic products. Although there is some uncertainty about the future of the EU and whether Hungarian public institutions will have the funding to use organic ingredients in public catering, this does not alter the vision that 80-85% of Hungarian organic vegetable production will be directed toward processing and export. As dietary patterns become healthier under pressure of public policies and public procurement, total vegetable production increase at the same rate as in the Organic on Every table scenario. More ambitious public policies in this scenario support the organic sector and help it to increase its production share in the vegetable sector, reaching a share of 15% in the vegetable sector (and 28% of the area converted to organic production for the whole arable sector). The future population of farms is the same as Organic on Every Table and all farm types experience the same increase in the share of organic products.

Table 22 and Table 23 show respectively the changes in the allocation of agricultural land destined to vegetable production and the final repartition of agricultural land destined to vegetable production for the different future farm types in the three simulated scenarios.

Table 22 Allocation of agricultural land for vegetable production for each category of farm types in the initial situation and in three simulated scenarios in the outdoor vegetable sector in Hungary

	Initial situation	Reference	Organic on Every Table	Green Public Policy
Specialist Outdoor	44%	44%	41%	41%
FC Small Vegetable Specialist	7%	7%	10%	10%
FC Small	6%	4%	3%	3%
FC Medium Vegetable Specialist	5%	5%	10%	10%
FC Medium	8%	10%	9%	9%
FC Large	16%	16%	14%	14%
Mixed Crops	8%	8%	7%	7%
Mixed Crops and Livestock	6%	6%	5%	5%
Specialist outdoor				
Conventional	99.0%	99.0%	97.5%	97.5%
Organic	1.0%	1.0%	2.5%	2.5%
FC small vegetable specialist				
Conventional	95.6%	95.6%	88.9%	88.9%
Organic	4.4%	4.4%	11.1%	11.1%
FC small				
Conventional	94.7%	94.7%	86.7%	86.7%
Organic	5.3%	5.3%	13.3%	13.3%
FC medium vegetable specialist				
Conventional	91.6%	91.6%	78.8%	78.8%
Organic	8.4%	8.4%	21.2%	21.2%
FC medium				
Conventional	85.2%	85.2%	62.8%	62.8%
Organic	14.8%	14.8%	37.2%	37.2%
FC large				
Conventional	85.1%	85.1%	62.5%	62.5%
Organic	14.9%	14.9%	37.5%	37.5%
Mixed crops				
Conventional	95.3%	95.3%	88.3%	88.3%
Organic	4.7%	4.7%	11.7%	11.7%
Mixed crops and livestock				
Conventional	91.6%	91.6%	78.8%	78.8%
Organic	8.4%	8.4%	21.2%	21.2%

Table 23 Repartition of land use for vegetable production for the different farm types in the initial situation and in the three simulated scenarios in the outdoor vegetable sector in Hungary

	Initial situation	Reference	Organic on Every Table	Green Public Policy
Specialist Outdoor				
Conventional	43.1%	43.1%	40.0%	40.0%
Organic	0.4%	0.4%	1.0%	1.0%
FC Small Vegetable Specialist				
Conventional	6.7%	6.7%	9.3%	9.3%
Organic	0.3%	0.3%	1.2%	1.2%
FC Small				
Conventional	5.6%	3.7%	2.9%	2.9%
Organic	0.3%	0.2%	0.4%	0.4%
FC Medium Vegetable Specialist				
Conventional	4.4%	4.4%	8.2%	8.2%
Organic	0.4%	0.4%	2.2%	2.2%
FC Medium				
Conventional	6.8%	8.5%	5.5%	5.5%
Organic	1.2%	1.5%	3.3%	3.3%
FC Large				
Conventional	13.6%	13.6%	8.7%	8.7%
Organic	2.4%	2.4%	5.2%	5.2%
Mixed Crops				
Conventional	8.1%	8.1%	5.8%	5.8%
Organic	0.4%	0.4%	0.8%	0.8%
Mixed Crops and Livestock				
Conventional	5.8%	5.8%	4.3%	4.3%
Organic	0.5%	0.5%	1.2%	1.2%

3.6.4.Modelling results

In the **Reference** scenario, the concentration of farming activities forces 29% of FC small farms out of the market as they are absorbed by larger farms (Figure 30). This results in a 21% reduction in the number of holdings in the sector. Since small farms are more labour-intensive, their decline also leads to a 1% decrease in overall sector employment (Figure 31). Looking at farms average structural characteristics (Figure 32), farm size increases by 26%, the number of people employed per farm rises by 24%, and annual capital depreciation per farm grows by 32%. Finally, the share of vegetable cultivation in agricultural land increases from 2.5% to 2.6%.

In the **Organic on Every Table** scenario, the number of holdings leaving the market is very similar to that in the Reference scenario, resulting in an almost identical final number of farms in the sector. While the number of FC Large, FC Medium, and Mixed Crop-Livestock farms remains unchanged, the number of FC Medium vegetable specialist holdings more than doubles compared to the Reference scenario (148%), and FC Small Vegetable Specialist holdings see a significant increase (70%). The number of Specialist Outdoor farms also grows (8%). In contrast, Mixed Crop farms and FC Small farms decline by 11% and 2%, respectively. The total number of agricultural workers in the sector increases by 2% compared to the Reference scenario, as vegetable specialist farms have a higher labor intensity per hectare. The expansion of organically managed land significantly boosts employment in organic production, with the number of workers in this sector rising by 154%. In this scenario, organic vegetable land becomes more concentrated in vegetable specialist farm types. FC Small Vegetable Specialist holdings increase their share of organic land from 5% to 8%, while FC Medium Vegetable Specialist holdings see an increase from 7% to 14%. Finally, the average farm structural characteristics are very similar to those in the Reference scenario, except for the share of vegetable cultivation in agricultural land, which increases from 2.6% to 2.9%.

Since the same assumptions were applied to both the Organic on Every Table and Green Public Policy scenarios in this case study, the results of the Organic on Every Table scenario are identical to those of the **Green Public Policy** scenario.

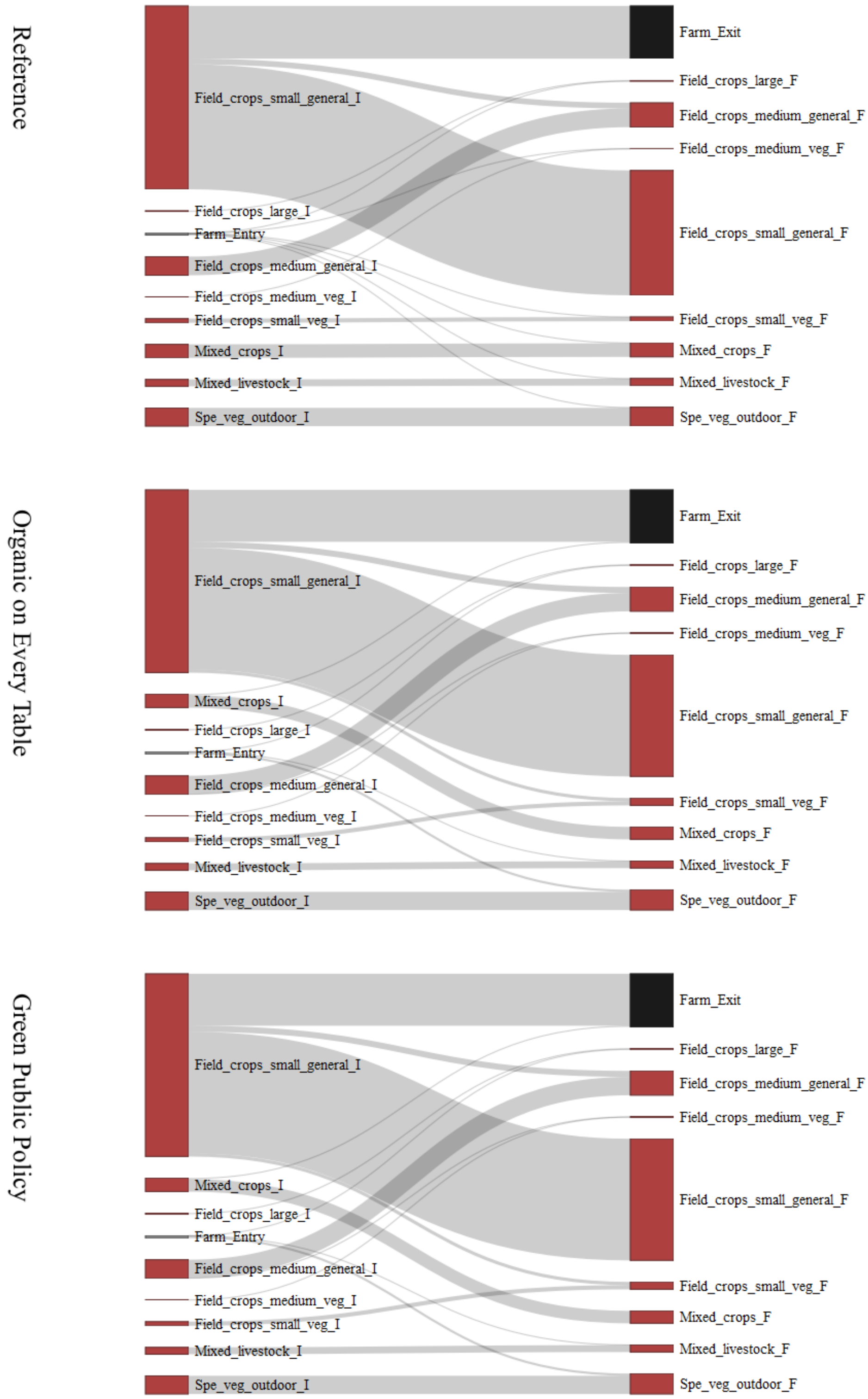

Figure 30 Transition pathways of current farms in the three simulated scenarios in the outdoor vegetable sector in Hungary (I= Initial farm type; F= Future farm type)

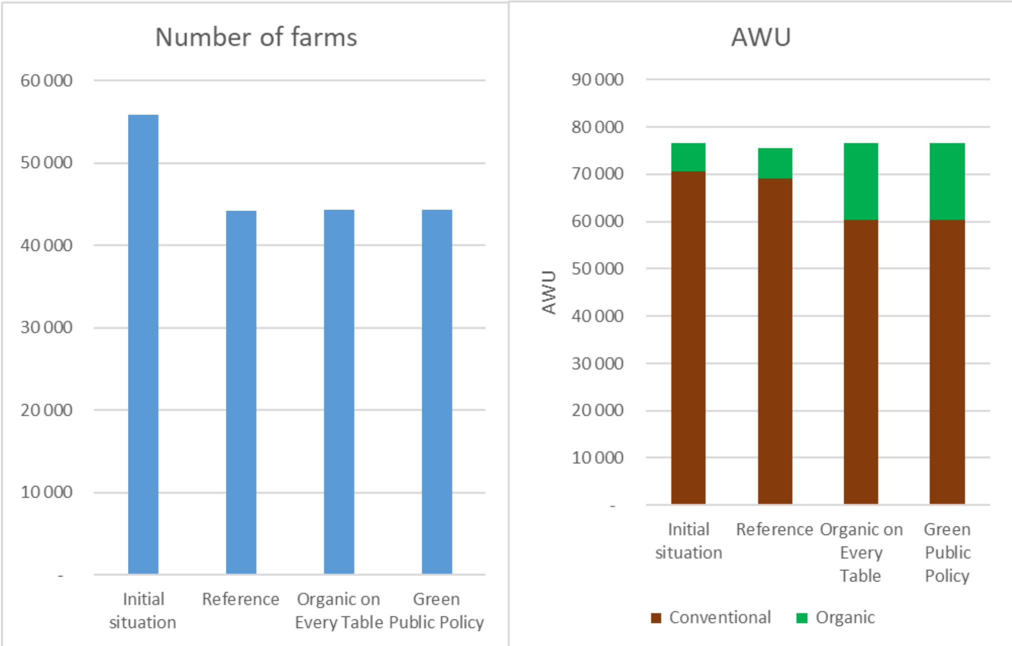

Figure 31 Number of farms and Agricultural Working Unit (AWU) in the Initial situation and in the three simulated scenarios in the outdoor vegetable sector in Hungary

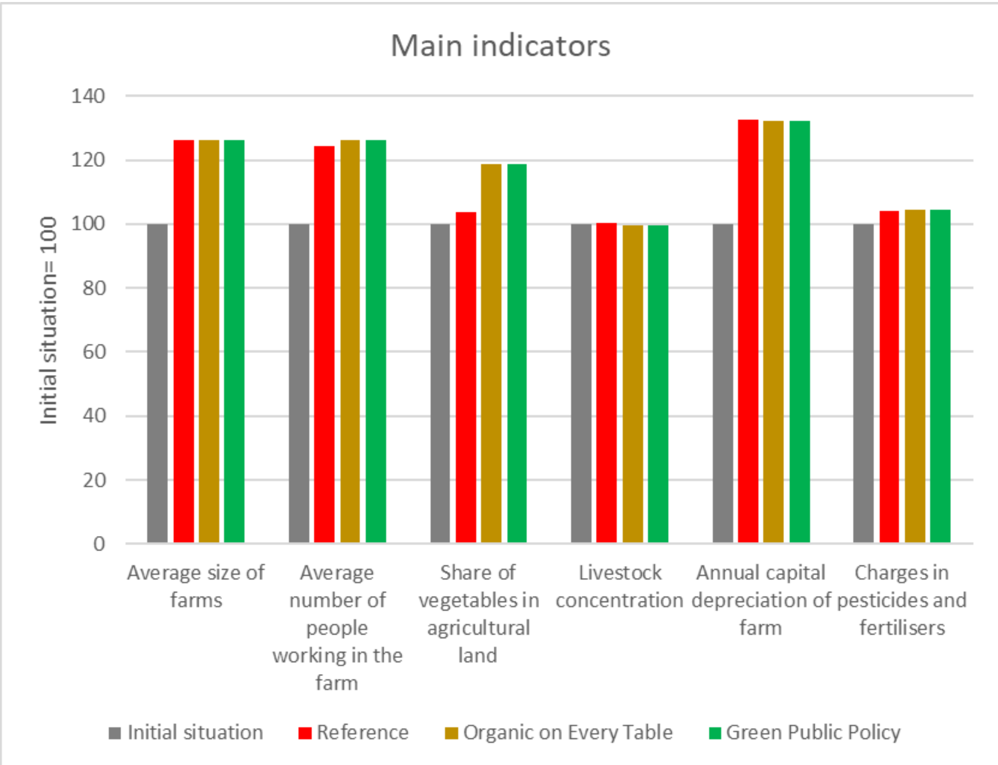

Figure 32 Main structural indicators of outdoor vegetable farms in Hungary in the Initial situation and in the three simulated scenarios

3.7.The wine sector in Italy

3.7.1.Current typology

Italy has 526 PDO-PGI wines, with PDO wines making up two-thirds of the country's wine export value, which increased by 16% from 2021 to 2022. Organic wine production is also significant, with 29,910 registered operators in 2022, representing 32.2% of the total organic sector (CREA, 2022). Organic vineyards cover around 100,000 hectares (18% of total vineyard area), primarily in Sicily, Tuscany, Apulia, and Veneto (FSS data). The average organic farm size varies by region, with Tuscany, Sicily, and Piedmont having over 10 hectares, while regions like Lazio and Liguria have smaller vineyards of less than 2 hectares.

The organic wine market was valued at €43.3 million in 2022, accounting for 1.9% of total Italian wine consumption (CREA, 2022). A common trend in wine farming is the coexistence of organic and conventional production, with 14% of organic wine land area operating under mixed systems (FSS data). Export plays a crucial role, with 50% of Italian wine production sold internationally. Vineyard altitude also influences production, with 57% of wineries in hilly areas, 31% in plains, and 11% in mountains. Cooperatives dominate production, making up nearly 60% of total wine volume (Ismea on SIAN data).

Organic vineyards have grown at a steady rate of 5% annually from 2013 to 2022, positioning Italy to meet the EU's target of 25% organic vineyard area by 2030 (Ismea). However, climate change poses a significant challenge, with rising interest in resistant grape varieties, particularly for PGI wines. Ensuring a diverse and resilient organic wine sector will be crucial for the future of Italian wine production.

Relatively to conventional farms, organic wine farms are on average larger, more specialised in wine production, and with a higher share of wine processed on the farm. They are spread all over the peninsula, on areas with limestone and clay soils. However, there are large differences in agricultural management (irrigation, pest and diseases) of the organic winegrapes cultivation amongst the different regions, especially in areas where temperatures are considerably higher than the national average and where rainfalls are much lower than the national average during the months of fruits setting and ripening of the bunches. The products are sold bottled through diversified marketing channels including on-farm and online selling, specialised wine and organic shops, export within and outside EU (15% to 20) as well as in restaurants and hospitality. In terms of consumers perception, it has been reported that the organic label appears to have much less impact on the final consumer than a PDO or PGI label.

In Italy, the typology of wine farms was based on two criteria (Figure 33): the size of the farm and the production according to conventional or organic specifications. To simplify the analysis, it is assumed that all holdings are either conventional or organic. All holdings growing grapes for wine production are selected.

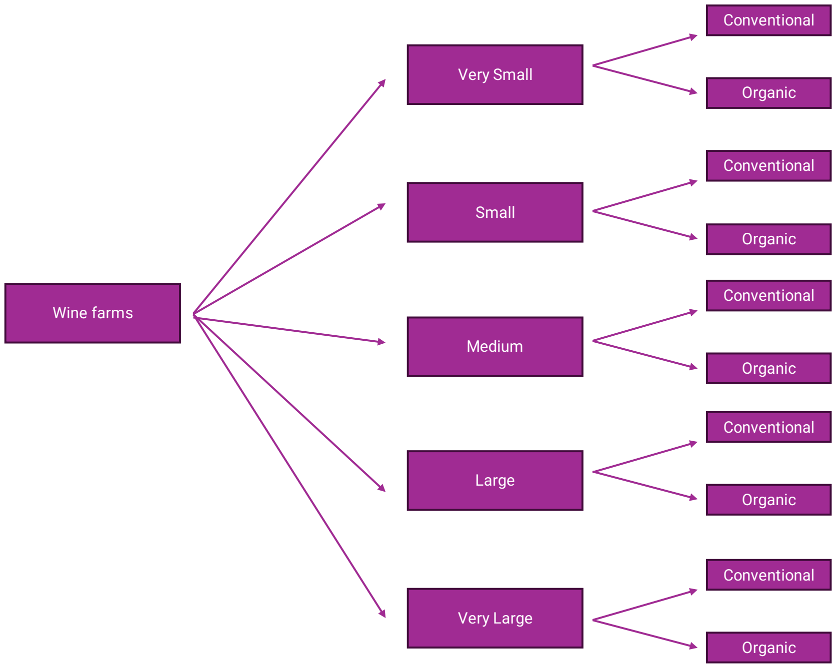

Figure 33 The typology tree for the current typology of wine farms in Italy

- **Very Small**. This type includes small family-run conventional farms between 1 to 2 hectares specialised in quality wine grape production with no processing on-farm. The entire grape production is sent to private local wineries for vinification. Their production is entirely intended for quality wines: Protected Designation of Origin (PDO) and Protected Geographical Indication (PGI). The presence of other crops in the farms is very limited. This type of farm can be found in all the regions and is characterised by limestone soils with different percentages of lime varying between clayey and sandy texture changing according to the farm location area and region. Precipitations also vary according to the geoclimatic area of the farm. The labour input is entirely consisting of unpaid labour input, as farm work is entirely covered by family labour. *2 ha ≤ UAA ≥ 1 ha AND NOT ORGANIC*
- **Very Small Organic**. Very small farm adopting the organic specifications with a consistent share of wine processed on the farm. *2 ha ≤ UAA ≥ 1 ha AND ORGANIC*
- **Small**. Small-medium farm size of 2 to 5 hectares of vineyard. The vinification is made in an external winery outside the farm generally in social (cooperative) winery. The vineyards are planted in shallow landslides with medium-textured limy to clayey soil, with proportions varying with the farm location area and region. The family workforce constitutes the main labour force on the farm and can avail of seasonal workers during the most labour and time-consuming agricultural activities as pruning and harvesting. This type of farm does not usually have any type of technology for the agricultural activities nor any specific consultancy for the management. The phytosanitary treatments are administered based on a pre-planned calendar based on the precipitation occurring from May until the harvest. These small to medium conventional vineyards farms are oriented towards wine making in social (cooperatives) wineries mainly due to their relatively small surface with no economic potentials to vertically develop the value

chain by investing in on-farm winery. It is more secure and sustainable to sell the entire grape production to a cooperative. *5 ha ≤ UAA > 2 ha AND NOT ORGANIC*

- **Small Organic**. Small farm adopting the organic specifications. *5 ha ≤ UAA > 2 ha AND ORGANIC*
- **Medium**. Medium-sized typical Italian farms of 5 to 10 hectares with quality wine production through on-farm cellar and cultivation of various arable crops commonly cereals or fodder crops. Even if the farm production is diversified, the highest gross marketable production remains of the conventional quality wine production for Protected Designation of Origin (PDO) and/or Protected Geographical Indication (PGI). The share of seasonal workers on total farm labour increases compared to small and very small farms. *10 ha ≤ UAA > 5 ha AND NOT ORGANIC*
- **Medium Organic**. Medium farm adopting the organic specifications. *10 ha ≤ UAA > 5 ha AND ORGANIC*
- **Large**. Large farm of 10 to 20 hectares where grapes represent around a third of total farm area. The production of grapes for quality wine is similar to that of medium farms as well as the share of wine processed on the farm. *20 ha ≤ UAA > 10 ha AND NOT ORGANIC*
- **Large Organic**. Large farm adopting the organic specifications. *20 ha ≤ UAA > 10 ha AND ORGANIC*
- **Very Large**. Large conventional farms with total UAA exceeding 20 hectares, with vineyard for quality wines, on-farm vinification and own cellar. This type of farm is characterised by a higher diversification of the production including, besides wine, permanent and arable crops mainly cereals. Large wine farms are present all over the country on limestone soils with different percentages varying between clayey and sandy texture. The labour activities are equally divided between waged labour input and unpaid labour input. The farm employs permanent workers and occasional seasonal workers for a period from January to August. For the most labour demanding activities of pruning, both in winter and summer, and harvesting, additional seasonal workers are hired. Over 75% of the produced wine is bottled and marketed directly on-farm or through other channels mainly export (50% of the bottled product). A lower share (around 10%) is sold in bulk, while the remaining wine is sold in bag-in-box. This type of farms usually has large and modern on-farm sale point where, in addition to wine, other local products are also sold. Marketing is done through multiple channels: on-farm direct selling point, large-scale distribution and Ho.re.Ca channels. Wine is sold on both national and international (export) markets. *UAA > 20 ha AND NOT ORGANIC*
- **Very Large Organic**. Very large farm adopting the organic specifications. *UAA > 20 ha AND ORGANIC*

The main characteristics of the current farm types are presented in Table 24. Organic farms account for 17% of land use.

Table 24 The main structural characteristics of current farm types in the wine sector in Italy

Farm type	Number of farms (2020)	Share of land use [%] (2020)	Farm size [ha]	Share of grapes for wine in farmland use [%]	Share of grapes for quality wine in farm wine area [%]	Share of area of grapes processed on the farm in farm wine area [%]	AWU	Labour intensity [AWU/100 ha]	Per farm depreciation [€/farm]
Very Small	15,958	1%	1.6	72%	90%	1%	0.6	36.9	1,609
Very Small Organic	512	0.03%	1.5	56%	100%	22%	0.9	58.8	3,973
Small	43,931	6%	3.5	52%	75%	1%	0.8	23.4	2,675
Small Organic	1,982	0.3%	3.7	61%	78%	3%	1.1	30.2	4,278
Medium	36,511	11%	7.2	41%	69%	4%	1.1	15.7	3,798
Medium Organic	6,450	2%	7.1	36%	55%	7%	1.1	15.9	4,263
Large	25,394	15%	14.0	32%	67%	3%	1.4	10.0	5,504
Large Organic	4,889	3%	14.3	39%	68%	8%	1.6	11.2	6,564
Very Large	23,807	50%	51.3	14%	61%	10%	2.1	4.1	14,136
Very Large Organic	5,599	12%	52.3	19%	67%	5%	2.3	4.4	12,950

3.7.2.Future typology

By 2035, the global wine industry is expected to undergo significant changes due to evolving consumer preferences, climate change, and market dynamics. Standard wine consumption will likely decrease, with consumers focusing more on health-conscious choices, such as low or no alcohol wines, sulphite-free options, and biodynamic or organic varieties. There will also be a growing demand for wines with “nature” or “healthier” claims. Wine will increasingly be intertwined with experiences, particularly in tourism, where small-to-medium-sized, family-owned, and organic wineries will thrive by offering accommodations, food, and wine tasting.

As global wine appreciation expands, new consumers will likely emerge from diverse regions, particularly in Asia. These new consumers may prefer lighter wines, such as white or sparkling wines, which are more accessible and suitable for mixology. While more complex red wines may not initially appeal to these new markets, the increasing popularity of wine-tasting and sommelier courses may influence preferences over time. To cater to younger consumers, innovation in wine packaging and sales methods, like cans, screw-cap bottles, and single-serving sizes, will become more prevalent. Direct engagement with producers, both online and in-person, will build consumer trust and value.

New wine-producing regions, especially those in Northern Europe such as the Netherlands and Denmark, will focus on organic wine production, intensifying competition for traditional wine-producing areas. The preference for locally produced organic wine may give a boost to Northern European wine markets.

Climate change poses significant challenges for wine producers, particularly regarding more frequent extreme weather events like heatwaves, storms, droughts, and frosts. These challenges will affect grape growing, with climate change potentially altering the characteristics of wines, such as higher alcohol content and altered aromas. Smaller farms may find it easier to adapt to these changes, with organic farming proving to be more resilient due to its emphasis on biodiversity, ecological infrastructure, and soil health. The impact of climate change could also shift wine production areas, with some regions becoming less viable, while others, such as mountainous regions, may see growth.

In the broader context of agriculture, the wine sector will face the pressures of globalisation and shifting farm structures. The trend will be a decline in small family-run farms, while diversified farms that combine agriculture with tourism and other non-farming activities will become more common. As a result, certain types of wine production will increasingly focus on localisation, optimising logistics and market opportunities.

Overall, while there is considerable diversity across Italy's regions and wine-producing areas, the evolution of farms in the wine sector can be summarised (in simplified terms) as described below. It is important to note that while almost all current farm types evolve in the future systems, some of them remain still present in the future scenarios (Very small, Small, Small Organic, Medium, Medium Organic).

- **Very Small**. Same farm type as the current Very small farm type.
- **Small**. Same farm type as the current Small farm type.
- **Small Organic**. Same farm type as the current Small Organic farm type.
- **Small HQ (High Quality)**. Small farms, ranging from 2 to 5 hectares specialised in high-quality wine production. These farms are often situated in unique areas with strong local identities, such as mountains, coastal regions, or islands, and produce wines that are highly personalised. As production grows, the income of these small farms increases, allowing them to diversify their offerings and secure better prices thanks to stronger bargaining power with social or cooperative wineries. These farms are usually managed by younger farmers who possess excellent technical knowledge and strong communication skills. While the market for these wines is global, it remains closely linked to the individuals running the farms. Many of these wines are sold directly to consumers or through the horeca sector, which makes up a significant portion of their customer base. Although these farms won’t have a major impact on overall vineyard acreage, they play an important role in market innovation. They introduce new wine varieties and serve as powerful change-makers in their regions. These producers often emerge from the evolution of existing very small or small farms. The development of these farms is driven by the next generation of farmers or newcomers who take over land from retiring farmers. With a strong focus on technical skills and training, these farmers will also invest in communication strategies beyond traditional marketing. Additionally, they will adopt new technology and more efficient equipment. *5 ha ≤ UAA > 2 ha AND SHARE OF QUALITY WINE IN WINE UAA > 0.9 AND NOT ORGANIC*
- **Medium**. Same farm type as the current Medium farm type.
- **Medium Organic**. Same farm type as the current Medium Organic farm type.

- **Medium HQ**. Medium farms, ranging from 5 to 10 ha specialised in high-quality wine production. As for Small HQ, these farms emerge because of younger, more innovation-driven farmers who choose to leave the cooperative structure to establish their own winemaking businesses. On the other hand, also cooperative or other collective forms of processing may also focus on more specialised and quality-driven production, in response to new market demands and to increase profitability. In this farm, mechanisation, likely through shared machinery becomes necessary, alongside advancements in vineyard management technology. These improvements will need to be paired with advisory services that the cooperative will provide. Enhanced vineyard management will be crucial for dealing with the challenges of climate change, as well as complying with increasing regulatory restrictions on pesticide use. The market for wine produced by this farm will increasingly be global, with a significant portion of it being sold in bulk. The cooperative will take on new roles, providing advisory services and sharing machinery. Key innovations will focus on mechanisation and digitalisation in the vineyard, optimising plant protection, fertilisation, and managing water and temperature stress conditions. Additionally, the winery will be upgraded to support precision winemaking, enabling the production of a wider variety of wine types. *10 ha ≤ UAA > 5 ha AND SHARE OF QUALITY WINE IN WINE UAA > 0.9 AND NOT ORGANIC*
- **Large**. Current large farms that increase their size expanding their vineyards either within the same area or in neighbouring regions for several reasons. First, they may convert some of their arable crop land into vineyards, as arable crops tend to be less profitable, allowing part of their surface to be repurposed. Second, very small farms in the area may close, offering opportunities for the active farms to purchase new land. To mitigate risks related to climate change, farms of this group diversify by planting different grape varieties and producing a broader range of wines. To increase added value and improve the winemaking process and marketing strategies, more wine is bottled, and bulk sales gradually decrease. These farms also become more closely connected to farm visits, particularly if the farm offers both traditional and innovative tourism activities. Additionally, arable products, such as flour, pasta, and bakery items, continue to be marketed alongside the wine. The percentage of bottled wine sold rise, while average production volumes decrease. Key innovations focus on mechanisation, especially in hilly areas, and soil management techniques in the vineyard. Digitalisation plays a significant role in optimising plant protection, fertilisation, and managing water and temperature stress conditions, both in the vineyard and in the wine cellar, to increase precision and improve the winemaking process. Additionally, the valorisation of by-products, such as distillates, grapeseed oil, and cosmetics (even if produced in small quantities) diversifies the farm's offerings and enhance its appeal. *30 ha ≤ UAA > 16 ha AND SHARE OF GRAPES IN UAA > 0.1 AND NOT ORGANIC*
- **Large Organic**. Current Organic large farms that increase their size and follow the same evolution as large conventional farms**.** *30 ha ≤ UAA > 16 ha AND SHARE OF GRAPES IN UAA > 0.1 AND ORGANIC*
- **Very Large**. Current very large farms that increase their size. The average farm size increases as smaller farms in the area close, creating opportunities to acquire land and vineyards at moderate prices. The market for these farms shifts towards greater export, targeting the medium-to-high price range, with variations depending on the specific wine regions and farm brands. Synergies with other high-quality farm products, such as olive

oil, flour, or even pasta help strengthen their market position. This diversified, high-quality offering also aligns well with local tourism, as some of the market comes from visitors staying on the farm and purchasing directly. Byproducts from winemaking, such as cosmetics or distillates, gain value through niche markets. These include traditional products like grappa, but also newer, consumer-oriented items like gin, which appeal to younger demographics. The main innovations centre on mechanisation and digitalisation, both in the vineyard and the cellar, to improve traceability and other aspects of production. *UAA > 30 ha AND NOT ORGANIC*

- **Very Large Organic**. Current Organic very large farms that increase their size and follow the same evolution as very large conventional farms**.** *UAA > 30 ha AND NOT ORGANIC*

The main structural characteristics of the future farm types are presented in Table 25.

Table 25 The main structural characteristics of future farm types in the wine sector in Italy

Farm type	Farm size [ha]	Share of grapes for wine in farmland use [%]	Share of grapes for quality wine in farm wine area [%]	Share of area of grapes processed on the farm in farm wine area [%]	AWU	Labour intensity [AWU/100 ha]	Per farm depreciation [€/farm]
Very Small	1.6	72%	90%	1%	0.6	36.9	1609
Small	3.5	52%	75%	1%	0.8	23.4	2675
Small Organic	3.7	61%	78%	3%	1.1	30.2	4278
Small HQ	3.4	55%	100%	1%	0.8	23.3	2894
Medium	7.2	41%	69%	4%	1.1	15.7	3798
Medium Organic	7.1	36%	55%	7%	1.1	15.9	4263
Medium HQ	7.1	46%	100%	5%	1.2	16.9	4497
Large	21.4	44%	70%	3%	1.8	8.6	10111
Large Organic	21.5	47%	70%	3%	1.9	8.7	9943
Very Large	70.7	12%	57%	13%	2.5	3.5	18398
Very Large Organic	69.6	16%	69%	6%	2.6	3.7	16524

3.7.3. Simulated scenarios

For the sake of simplicity, all simulated scenarios assume that the total agricultural land of the wine sector in Italy remains stable. Specific modelling assumptions for each simulated scenario are outlined below.

Reference. In the Reference Scenario, the global socio-economic situation, along with mainstream political and cultural approaches, results in reduced political support for environmentally focused production systems. Additionally, the economic climate, both globally and specifically within the EU, limits consumers' ability to make diverse choices. Despite these challenges, the organic wine sector is expected to grow and reach the target of 25% of agricultural land being managed organically. In this scenario, agricultural land continues to concentrate in fewer, larger farms, with many small and very small farms exiting the market. This leads to a 32% decrease in the total number of holdings, reflecting half of the decline seen from 2010 to 2020, spread over a 15-year period. As consumer preferences shift toward higher consumption of high-quality wine, small and medium conventional farms specialising in high-quality production emerge, occupying half of the land managed by conventional farms within their size group. Except for the few very small organic farms that exit the market, all other farm groups, regardless of size, experience the same increase of the share of organically managed land.

Organic on Every Table. In the Organic on Every Table scenario, increased demand for organic food drives a rise in organic wine production. As a result, the share of agricultural land managed organically in the wine sector reaches 50%. The distribution of farmland by farm size remains the same as in the Reference scenario; however, the conversion rate is significantly higher. As in the Reference scenario, except for a few very small organic farms that exit the market, all other farm groups, regardless of size, experience the same increase of the share of organically managed land. This means that the farm types that already have a higher proportion of organic land increase relative more their land managed organically in absolute terms. Additionally, for conventional small and medium-sized farms, those specialising in high-quality production maintain the same amount of agricultural land as in the Reference scenario.

Green Public Policy. In the Green Public Policy scenario, the impact of public policies on the share of farmland managed organically in the wine sector is relatively low, reaching only 30%. The distribution of farmland by farm size remains the same as in the Reference scenario; however, the conversion rate is slightly higher. Unlike the Organic on Every Table scenario, Green Public Policy assumes that policies promoting organic conversion primarily target small farms, as they currently have the lowest share of organically managed land. Very large farms also convert, as they are well-positioned for the transition to organic production. These farms can easily benefit from increased subsidies due to their solid technical and logistical foundation, existing equipment and technology, and capacity for further investment. All other farm types maintain the same area of organically managed land as in the Reference scenario. Finally, as in the Organic on Every Table Scenario, conventional high-quality small and medium-sized farms maintain the same amount of agricultural land as in the Reference scenario.

Table 26 and Table 27 show respectively the changes in the allocation of agricultural land and the final share of agricultural land for the different future farm types in the three simulated scenarios.

Table 26 Allocation of agricultural land for each category of farm types in the initial situation and in three simulated scenarios in the wine sector in Italy

	Initial situation	Reference	Organic on Every Table	Green Public Policy
Very Small (conv & org)	1%	0.4%	0.4%	0.4%
Small (conv & org)	7%	2%	2%	2%
Medium (conv & org)	13%	13%	13%	13%
Large (conv & org)	17%	22%	22%	22%
Very Large (conv & org)	62%	62%	62%	62%
Very small (conv & org)				
Very Small	97%	100%	100%	100%
Very Small Organic	3%	0%	0%	0%
Small (conv & org)				
Small	95%	47%	40%	28%
Small Organic	5%	7%	13%	25%
Small HQ	0%	47%	47%	47%
Medium (conv & org)				
Medium	85%	40%	19%	40%
Medium Organic	15%	21%	42%	21%
Medium HQ	0%	40%	40%	40%
Large (conv & org)				
Large	84%	77%	54%	77%
Large Organic	16%	23%	46%	23%
Very large (conv & org)				
Very Large	81%	73%	45%	65%
Very Large Organic	19%	27%	55%	35%

Table 27 Share of land use for the different farm types in the initial situation and in the three simulated scenarios in the wine sector in Italy

	Initial situation	Reference	Organic on Every Table	Green Public Policy
Very Small	1.0%	0.4%	0.4%	0.4%
Very Small Organic	0.03%	0.0%	0.0%	0.0%
Small	6.3%	1.1%	1.0%	0.7%
Small Organic	0.3%	0.2%	0.3%	0.6%
Small HQ	0.0%	1.1%	1.1%	1.1%
Medium	10.7%	5.0%	2.3%	5.0%
Medium Organic	1.9%	2.6%	5.3%	2.6%
Medium HQ	0.0%	5.0%	5.0%	5.0%
Large	14.6%	17.1%	11.9%	17.1%
Large Organic	2.9%	5.2%	10.4%	5.2%
Very Large	50.2%	45.2%	28.2%	40.7%
Very Large Organic	12.0%	17.0%	34.0%	21.6%

3.7.4. Modelling results

In the **Reference** scenario, the concentration of farming activities forces 32% of current farms out of the market (Figure 34). Most of these are small and very small conventional farms that can no longer withstand economic competition from larger farms and are absorbed by them. The decline in the number of farms leads to a 32% reduction in total farms and a 17% decrease in agricultural workers (Figure 35). This is because the farms that remain in the market are, on average, less labour-intensive and can more easily achieve economies of scale due to their larger size. In the organic sector, the land area destined to organic production increases by 46%. However, as we also assist to a concentration of production activities in larger organic farms, the total number of organic holdings and the number of agricultural workers employed in organic farms rise by only 13% and 24% respectively. Looking at average structural characteristics (Figure 36), farms in the Italian wine sector increase their average size by 46% and the number of workers per farm by 21%. Due to their larger size, they also experience higher annual capital depreciation. Additionally, they expand the share of grape area dedicated to quality wine and the proportion of wine processed on the farm. Finally, with the rise in organic production, the average use of pesticides and fertilisers decreases by 4%.

In the **Organic on Every Table** scenario, the number of farms exiting the market is very similar to that in the Reference scenario, as the same process of concentrating farming activities in larger farms occurs. However, unlike the Reference scenario, a higher number of conventional farms convert to organic. Since conversion to organic practices occurs more frequently among farm types that already have a relatively high proportion of organically managed land, around 10% of small and medium conventional farms make the switch, while the share is much higher for large and very large farms, reaching approximately one-third. As organic farms have slightly higher labour intensities compared to conventional farms, the number of agricultural workers in the sector increases by 0.8% with respect to the Reference scenario. In contrast, as in this scenario conversion to organic does not imply a change in size of farms, the number of farms remains the same as in the Reference scenario. In the organic sector, the land area destined to organic production increases by 100% compared to the Reference scenario. As all farm types convert to organic farming proportionally, the number of organic farms and the number of agricultural workers employed in these farms increase linearly. In this scenario, the average structural characteristics of farms are very similar to those in the Reference scenario. As organic farms are relatively more specialised, the share of grapes in agricultural land use slightly increases, along with the area dedicated to quality wine. In contrast, organic farms are less involved in on-farm wine processing, particularly larger farm types. As a result, the average share of grape area processed on the farm declines. Finally, although organic production methods require fewer pesticides and fertilizers, their use remains relatively high in grape production. Consequently, production costs for these inputs decrease by only 10% compared to the Reference scenario.

In the **Green Public Policy** scenario, the number of farms exiting the market is very similar to that in the Reference and Organic on Every Table scenarios. The share of initial farm types converting to organic is more similar between farm types than in the Organic on Every Table scenario ranging from 4% to 8% of initial types (very small conventional farms excluded). As in the Organic on Every Table scenario, the total number of farms remains stable compared to the Reference scenario, while the number of agricultural workers rises by 0.6%. In the organic sector, the land area dedicated to organic production increases by 20% compared to the Reference scenario. This growth leads to an almost linear increase in the number of organic holdings and agricultural workers, both rising by 20%. When looking at farm structure characteristics, since the increase in organic land is quite limited in this scenario, and organic farms are similar to conventional ones, the average wine farm remains very similar to that in the Reference scenario. Charges for pesticides and fertilisers decline by 2% compared to the Reference scenario.

In the Italian wine case study, we analysed two possible transition pathways for farms, which we consider to be meaningful for the sector. In both transitions, we used the current Large farm type as the starting point, as this farm type represents a significant share of total agricultural land in the wine sector and has a high proportion of grape area in the farm's UAA. This farm type has an average family farm income per family work unit of € 29,620. In the first transition, the current Large farm remains the same type but with future characteristics (larger size of the farm and higher share of grapes in farm UAA). In the second, it converts to the Large Organic farm type.

In the first case, we assume that the share of the assets of the initial farm that are incompatible with the transition is 0% (ω_{ff}), and that the share of the assets of the future farm that must be purchased brand new (σ_{ff}) is also 0%. The value of β_{ff} (the annual depreciation of assets of the initial farm that exceeds the needs of the future farm) is also zero meaning that the depreciation schedule D is equal to D*. In the second case, we assume that the conversion to organic may render some machinery used for spreading synthetic fertilisers or chemical pesticides unnecessary. This leads to consider that the share of the assets of the initial farm that are incompatible with the transition, amounts to 15% (ω_{ff}). In addition, as after the conversion to organic the farm has to purchase some new machineries for mechanical weeding σ_{ff} is fixed to 17%. In this transition, β_{ff} value is 0 as the depreciation of the future farm is largely higher than the depreciation of the current farm.

Figure 37 shows that, all things being equal, the family farm income per family work unit is higher in both cases than in the initial situation. However, the conversion to the Large Organic farm type allows a slightly higher performance than the transition to the future Large farm type in all possible situations. Conversion to organic farming can still bring in more money than the initial situation for the current Large farm if the total prices and subsidies decrease by 20%, all other things being equal. Finally, as the value of ω_{ff} is very small and the value β_{ff} is 0, depreciation schedule D and D* are very comparable and yield similar results.

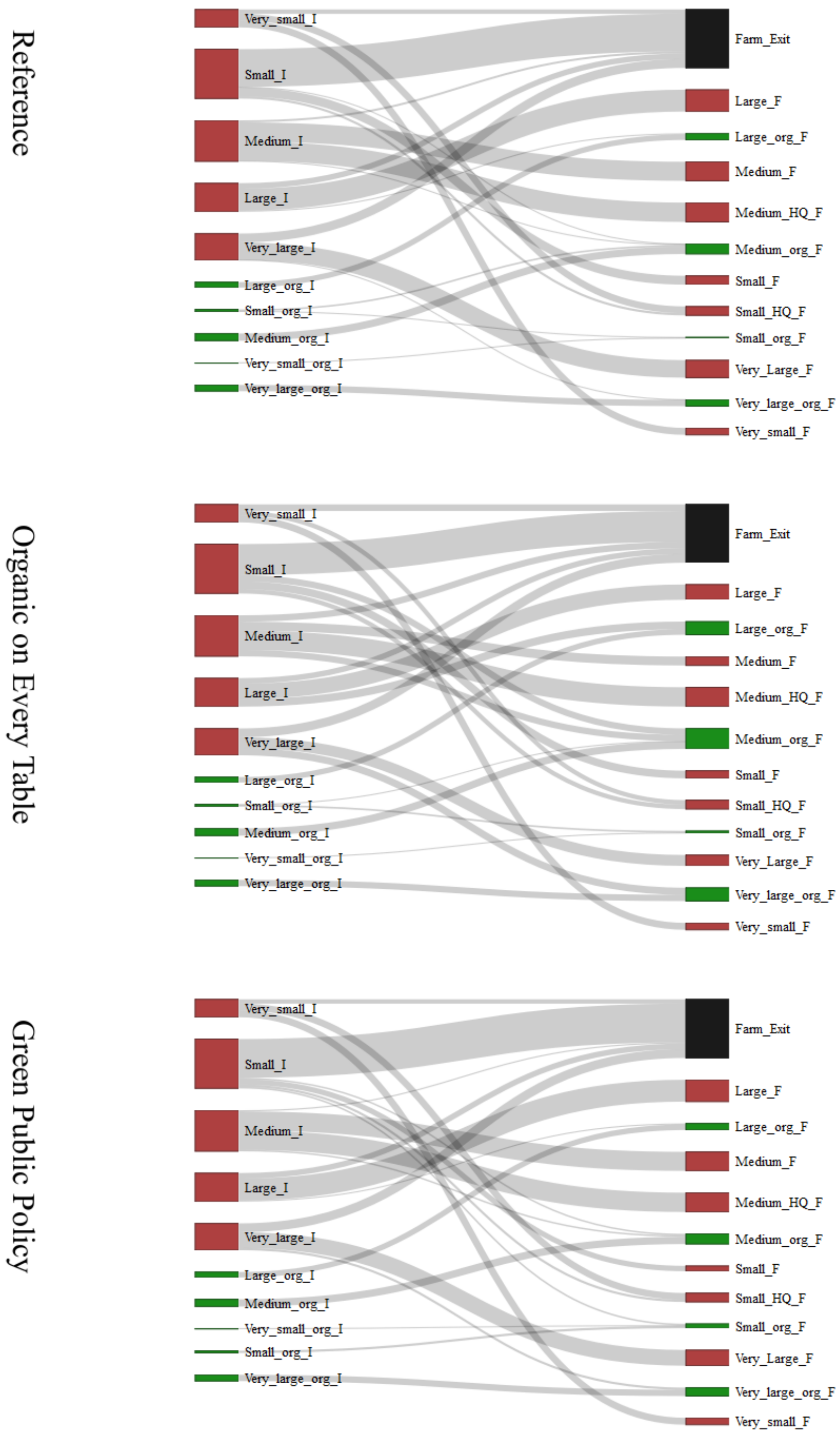

Figure 34 Transition pathways of current farms in the three simulated scenarios in the wine sector in Italy (I= Initial farm type; F= Future farm type)

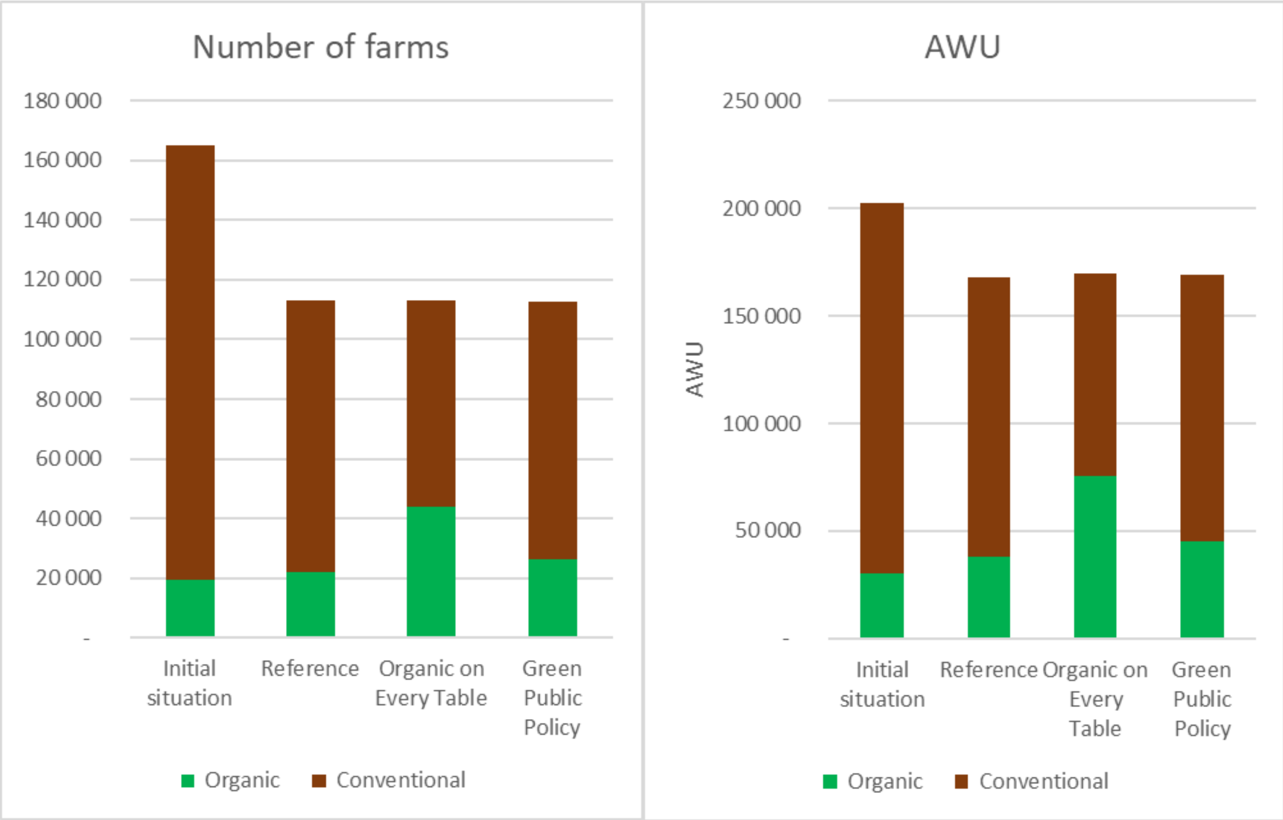

Figure 35 Number of farms and Agricultural Working Unit (AWU) in the Initial situation and in the three simulated scenarios in the wine sector in Italy

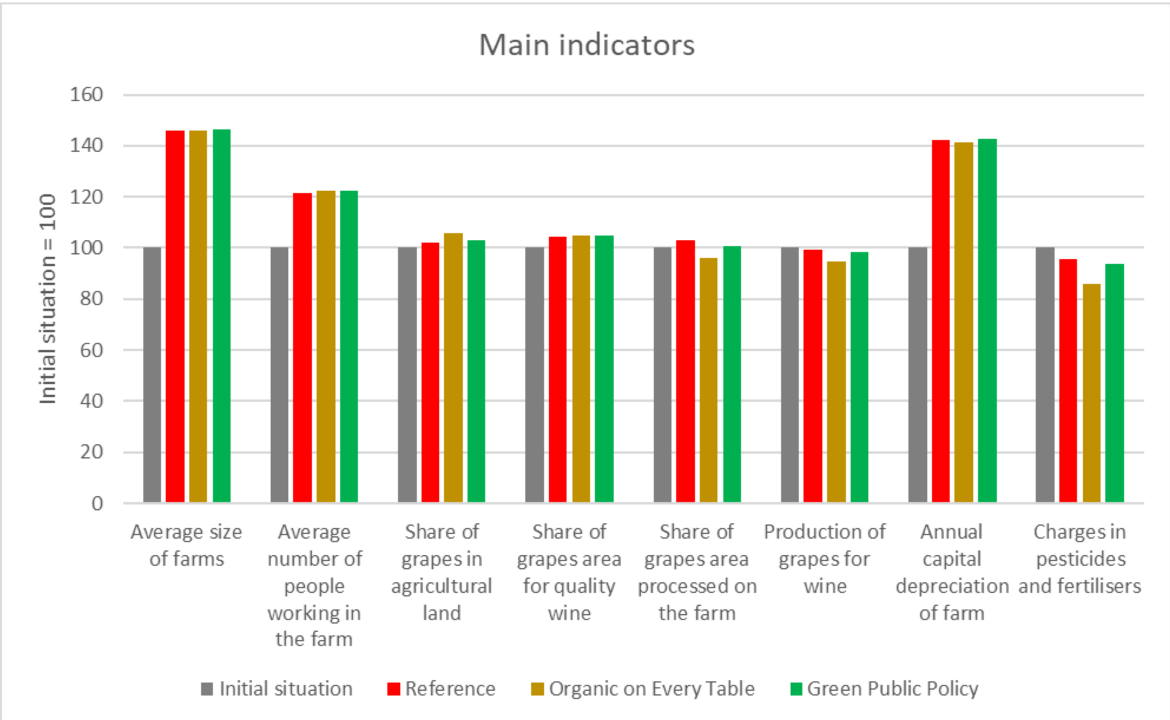

Figure 36 Main structural indicators of dairy farms in France in the Initial situation and in the three simulated scenarios

a			D			D*		
Large (future type)			IC-20	IC	IC+20	IC-20	IC	IC+20
	P-20	S-20	34 172	27 139	20 105	34 172	27 139	20 105
		S	35 717	28 683	21 649	35 717	28 683	21 649
		S+20	37 262	30 228	23 194	37 262	30 228	23 194
	P	S-20	50 305	43 272	36 238	50 305	43 272	36 238
		S	51 850	44 816	37 782	51 850	44 816	37 782
		S+20	53 395	46 361	39 327	53 395	46 361	39 327
	P+20	S-20	66 438	59 405	52 371	66 438	59 405	52 371
		S	66 438	59 405	52 371	66 438	59 405	52 371
		S+20	69 528	62 494	55 460	69 528	62 494	55 460

b			D			D*		
Large Organic			IC-20	IC	IC+20	IC-20	IC	IC+20
	P-20	S-20	40 844	33 056	25 269	40 114	32 327	24 539
		S	43 728	35 941	28 153	42 999	35 211	27 423
		S+20	46 613	38 825	31 037	45 883	38 095	30 308
	P	S-20	58 339	50 552	42 764	57 610	49 822	42 034
		S	61 224	53 436	45 649	60 494	52 706	44 919
		S+20	64 108	56 320	48 533	63 378	55 591	47 803
	P+20	S-20	75 835	68 047	60 260	75 105	67 318	59 530
		S	78 719	70 932	63 144	77 989	70 202	62 414
		S+20	81 604	73 816	66 028	80 874	73 086	65 299

Figure 37 Transition matrix from a current Large farm type to a future Large farm type (a) and to a Large Organic farm type (b). Current income **€ 29,620**.

3.8.The aquaculture sector in the EU

3.8.1.Current typology

In this report, the aquaculture sector is studied at the EU level for three specific species: mussels, trout, and sea bass/sea bream. Figure 38 shows the typology tree used to create the current typology of conventional and organic farms.

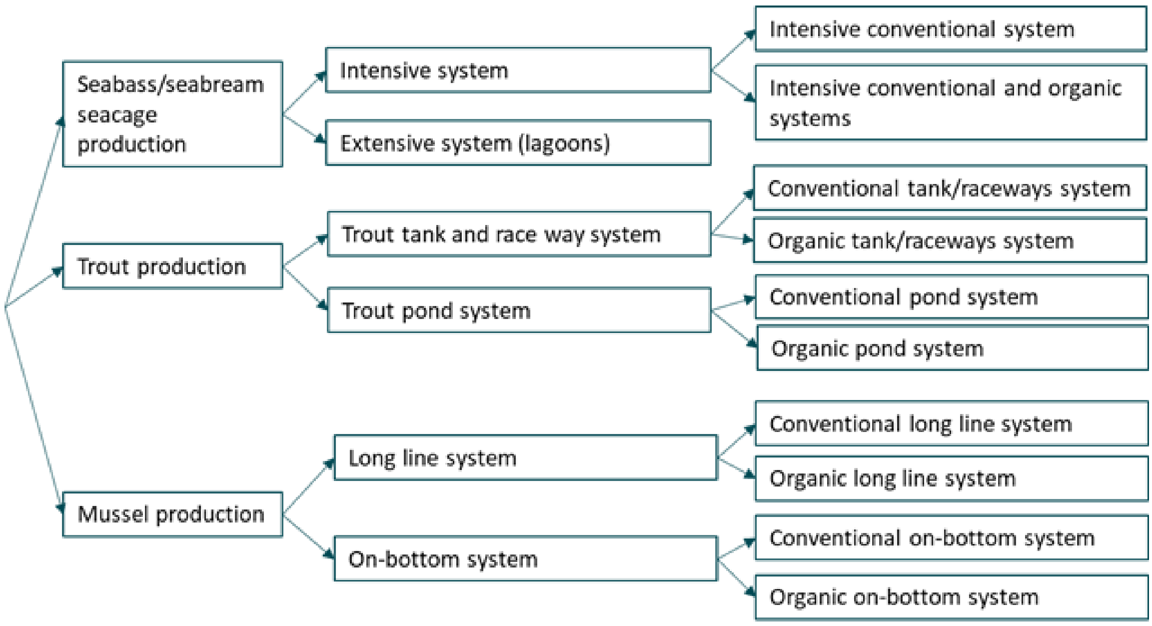

Figure 38 The typology tree for the current typology of aquaculture farms in the EU

Mussel production can be considered as an environmentally friendly business, as no feed is necessary, and the mussels take nutrients from the water column. It should also be noted that mussels provide ecosystem services to the environment: they sequester carbon, eliminate excess nitrogen, and clarify water while feeding to produce a food recommended by dieticians.

The organic certification is in danger due to recent European regulatory developments governing it (Reg. EU 2018/848): shellfish waters where a product would be organic shall now be classified A, within the meaning of the Hygiene Package for microbiological criteria and shall be in "good ecological condition". In this context, the European mussel farming sector thus may face some tensions between the willingness of the Farm to Fork Strategy to increase organic production and the organic regulation, which spatially limits this possibility.

A recent political, regulatory, and societal developments will have consequences for shellfish farming companies: the Single-use plastic Directive establishes the principle of extended producer responsibility, making it necessary to recycle plastics. A significant R&D effort is underway to supply nets or socks made from bio-based materials. The cost of such materials is higher than that of plastics currently in use.
Three main farming techniques are being used in the production of mussels in the EU. Rafts, long line and bottom harvest are well differentiated methods of production, with strong correlations with local culture, traditions and employees. Rafts are the dominant technique in the Spanish Northwest region of Galicia, but it is not considered in the present analysis.

- **Mussels Longline.** Long line cultivation is carried out in Italy, Ireland, Greece, and more recently in the Netherlands. A rope suspended by floats is stretched horizontally near the water surface. Mussels are grown on vertical ropes known as 'droppers' which hang from the horizontal rope for a length of about 4 m. Mussel seeds are collected from natural beds and kept in place onto the ropes by nylon nets or sock. This technique allows mussel culture in shallow waters, where rafts would not be suitable. It can be also envisaged in the context of offshore production combined spatially with floating or fixed wind farms.
- **Mussels Longline Organic.** Organic farm of mussels using the "longline" production method.
- **Mussels Bottom.** Bottom cultivation uses beds in the Netherlands and Ireland or poles (bouchots) and tables, very similar to rafts fixed in the seabed in France where the mussels are deposited or attached. This type of breeding "on bouchot" also makes it possible to benefit from the swaying of the tides, the mussels being alternately emerged and submerged and thus feeding on the various nutrients existing in the entire height of the water column. For most mussel farms, total production costs are almost fixed, given the absence of feed and livestock costs. Production, and therefore turnover, can vary significantly each year. But this is not explained by changes in the workforce, instead reflecting natural variation in production (availability of seed collected from natural beds) and levels of predation.
- **Mussels Bottom Organic.** Organic farm of mussels using the "bottom" production method.

Gilthead sea bream (Sparus aurata) and Sea bass (Dicentrarchus labrax) farming is practiced in extensive and intensive farming systems. The total production of organic sea bream and sea bass in the EU is only 2,750 tons, of which 800 tons are produced in Greece. Although demand in the EU has risen for organic marine products by 60% since 2015, this is mainly due to the increase of organic mussel farming (HAPO, 2022). Demand for organic sea bass/sea bream has not followed the same trend. The production of organic sea bream and sea bass in Europe represents only 2% of these two species total conventional production of 174,501 tons. The main reason for the low production of organic sea bass/sea bream is their higher production cost and the lack or scarcity of appropriate organic inputs, such as organic juveniles and well-balanced organic feed.

- **Sea bass/sea bream Intensive**. Fish fry are produced in the fish hatchery, an onshore facility where under controlled conditions larvae are maintained until day 40. Juveniles are then weaned in pre-growing facilities. These facilities are mainly artificial enclosures on land, operating with Recirculating Aquaculture Systems (RAS) or flow-through systems. Juvenile fish are held in these tanks for the pre growing phase, which lasts four months or until they reach the weight of 5-10 gr (depending on the farmer). Once the desired size is reached, they are transferred for grow out in floating, circular sea cages. Fish usually spend a year of their 16–18-month life in floating sea cages. These cages are a confined space made by a net bag of synthetic fibre, enclosed on all sides but the top as to permit a free exchange of water. The net bag is supported by a floating collar on the surface and a system of buoys, weights and chains hold it in place along with moorings to the seabed. Fish cages used are mostly of the types D20, D15, D13 and D12 (Pers. Communication with farmers). Formulated feed is added daily either by employees or robotic feeders. According to the EU official statistics, the average feed costs share is 30-31%, the average livestock costs share is 6-7%, the average wages and salaries share is 9-10%, the average energy costs share is 1-2%. The organic fish feed cost is 20-30% higher than the conventional feed, while the organic livestock cost is 10-20 higher than the conventional livestock. In conventional farms, usually, stocking density does not exceed 15 kg/m³, while in the organic farm the stocking density, usually, ranges from 10 to 15 kg/m³. These differences in production costs and stocking density between conventional and organic farms translate, to some extent, into lower production performance which must be compensated by higher sales prices of the organic product.

- **Sea bass/sea bream Intensive Organic.** Organic farm of sea bass/sea bream using the "intensive" production method.
- **Sea bass/sea bream Lagoon.** Mediterranean Sea lagoons are important for fisheries and extensive aquaculture while contributing significantly to the local fishery economies in many countries. Traditional extensive aquaculture is practiced in lagoons, shallow small bays formed by the headwaters of large rivers and separated from the sea by a strip of sand leaving a small opening for communication. These natural lagoons have been exploited traditionally since ancient times. Presently, they are managed mainly by fishing associations of local fishermen. These sheltered areas attract fish mainly because of abundant, natural food sources, suitable temperatures and salinity variations necessary for certain stages of their development, representing the typical nursery and feeding ground of the species (i.e., Messolonghi-Etoliko lagoon in West Hellas) (Dimitriou et. al., 2007). Fish are allowed to enter the lagoons for feeding and shelter during spring and early summer, after which the entrapment devices are closed. During the summer, most fish remain in the lagoons and the most commercial species are caught in the fish traps during their reproductive migration to the sea in autumn and early winter. Fishery exploitation is based mostly on traditional barrier fish traps consisting of permanent entrapment devices, i.e., stationary installations that catch live fish as they move seawards. These devices used to be made of wood, consisting of sticks hammered into the lakebed sustaining a net of reeds. Most of these installations were replaced after the 1980s with cement installations that copied the Italian *vallicoltura* capture systems. In the Northern Hellas lagoons, and to a certain extent also in the Amvrakikos Gulf (West Hellas), fish entrapment devices are usually combined with fish wintering channels, i.e., deep, dredged channels in which the juvenile fish spend the cold season without being fed artificially (Koutrakis et. al., 2007). Naturally, these systems require no extra feed and are characterised as an extensive farming system, however nowadays some extra feed is always added, hence it can be described as a semi-extensive farming system due to this extra feed input.

The main fish species in the trout industry is the rainbow trout (Oncorhynchus mykiss). In recent years, however, their importance has decreased somewhat; instead, the production of char (Salvelinus spp.) has increased. The native brown trout (Salmo trutta) is also a very relevant species but is mainly used to stock open waters.

The juvenile stages from the egg to the young fish weighing 1-5 g are raised in own buildings (hatchery) under controlled conditions, while round tanks or round current tanks are mainly used for raising young fish. However, the majority of trout producers buy eggs or stocking material from other companies (often from abroad). In 2022, 164 of the salmonid farms (9%) in Germany produced spawn; the number of operations has shown a declining trend since 2015. 330 of the salmonid operations (18%) in Germany raise young fish; these numbers are trending downward. The majority of the young fish are used by the companies for their own use as stock fish. In addition to the food fish market, there is also a significant market in Germany for the stocking of waters for recreational and professional fishing.

In less intensive systems, feeding is done by hand, while in higher production intensity it is usually done via computer-controlled feeding systems. The abrasion and floating properties of the feed are adapted to the system. In most systems, the most important parameters (oxygen content, inflow, water level) are monitored via probes connected to an alarm system.

In organic trout production, the stocking densities are kept lower than in conventional production (max. 25kg/m³ for trout production in ponds). This results in, among other things, a lower use of feed per unit area and thus a lower burden of organic inputs that enter the environment. It should be noted here, however, that certain lines of high-performance feed are not permitted in organic production (e.g., the use of synthetic amino acids). However, such feed can lead to extremely low feed conversion ratios. For this reason, for example, in organic trout production, phosphorus and nitrogen emissions—based on the absolute fish mass produced—can be higher than in conventional pond farming.

Organic trout producers primarily use natural, biological and mechanical processes through mostly simple measures, such as sedimentation ponds to separate solids and to reduce dissolved compounds. More complex mechanical-technical processes, such as the use of drum filters and biological sewage treatment plants, are generally not necessary due to the low organic load per water volume. Aeration measures are usually only used in special climatic conditions, such as high temperatures in summer.

Organic pond farming usually takes place in earthen ponds. However, there is also an increasing number of ecological trout production in concrete flow-through systems. In contrast to conventional trout producers, most organic producers produce their trout fry themselves in their own hatcheries. This happens primarily because there are hardly any commercially available organic juvenile fish on the market.

- **Trout Tank Raceways**. Raceways, which are usually 2-3 m wide, 12-30 m long and between 1-1.2 m deep, consist of elongated concrete channels. These are constantly flowed through by water, which is usually fed in from adjacent bodies of water and is usually actively aerated with air or even pure oxygen. Depending on the design, the systems are stocked with 25-50 juveniles per m³. This allows production rates of 30-35 kg/m³ to be achieved. Production is between 100-400 kg of fish per l/s inflow per year in less intensively operated systems, and up to 2.5 t per l/s inflow in more intensive systems. In the latter, the water is enriched with pure oxygen, either in the incoming water or in the housing units themselves. In addition, in more intensive systems, the outflow water is cleaned. The state of the art is a drum filter for removing suspended matter, a device for thickening the backwash water of the drum filter and a container for storing the fish manure. Furthermore, if necessary, processing can be carried out using plant filters, biofilters and even denitrification. A new development is the production of edible trout in partial circulation systems based on the Danish model. The water is circulated, cleaned mechanically and biologically after passing through the fish farm and then enriched with air and/or oxygen. Usually only a comparatively small amount of fresh water is supplied, so that in purely mathematical terms the water is replaced once in 24 hours. This form of production enables a significant increase in production per amount of water supplied while maintaining the same water supply. In addition, the emerging water shortage caused by climate change could be counteracted.

- **Trout Tank Raceways Organic**. Organic farm of trout using the raceway production method.
- **Trout Pond**. Rearing in ponds is considered a semi-intensive method as the stocking densities or quantities produced rarely exceed 25 kg/m³. A fundamental requirement for production in ponds is the sufficient supply of fresh water of sufficient quality. Therefore, corresponding systems are often found in spring water areas or in those with suitable groundwater resources.
- **Trout Pond Organic**. Organic farm of trout using the pond production method. Pond systems are per se quite suitable for organic certification. However, the availability of organic juveniles, as well as the significantly higher costs for organic feed (and the often-unsatisfying quality) are an obstacle for farmers to convert to organic practices. Moreover, as traditional pond farming is typically marketing the fish directly to the consumers, the aspect of regionality seems more important than a third-party organic certification.

The main characteristics of the current farm types are presented in Table 28. Organic farms account for 10% of total production in the mussel sector, and 2% in the sea bass/sea bream and trout sectors (if we consider all the three sectors combined organic production represents 6% of total production). Organic mussels currently account for 85% of production of the three species considered, sea bass/sea bream 6% and trout 9%. **Because of limited data available, for a given species and production method, it was not possible to distinguish between organic and conventional farm types.**

Table 28 The main structural characteristics of current farm types in the aquaculture sector in the EU

Farm type	Number of farms	Share of production [%]	Average size [t/farm]	Full Time Equivalent (FTE)	Labour Intensity [FTE/1000t]
Mussels					
Mussels Longline	1153	43%	151	2.6	17
Mussels Longline Organic	132	5%	151	2.6	17
Mussels Bottom	683	47%	283	3.0	10
Mussels Bottom Organic	78	5%	283	3.0	10
Sea Bass/Sea Bream					
Sea Bass/Sea Bream Intensive	462	98%	370	10.2	28
Sea Bass/Sea Bream Intensive Organic	7	2%	370	10.2	28
Sea Bass/Sea Bream Lagoon	107	1%	8	2.9	353
Trout					
Trout Tank Raceways	1141	72%	118	1.8	15
Trout Tank Raceways Organic	29	2%	118	1.8	15
Trout Pond	1650	26%	29	1.0	34
Trout Pond Organic	41	1%	29	1.0	34

3.8.2.Future typology

In future scenarios, all current aquaculture systems are maintained. In addition to current types, the IMTA (Integrated Multi-Trophic Aquaculture), the trout semi-recirculating raceways systems, and the multifunctional pond fish farming are introduced. Because of data limitation the trout semi-recirculating raceways systems and the multifunctional pond fish farming are only described qualitatively and are not modelled in the present report.

For all species and farm types except Sea bass/sea bream lagoon, we assume in future scenarios an increase size of 10% as a result of increased logistic capacities, technological progress, and concentration of aquaculture production. We assume that the combined effects of these drivers will reduce the reduce labour intensity of farms of 10%.

- **Mussels Longline.** Same farm type as the current Mussels longline farm type with an increase in size and decrease in labour intensity.
- **Mussels Longline Organic.** Same farm type as the current Mussels longline organic farm type with an increase in size and decrease in labour intensity.
- **Mussels Bottom.** Same farm type as the current Mussels bottom farm type with an increase in size and decrease in labour intensity.

- **Mussels Bottom Organic.** Same farm type as the current Mussels bottom organic farm type with an increase in size and decrease in labour intensity.
- **IMTA.** IMTA is defined as the cultivation of two or more aquatic species from different trophic levels in the same area in order to mimic the energy flow in natural ecosystems. IMTA systems have been suggested as an innovative method of aquaculture development (Chopin et al., 2012; Chatzivasileiou et al, 2022; Mansour et al., 2022). The concept has long been used in Asia and contributes significantly to the sustainability of aquaculture as it can potentially drive ecological efficiency, environmental acceptability, product-diversity, and profitability, while benefiting society (Kleitou et.al, 2018). By integrating lower trophic, non-fed species, a greater diversity of product, as well as an increased market potential, are introduced in the farm at the same time. As a result, significant benefits are achieved, by maximising the productivity and cost-effectiveness of sea bream and sea bass aquaculture through the exploitation of soluble and insoluble substances that have so far been lost in the framework of conventional monoculture and at the same time restoring negative perceptions of extensive, monoculture mariculture. In this framework, IMTA extractive species (echinoids, holothurians, oysters, scallops, and seaweed) can be chosen and placed in already existing fish or mussel farms. The roles of extractive species can be summarised here:
    - A circular system: the extractive species utilise the waste from the fed species as well as any excess nutrients that enter the marine ecosystem from the land.
    - Environmental benefits: the utilisation of waste which would previously have entered the environment is now remediated by the extractive species.
    - More resilient ecosystem that may prevent disease, pests and parasite load for the system as a whole.
    - Additional biomass and economic products from a farm, while mitigating financial risks associated with monoculture practices.
    - More optimised use of licenced aquaculture space.
    - Intelligent management systems employed on each site-specific farm can offer information (nutrients, currents, physicochemical parameters) on the specificity of each site, for the appropriate species selection and placement within the structure of any individual farm.

      For the sake of simplicity, in our simulations we assume that IMTA systems produce 35% of mussels and 65% of sea bass/sea bream.
- **IMTA Organic**. Organic IMTA farm.
- **Sea bass/sea bream Intensive**. Same farm type as the current Sea bass/sea bream intensive farm type with an increase in size and decrease in labour intensity.
- **Sea bass/sea bream Intensive Organic.** Same farm type as the current Sea bass/sea bream intensive organic farm type with an increase in size and decrease in labour intensity.
- **Sea bass/sea bream Lagoon.** Same farm type as the current Sea bass/sea bream lagoon farm type.
- **Trout Tank Raceways**. Same farm type as the current Trout tank raceways farm type with an increase in size and decrease in labour intensity.
- **Trout Tank Raceways Organic**. Same farm type as the current Trout tank raceways organic farm type with an increase in size and decrease in labour intensity.

- **Trout Pond**. Same farm type as the current Trout tank pound farm type with an increase in size and decrease in labour intensity.
- **Trout Pond Organic**. Same farm type as the current Trout tank pound organic farm type with an increase in size and decrease in labour intensity.
- **Trout Semi-recirculating Raceways (not modelled).** Semi-recirculating raceways are based on a common, overall layout, with a much-reduced intake of fresh water and increased retention of nutrients. In these so-called model farms basic principles and technologies from existing recirculation technology is implemented into traditional earthen pond or concrete raceway trout farms in varying degrees. These systems have gained significant importance in Denmark over the last years because the government has decided to specifically support these kinds of production systems. In these so-called model farms the water is circulated, cleaned mechanically and biologically after passing through the fish farm and then enriched with air and/or oxygen. Usually only a comparatively small amount of fresh water is supplied, so that in purely mathematical terms the water is replaced once in 24 hours. This form of production enables a significant increase in production per amount of water supplied while maintaining the same water supply. In addition, the emerging water shortage caused by climate change could be counteracted. These systems may be of interest also in other countries than Denmark, if policy regulations favour these systems for financial investment. Organic certification however will probably not be economically viable, because of the relative high stocking densities of these systems.
- **Multifunctional Pond Fish farming (not modelled).** It involves the integration of fish production with nature reserves, renewable energy production, recreational angling, and eco-tourism facilities such as a health and leisure centre and excursions such as wildlife watching, all on one site. A good example for this is the Aranyponty Fish Farm in Hungary. Although this type of integrated systems offers the prospect of more efficient use of resources, the development of commercial systems is still at an early stage. The few commercial fish farms that have already embraced the concept of integrated production are still at a pilot-scale level and appear to value it more on ideological grounds than the purely financial point of view. It remains to be seen whether integrated systems will develop into a significant sector in Europe. There appear to be legislative barriers to its adoption in some countries, potential risks concerning market image, and a reluctance on the part of some commercial fish farmers to accept that it may have a serious role to play in the future

The main characteristics of the current farm types are presented in Table 29.

Table 29 The main structural characteristics of future farm types in the aquaculture sector in the EU

	Average size [t/farm]	Full Time Equivalent (FTE)	Labour Intensity [FTE/1000t]
Mussels			
Mussels Longline	166	2.6	16
Mussels Longline Organic	166	2.6	16
Mussels Bottom	311	2.9	9
Mussels Bottom Organic	311	2.9	9
Sea Bass/Sea Bream			
Sea Bass/Sea Bream Intensive	407	10.1	25
Sea Bass/Sea Bream Intensive Organic	407	10.1	25
Sea Bass/Sea Bream Lagoon	8	2.9	353
IMTA (Mussels & Sea Bass/Sea Bream)			
Imta	431	11.5	27
IMTA Organic	431	11.5	27
Trout			
Trout Tank Raceways	130	1.7	13
Trout Tank Raceways Organic	130	1.7	13
Trout Pond	32	1.0	31
Trout Pond Organic	32	1.0	31

3.8.3.Simulated scenarios

For simplicity, all simulated scenarios assume that total production (conventional plus organic) for each aquaculture species in the EU remains stable. Specific modelling assumptions for each simulated scenario are outlined below.

Reference. In the Reference scenario, both conventional and organic production remain stable. Some IMTA systems emerge for mussel and sea bass/sea bream production and partly replace mussels longline and sea bass/sea bream intensive production. In the sea bass/sea bream sector lagoon systems maintain their production unchanged. In the trout sector, ponds decrease their market share, while raceways increase their market share.

Weak EU. Weak EU follows the growth prospects of the EUMOFA pessimistic scenario (EUMOFA, 2022). In this scenario, the organic production of mussels decreases by 20% and that of finfish (sea bream/sea bream, trout) by 38%. As a result, the share of organic production decreases and reaches 8% for mussels, 1% for sea bream and 1.5% for trout (if we consider all the three sectors combined organic production represents 5% of total production). Only the most competitive organic systems with low conversion costs can increase. In this scenario, there is a risk that organic farms will convert to conventional farming (especially for trout and sea bass/sea bream). The less competitive systems are threatened, such as trout pound systems and longline mussel systems. As in the Reference Scenario, in the Weak EU, some IMTA systems emerge and partly replace mussel longline and sea bass/sea bream intensive production; and in the trout sector, raceway systems increase their market share at the expense of ponds.

Green and Fair. Green and Fair follows the growth prospects of the EUMOFA optimistic scenario (EUMOFA, 2022). Driven by a favourable consumer demand, progress in new species research, increased availability of organic juveniles, and supportive public regulation, in this scenario, the organic production of mussels increases by 167% and that of finfish (sea bream/sea bream, trout) by 421%. As a result, the share of organic production increases and reaches 27% for mussels, 8% for sea bream and 13% for trout (if we consider all the three sectors combined organic production represents 19% of total production). In this scenario, IMTA systems develop more rapidly than in the other two scenarios, replacing mussel longlines and intensive sea bass/sea bream production. In this scenario, the more "traditional" and less competitive forms of farming, such as trout pounds, increase their share of production and establish their niche mostly in direct marketing.

Table 30 and Table 31 show respectively the changes in the allocation of aquaculture production and the final share of aquaculture production for the different future farm types in the three simulated scenarios.

Table 30 Allocation of aquaculture production for each category of farm types in the initial situation and in three simulated scenarios in the aquaculture sector in the EU

	Initial situation	Reference	Weak EU	Green and Fair
	Mussels Conventional			
Mussels Longline	47%	45%	45%	37%
Mussels Bottom	53%	53%	53%	53%
IMTA	0%	3%	3%	10%
	Mussels Organic			
Mussels Longline Organic	47%	47%	47%	45%
Mussels Bottom Organic	53%	53%	53%	53%
IMTA Organic	0%	1%	1%	2%
	Sea Bass/Sea Bream Conventional			
Sea Bass/Sea Bream Intensive	99%	90%	89%	65%
Sea Bass/Sea Bream Lagoon	1%	1%	1%	1%
IMTA	0%	10%	10%	34%
	Sea Bass/Sea Bream Organic			
Sea Bass/Sea Bream Intensive Organic	100%	86%	82%	71%
IMTA Organic	0%	14%	18%	29%
	Trout Conventional			
Trout Tank Raceways	74%	90%	90%	80%
Trout Pond	26%	10%	10%	20%
	Trout Organic			
Trout Tank Raceways Organic	74%	90%	90%	80%
Trout Pond Organic	26%	10%	10%	20%

Table 31 Share of aquaculture production for the different farm types in the initial situation and in three simulated scenarios in the aquaculture sector in France

	Initial situation	Reference	Weak EU	Green and Fair
	Mussels			
Mussels Longline	42.6%	40.3%	41.3%	27.2%
Mussels Longline Organic	4.9%	4.8%	3.8%	12.4%
Mussels Bottom	47.2%	47.2%	48.3%	38.2%
Mussels Bottom Organic	5.4%	5.4%	4.3%	14.3%
IMTA		2.2%	2.3%	7.3%
IMTA Organic		0.1%	0.0%	0.5%
	Sea bass/Sea bream			
Sea Bass/Sea Bream Intensive	97.9%	88.1%	88.5%	59.6%
Sea Bass/Sea Bream Intensive Organic	1.6%	1.4%	0.8%	5.8%
Sea Bass/Sea Bream Lagoon	0.5%	0.5%	0.5%	0.5%
IMTA		9.8%	10.0%	31.6%
IMTA Organic		0.2%	0.2%	2.4%
	Trout			
Trout Tank Raceways	71.9%	87.8%	88.6%	69.8%
Trout Tank Raceways Organic	1.8%	2.2%	1.4%	10.2%
Trout Pond	25.7%	9.8%	9.8%	17.5%
Trout Pond Organic	0.6%	0.2%	0.2%	2.5%

3.8.4.Modelling results

In the **Reference** scenario, as organic production remains stable, no current initial conventional farm converts to organic production (Figure 39). 25% of initial aquaculture farms exit the market as they are absorbed by larger farms. In the trout sector, a very large proportion (65%) of trout pond farms exit the market, as we assume that this system cannot be converted to the raceway system. On the other hand, new farms enter in the market and develop raceways for trout tanks. New IMTA systems emerge from mussel longline and sea bass/sea bream intensive systems. The total number of farms decreases compared to the Initial situation (by 23%), especially in the trout sector (Figure 40) as a result of the disappearance of the very numerous, but also very small trout pond farms. The decline in organic farms is less pronounced (15%), as large IMTA systems develop relatively less than in the conventional sector. The total number of employees in the sector decreases (by 13%) due to the combined effect of the lower labour intensity of all farms and the lower relative share of trout ponds. The higher number of more labour intensive IMTA systems does not change this trend. The average number of persons working employed on farms increases by 13% as a result of the increased concentration of aquaculture activities (Figure 41).

In the **Weak EU** scenario, the share of organic production decreases and leads to the exit of current organic farms in the aquaculture sector, which is more than double the level in the Reference scenario. As this scenario does not present major differences with the Reference Scenario, apart from the decrease in organic production, the total number of farms in the sector as well as the total number of persons employed are very similar to those in the Reference Scenario. Finally, for all sectors combined, total organic production falls by 23% and the number of organic holdings by 24% compared to the Reference scenario.

In the **Green and Fair** scenario, all current organic farms remain in the market, driven by a favourable economic environment for organic production. The total number of organic farms increases strongly (242% compared to the Reference scenario), with several conventional farms converting to organic in each aquaculture sector. In this scenario, only 18% of the farms leave the market. This proportion is lower than in the Reference scenario because a relatively higher number of trout pond systems remain active. As a result, the total number of farms is also higher than in the Reference scenario (8%). In this scenario, the higher presence of labour-intensive trout pond and IMTA systems pushes up the total number of persons employed in aquaculture compared to the Reference scenario (5%). In the organic sector, the increase in employment is 329% overall and 162%, 331%, 967%, and 481% in the mussel, sea bass/sea bream, IMTA and trout sectors respectively. This means that in this scenario more than 2,000 workers are involved in organic aquaculture production in total.

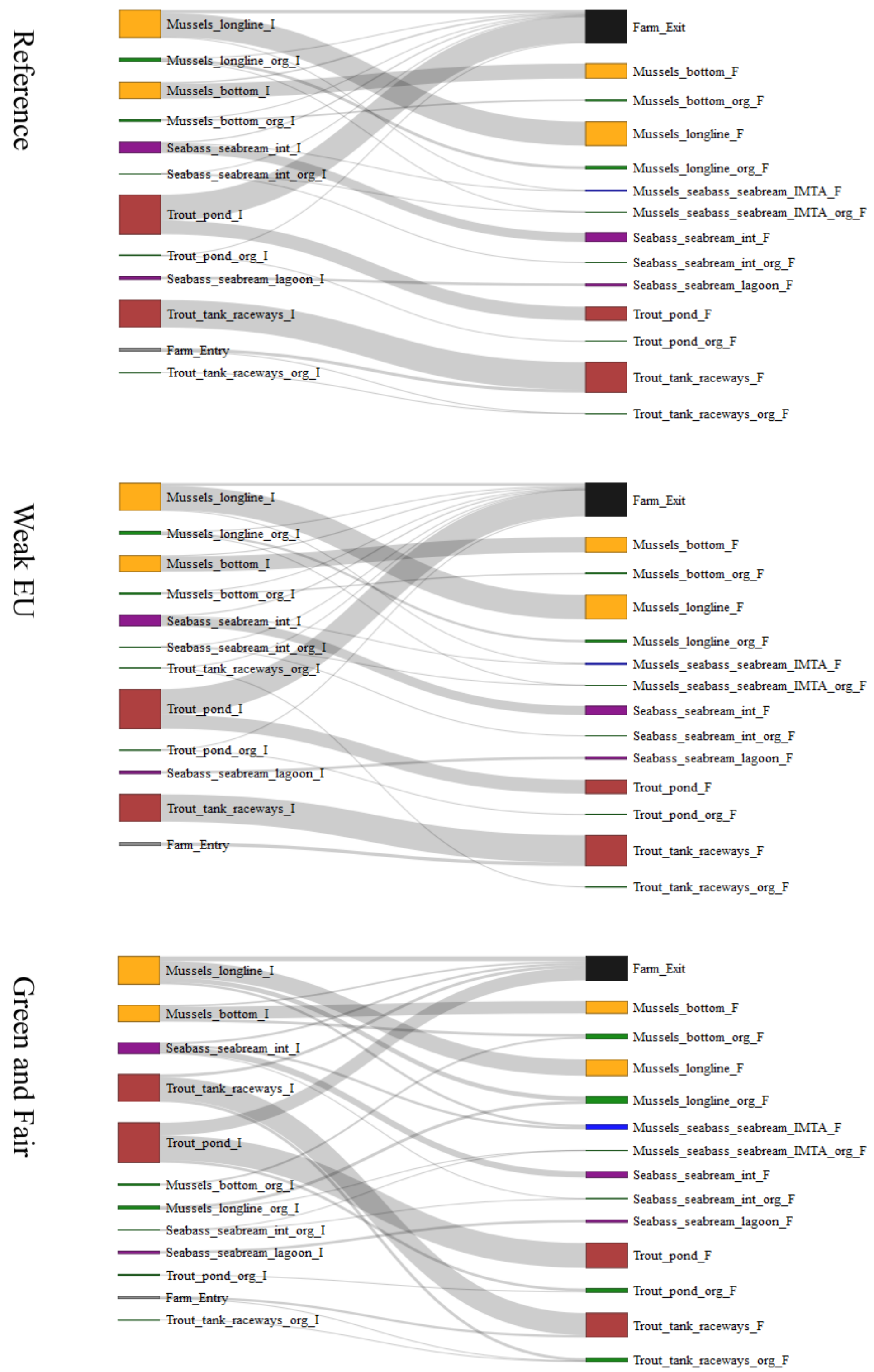

Figure 39 Transition pathways of current farms in the three simulated scenarios in the aquaculture sector in the EU (I= Initial farm type; F= Future farm type)

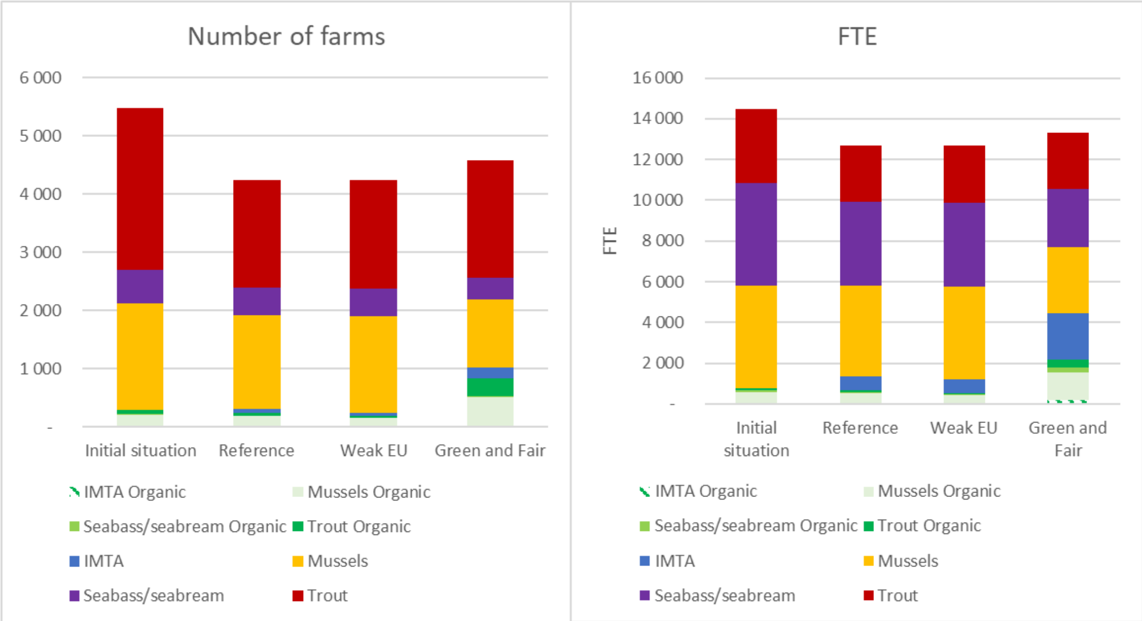

Figure 40 Number of farms and workforce employed in Full Time Equivalent (FTE) in the Initial situation and in the three simulated scenarios in the aquaculture sector in the EU

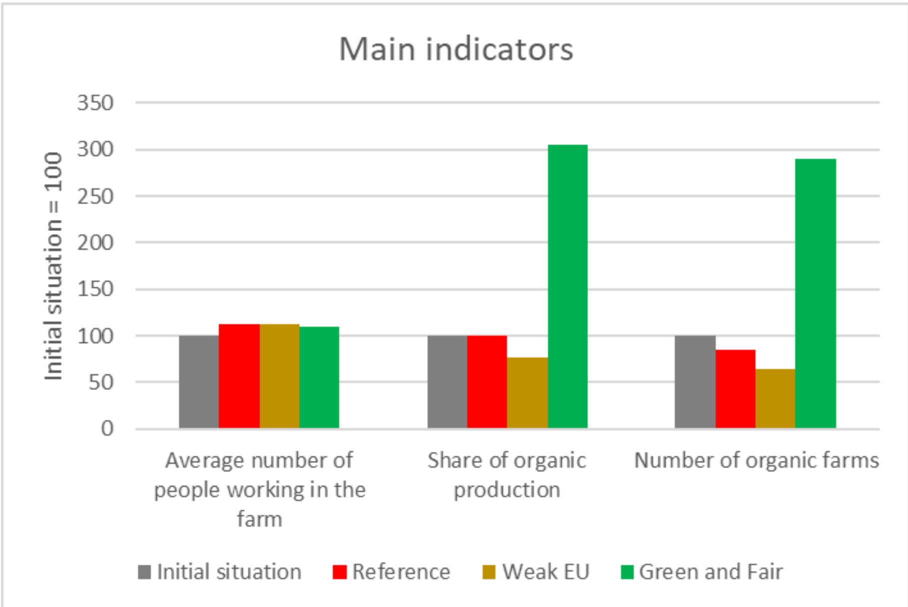

Figure 41 Main structural indicators of aquaculture farms in the EU in the Initial situation and in the three simulated scenarios

4. Discussion

In this section, we summarise the main key results of the report and we provide some policy recommendations. We divide this section in three parts: the first is dedicated to the farm typologies, the second to the organic targets indicated by practice partners, and the third to the simulation results. Policy recommendations are highlighted in italic.

4.1 Typologies

Initial and future typologies reflect the fact that organic farms are more labour intensive (AWU/ha or AWU/animal) than conventional farms. This is due to a combination of factors: smaller farm size notably in the livestock sector (and fewer economies of scale), additional farming operations required for organic farming (such as mechanical weeding), presence of alternative on-farm marketing channels (direct sales, farmers' markets, on-farm processing). This is particularly true for livestock case studies. This result aligns with the findings of Orsini et al. (2018), which indicate that organic arable farms use more labour per hectare than conventional ones. However, it differs from their conclusions regarding livestock farms. Their study only measures the ratio of labour units to hectares, without accounting for the fact that organic livestock farms are generally more extensive, with lower milk yields, and include free-range areas. This increase in labour requirements, as shown by Hilal et al. (2021) and Schiavo (2025), could also apply to the production of processed products.

This consideration raises the question of how to support the expansion of organic farming through public policies in cases where there might be resistance to conversion in conventional family farms—where only family workers work in the farm and which do not want to increase and manage external labour. Many organic farmers may hesitate to expand their workload or hire more workers, as it increases stress and complicates farming logistics.

An alternative to increasing labour might be reducing the size of the farm and/or herd. However, this could lead to increased fixed costs and potential stranded assets.

In almost all the case studies, the practice partners mentioned possible trends for future organic farms:

- **Increase in size**, in some cases reaching the current size of large conventional farms. This strategy is linked to the development of economies of scale, more employment of paid labour, and vertical integration with processors and retailers. As highlighted by Liebert et al. (2022), the expansion of larger organic farms may raise concerns about a reduced adoption of agroecological practices. This trend warrants careful monitoring.

- The development of organic farm types that are even more **specialised** in direct sales and on-farm processing. These types of farms may attract new people to farming. They are generally smaller and more labour-intensive and produce a wider range of goods than other types of farms (Enjolras and Aubert, 2017).

- The development of organic livestock farm types with more **ambitious animal welfare** requirements, certified with additional labels and distribution channels. In this respect, a key point, besides the increased time spent outside by monogastrics, is reducing the distance between farms and the few slaughterhouses that accept organic livestock (IFOAM, 2023).

- The emergence of organic farm types that **mix livestock and crop** activities, especially in areas where crop specialisation is high and livestock production is currently low. These systems play a crucial role in ensuring the complementarities between crops and livestock, as demonstrated by Poux and Aubert (2022) in fertility transfer and reduction of synthetic fertilisation. However, at present, in the case studies analysed, these systems are very marginal due to their high labour requirements, which add to the already labour-intensive nature of organic farms. Many organic farmers may be reluctant to increase their workload or to hire additional workers, as it generates stress and complicates farming logistics (Hermelin, 2019; Dubrulle et al., 2023; Denantes et al., 2025). A reduction of transition costs is needed to reduce critical factors for crop-livestock integration (Asai et al., 2018).

- In aquaculture, the cultivation of two or **more aquatic species** from different trophic levels in the same area (IMTA systems) to optimise natural ecosystem services has also been identified as an option for the expansion of organic aquaculture (as well as the multifunctional pond fish farming where aquaculture is combined with other non-aquaculture economic and social activities).

The existence of these different strategies for future organic farms suggests that policies to support organic production may have different outcomes (in terms of number of farms, jobs, investment needed for example) depending on the **policy instrument** chosen—e.g., support for physical investment in organic farms may not have the same outcomes for future farm types as policies to support organic short value chains, livestock relocation, or new animal welfare legislation.

In case studies where organic production is still very low, the amount of good quality data on organic farms is low or absent in the FADN, but also in national data. *For this reason, policies aimed at increasing organic production should also invest in a more* ***comprehensive data collection*** *process, increasing the sample of organic farms present in the FADN to have a minimum number of organic farms for each FADN farm type classification. This data would also help farmers to make better investment decisions relating to conversion, providing them with up-to-date market and price information.*

4.2 Organic targets in case studies

As expected, the targets fixed by practice partners vary according to the initial level of adoption of organic farming and the specific characteristics of the different case studies. In most case studies, we observe similar adoption targets between the Organic on Every Table and Green Public Policy scenarios.

Based on the current rather unfavourable outlook for organic farming (inflation, political uncertainty, reduced environmental regulation, etc.) in the countries studied, the practice partners were rather pessimistic when setting the organic targets in the business-as-usual (Reference) scenario. Sometimes this pessimistic outlook was also reflected in the targets set in Organic on Every Table and Green Public Policy.

Practice partners see the expansion of organic in **livestock** products (especially meat) as more difficult, mainly because of higher price differences compared to conventional production, lower initial levels and future diets where consumption of livestock products stagnates or decreases (especially those of potential consumers of organic products). *This suggests that public intervention is more crucial than ever to restore trust in the sector and encourage investment and the conversion process. In the livestock sector, this means that public policies should focus more on highlighting the complementarity* ***and synergies between (organic) livestock and arable*** *crops.*

The choice of farms to **convert to organic** also depends on the case studies and scenarios. In some cases, organic farms expand in the currently most productive areas of the country; in others, relatively more in marginal areas; in yet others, the expansion is more balanced. *This also suggests that policies aimed at supporting organic farming should also be adapted to the* ***region*** *where the expansion of organic farming is targeted, since the initial conventional farm types may be very different and may need different policy measures to convert to organic farming* (these conventional farms may have a lower presence of livestock on the farm, lower or higher yields than the national average, they may have very specialised cropping activities, they may use external sources of labour etc.).

4.3 Simulation results

The results of the present study, based on a simulation approach which considers the direct correlation between the number of farms and agricultural labour on the one hand and farm output on the other, suggest that **expanding organic farming would generally lead to an increase in both the total demand for agricultural labour and the number of farms in almost all case studies**, in comparison with the Reference Scenario. This is particularly true in the livestock case studies, where organic farms tend to be smaller and have higher labour intensities (AWU/animal). In the arable case studies, however, the differences in labour intensities (AWU/ha) and farm sizes between conventional and organic farms are smaller, leading to only minor variations in the total number of agricultural workers and farms.

However, despite the increase in the number of farms and workers compared to the Reference Scenario, these figures will remain lower than the current situation. This is due to the growth in average farm size, improvements in productivity (driven by technological progress and economies of scale), and the potential reduction in livestock numbers driven by more sustainable diets. It is worth noticing that these results might be influenced by the modelling approach, which assumes fixed farm sizes and labour units per hectare/animal and might not capture the "lumpy" nature of labour for livestock. Small reductions in livestock numbers often do not reduce labour requirements, as at least one or more workers must still be present on the farm.

Organic farming can be viewed as a valuable option for enhancing the appeal of farming and reducing rural depopulation*. This is because it creates more jobs in rural areas and may encourage new entrants, particularly young and female farmers, to join the agricultural sector (Sapbamrer and Thammachai, 2021). However, policymakers should anticipate a* ***decline in the farm population*** *in the near future, as farm concentration and specialisation are expected to continue, regardless of the* *growth of organic farming. To mitigate the negative effects of this trend, policymakers should **create new job opportunities in rural areas**, some of which may be connected to agriculture, such as agro-tourism or direct sales.*

Based on 2020 data, which is particularly favourable for organic farming compared to more recent years (for which we lack data access in this project), the **income per family farm worker for future organic farm types is, in most cases, similar to or even higher than that of future conventional farms**. This result is consistent with the works of Guyomard (2013), Moakes et al. (2015), Crowder and Reganold (2015), Lambotte et al. (2023).

Additionally, transitioning to organic farming often leads to higher family farm income for farms that start as conventional farm types. This result holds true even when accounting for depreciation schedules, where path dependence is stronger (with the broiler sector being a notable exception).

Future organic farms have in some cases a significantly higher income per family farm worker than standard organic farms, *which means that there is likely to be scope for **increasing farm profits** independently of market conditions if public policies help organic farms to evolve towards higher performing types in the future.*

5.Conclusion

This report explores how organic and conventional farming may evolve under various scenarios related to the expansion of organic agriculture in the EU. Using an input-output analysis, the report examines key socio-economic indicators and the changes in farm structures. It also assesses and quantifies the conditions under which certain transitions toward organic agriculture are feasible. To our knowledge, this is one of the first reports to provide a detailed analysis of organic farms through several case studies, rather than treating them as a single, homogeneous group. It also offers modelling results that explicitly consider the future structural transformation of organic farms.

This report has several limitations. First, there is significant variability in the quality and quantity of data on organic farms across different case studies, which affects the quality of the results. In case studies where organic farming is not widespread, the amount of available data can be particularly limited. Second, the methodology assumes that future farms will consist of groups of farms that are already existing but that are currently marginal or not widespread and that will become the norm in the future. As such, the identification of future organic farms is constrained by the presence of these farms in the FADN database. This may pose challenges in cases where the sample of organic farms in the FADN is small, or when experts envision future organic farms that do not exist today. Finally, our modelling simulator treats the modeller as a central planner with the authority to determine the final population of farms. While this approach is suitable for foresight analysis and provides flexibility for expert discussions and scenario design, it does not aim to optimise the behaviour of economic agents or assess the impact of scenarios on product prices, farmers' remuneration, wages, or social welfare.

Despite these limitations, this study presents opportunities for future research on the organic sector and provides valuable insights for policymakers and stakeholders on the potential development of the organic farms through various alternative pathways.

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Annex

Summarised description of Organic on Every Table and Green Public Policies scenario narratives

PUSH - POLICY DRIVEN SCENRIOS	DIVERGENT PATHWAYS FOR ORGANIC SECTOR
	GREEN PUBLIC POLICY
PULL-DEMAND DRIVEN SCENARIOS	ORGANIC ON EVERY TABLE
	ORGANIC POWER TO THE PEOPLE

		PUSH - POLICY DRIVEN			PULL - DEMAND DRIVEN		
	DRIVER	STATE 1	STATE 2	STATE 3	STATE 1	STATE 2	STATE 3
MEGA TRENDS	Political climate towards OF	Green Deal cancelled	Green Deal stalled	Green Deal +	Green Deal cancelled	Green Deal stalled	Green Deal +
	Water availability for farming	Water conflicts	Mixed corporate-public governance of water	Circularity and regulated water	Water conflicts	Mixed corporate-public governance of water	Circularity and regulated water
CONSUMERS PERSPECTIVE	Competition from alternative standards	Mainstream agriculture revival	Entropy of standards	Organic primacy	Mainstream agriculture revival	Entropy of standards	Organic primacy
	Food scares	Organic scandals	No pain, no gain	Conventional food scandals	Organic scandals	No pain, no gain	Conventional food scandals
	Sustainable and healthy diets	Going junky	Healthy but Grey	Healthy & Green	Going junky	Healthy but Grey	Healthy & Green
SUPPLY CHAIN	Large retail chains involvement	Fragmented supply	Networking	Big is better	Fragmented supply	Networking	Big is better
	Organic public procurement	Organic demand stays private	Fragmented public procurement	Public procurement boost	Organic demand stays private	Fragmented public procurement	Public procurement boost
POLICY	Eco-schemes, national/ regional policies OF	Unfavourable CAP	Neutral CAP	Favourable CAP	Unfavourable CAP	Neutral CAP	Favourable CAP
	NGT in OF	NGT liberalisation	NGT only in conventional	NGT-free EU	NGT liberalisation	NGT only in conventional	NGT-free EU
	Subsidised credit for OF/processor	Credit crunch for organic farmers	Credit lines for organic farmers	Organic finance	Credit crunch for organic farmers	Credit lines for organic farmers	Organic finance
FARMERS PERSPECTIVE	Conversion of arable farming systems	Concentrated growth	Lagger countries catching-up	Widespread uniform conversion	Concentrated growth	Lagger countries catching-up	Widespread uniform conversion
	Conversion of livestock systems	Concentrated growth	Lagger countries catching-up	Widespread uniform conversion	Concentrated growth	Lagger countries catching-up	Widespread uniform conversion
	Farm-gate relative prices of OP vs CP	No more premium	Uneven premiums	Premium prices are there to stay	No more premium	Uneven premiums	Premium prices are there to stay
AKIS	Capacity building in organic NGOs	Fragmented NGOs	Few EU/National strong lobbying	Development of Organic NGOs	Fragmented NGOs	Few EU/National strong lobbying	Development of Organic NGOs
	Training and education for OF	Organic AKIS stay marginal	Common AKIS for farming	Knowledge boost in OF	Organic AKIS stay marginal	Common AKIS for farming	Knowledge boost in OF

Organic on Every Table scenario narrative

Organic farming's benefits for the environment and society are well understood by citizens and policymakers alike, and this is broadly reflected in their actions towards organic.

The Green Deal is challenged by the polarity between long-term green targets and emergency needs triggered by global crises and trade. However, evidence of the climate emergency and water issues keep environmental considerations prominent, triggering the agri-food industry push for NGTs. However, thanks to the lobbying of organic and like-minded NGOs and national authorities, the Green Deal remains, and NGTs are kept out of organic.

The push for protecting biodiversity and groundwater resources and reducing oxygen loss in rivers, lakes and local watercourses is connected to organic farming. It helps reinforce the positive political climate for organic. Organic primacy is propelled and stands out from attempts from alternative standards and schemes to gain room and legal recognition in the sustainability and market domain.

Nearly all people recognise the organic label as a guarantee for the food values they care about. Organic food has reached all European families – in their houses when preparing dinner, but also at work and in restaurants, and is increasingly coupled with health-related attributes and claims. Organic food is widely included in schools and public canteens, through targeted green public procurement policies.

The organic premium still exists, but the price differential is smaller (except for animal products), partly because supply chain actors are empowered, and farmers have more direct involvement in the distribution chains and can broker better agreements with processors and distributors, which is reflected in the prices offered by large retail chains to their customers.

Large-scale retailers play a leading role in facilitating the mainstream availability of organic products by increasing the range of products and getting more involved in the organic food chain. They have also incorporated and consolidated some small-scale alternative and specialised retailers. However, alternative models are expanding and innovating, e.g., e-commerce, digital box schemes and CSAs, farmers' markets, new distribution models, and general farmer-consumer partnerships.

Organic farmers receive preferential credit due to their ecosystem services (e.g., carbon and biodiversity credits). Private investment funds and public support both play an important role in financing the sector. While the generally positive policy and market conditions encourage a widespread conversion to organic for arable and permanent crops, livestock production is carried out in the context of wider societal shifts in relation to the diminishing role of animal products in healthy and sustainable diets. Issues such as appropriate production methods, animal welfare etc. are important, and grazing animal farming doesn't expand overall. Still, it is concentrated in specific areas, such as mountain regions and less favoured areas.

Organic Agricultural Knowledge and Information Services (AKIS) widely exists in all schools, agricultural training and advisory services, universities and research institutions and are becoming mainstream. The current trends on AKIS sustainable farming are mainstreaming organic agriculture, placing it side by side with agroecology and regenerative methods.

Shorter version

Public policy has long championed organic farming, but now consumer demand is reshaping the entire organic food chain, creating an organic market boom driven by big business. Consumers' desire for healthy, sustainable food at home, work, and restaurants is transforming the landscape. The organic label is a trusted symbol of the values they care about – environmental responsibility, animal welfare, and potential health benefits. This recognition is pushing supermarkets, restaurants, and even schools to offer more organic options.

Big business is strategically aligning itself with this consumer demand. Major retailers and processors are expanding organic product lines and getting directly involved in the food chain by partnering with or acquiring smaller organic players. This wider availability makes organic food more accessible to everyone. As competition rises, the price gap between organic and conventional shrinks. At the same time, alternative models like e-commerce, local box schemes, farmers' markets, and direct consumer partnerships are flourishing. These options empower farmers, giving them more control over the supply chain and allowing them to negotiate better deals with processors and retailers, ultimately capturing a larger share of the final consumer price. This shrinking price gap further fuels consumer demand, creating a virtuous cycle.

Investment is another key player. Private funds are pouring into the organic sector, driven by strong consumer demand. This financial backing helps farmers convert to organic practices and expand production to meet growing needs. This market-driven approach is making organic food more accessible and affordable, creating a win-win for everyone: consumers get the food they desire, farmers benefit from increased market opportunities, and taxpayers welcome more sustainable farming practices without the need for increased public support. Organic farmers, empowered by a strong market and greater control in the supply chain, are seamlessly integrating organic principles with agroecology and regenerative methods. A surge in organic conversion for arable and permanent crops is driven by favourable market conditions reinforced by favourable policies and regulations. Livestock production faces challenges due to shifting dietary preferences: grazing animal farming remains localised, primarily in mountain and less favoured regions, while pig and poultry production is increasingly challenged by plant-based meat substitutes.

This scenario is likely to create more regional differences than the Green Public Policy. In countries where – for various reasons (lower incomes and lower appeal/presence of big players) – organic demand will be lower, the effect would be mostly on exports, with lower farm-gate prices. In richer countries with stronger supply chains, imports will increase alongside with lower price gap between farmer and consumer prices, with a better share of value added going to organic farmers. Commoditisation may occur but only to a certain extent, or organic products will become indistinguishable from conventional ones. Given the market is led by big players, and there is a significant pouring of private funds also in the form of investments, increases in productivity, efficiency, and size are more likely to occur than in the first scenario. Networks and concentration processes are also more likely to occur.

- Consumer desire for healthy, sustainable food is driving a market boom for organic products, led by big business.
- The trusted organic label pushes supermarkets, restaurants, and schools to offer more organic options.
- Major retailers and processors are expanding organic offerings and directly entering the supply chain. Increased competition shrinks the price gap between organic and conventional products, further fueling consumer demand, but can also put pressure on farmers' share of the final price.
- Investment in the organic sector helps farmers convert and expand production, but the impact on their share of the final price depends on negotiation power within the market. Farmers' cooperatives/networks and stronger bargaining power can help ensure a fairer share of the final price for producers.

Green Public Policy scenario narrative

Growing concerns among the public and policymakers regarding significant environmental challenges such as climate change, biodiversity loss, and issues related to water and soils have intensified. In response, there is a heightened focus on bolstering and improving European policy frameworks, including initiatives like the Green Deal, Farm 2 Fork, and Biodiversity Strategies, along with subsequent policies. The escalating severity of extreme weather events, like droughts and floods, coupled with rising costs for energy, fertiliser, and imported feed, is prompting farmers to increasingly embrace and cooperate with green policies to mitigate risks.

The evolving political landscape, marked by the forming of new farmer networks, signals a proactive engagement with environmental concerns and a shift in production systems. There is an increasing collaboration between organic and agroecology organisations, as well as environmental NGOs. This collaborative effort extends to establishing diverse production standards, focusing on ensuring long-term resilience.

Building upon the commitments outlined in the CAP 2023-27, the future CAP reform strongly emphasises organic farming and agri-environmental support. Given the added environmental benefits, this strategic shift makes organic production more appealing, especially for arable producers. The pig and poultry systems witness a transition toward localised feed sourcing, leading to reduced intensity. Overall, livestock numbers decrease alongside reduced consumer demand for meat and dairy products.

The push for conversion to organic practices is primarily driven by policy initiatives and public support rather than market forces. While premium prices are not guaranteed and may experience fluctuations, policy measures actively support the organic Agricultural Knowledge and Innovation Systems (AKIS), supply chain, and market initiatives to encourage and facilitate conversion.
There is growing acceptance of organic practices at the national and local levels, with organic food becoming the standard in public institutions such as hospitals, canteens, and schools. The widespread adoption of organic practices is particularly encouraged in regions facing significant environmental challenges. Regions grappling with issues like abandonment find new opportunities to re-engage with farming.

While current organic regulations gain prominence, there is increasing pressure from other farming groups to develop alternative standards, such as integrated and regenerative approaches, including the introduction of EU sustainability labelling. Efforts to standardise and reduce greenwashing are essential to avoid the proliferation of competing standards. Adaptations to organic regulations are necessary to address emerging challenges related to climate, biodiversity, and consumer expectations, ensuring the continued predominance of organic practices.

Shorter version

The public's environmental concerns, including climate change and biodiversity loss, are shaping EU policies. European farmers are on the frontline of a public push for sustainable agriculture, driven by the urgency of climate change and extreme weather events. Public support is playing a crucial role in this transition. The new Common Agricultural Policy (CAP) emphasises stronger support for organic farming and agri-environmental measures, making organic production more appealing, especially for arable producers. The pig and poultry systems witness a transition toward localised feed sourcing, leading to reduced intensity. Grazing cattle and herds are maintained and supported by public policies aimed at biodiversity conservation. Overall, livestock numbers decrease alongside reduced consumer demand for meat and dairy products. The CAP's significant support for organic farming makes it the most attractive option for farmers. However, alternative standards lead to consumer confusion and unreliable private demand. Therefore, organic premium prices aren't guaranteed and can fluctuate. This is where robust public support from the European Union steps in. This support extends to research, education, and market development for organic products. Additionally, public institutions across Europe are increasingly buying organic, creating a stable and reliable market demand. National differences in public support and market development are reducing in importance. With the many emerging alternative standards (e.g., regenerative, outcome-based approaches) backed by large corporate players, the EU organic regulation remains the essential tool to ensure the continued growth of organic farming and maintain consumer confidence.

In this scenario, there isn't a specific incentive for farmers to grow in size, diversify their production, or increase their productivity, though EU, national, or regional policy may impact these variables by AKIS (e.g. funding research and extension), or by public schemes favouring networking (e.g., cooperatives), acquisitions and the like. Diversification may be however imagined if CAP measures ask for increased rotations, biodiversity, and the like.

- Public concern for the environment shapes EU policies, making organic farming the most attractive option for farmers, especially for crops.
- Public support through the CAP incentivises organic practices and reduces livestock intensity. It also helps maintain grazing herds for biodiversity.
- A strong, public-backed organic label ensures consumer confidence despite competition from alternative standards. However, fluctuating private demand due to alternative standards can impact the farmers' share of the final price.
- Public institutions buying organic creates a stable market, even if consumer demand fluctuates and price premia may reduce.

Summarised description of Weak EU and Green & Fair scenario narratives

DRIVERS	DRIVERS' STATES		
Changes in market globalisation processes	**Re-globalisation**	Strong EU	West-East polarisation
Food preferences	Sustainable & healthy diets prevail	Fragmented consumers' preferences	Unsustainable & unhealthy diets prevail
Water availability for organic aquaculture	Water conflicts	Mixed corporate-public governance of water	Circularity and regulated water
Competition from alternative fishery production standards	Mainstream aquaculture dominance	Entropy of standards	Organic primacy
Availability of **fishery resources**	Business as usual		Reduced availability of Fishery resources
Availability of processed fish species	Low	Medium	high
Processing form	Fresh (unprocessed)	Preserved (dried, smoked, canned, etc.)	Frozen
Price premium at farm gate for OA	No more premium	Uneven premiums	Premium prices are there to stay
Labour and other input costs	OA stays cost-inefficient	Moderate improvement in cost efficiency	Cost efficiency achieved for OA
Scale of production/ economy of scale for org. aquaculture sector	OA sector stays embryonic	Prevalence of SME	Big is better
EU policies and regulatory framework	Common rules	Patchwork regulation	Regulatory overload
Societal, environmental and ethical concerns	Green but not fair	Greenwashing	Green & Fair
Organic marketing campaigns and lobbying	Fragmented NGOs	Few EU/National strong lobbying	Development of Organic NGOs
R&D/training and advisory services for OA	Organic knowledge system stays marginal	Common knowledge system for aquaculture	Knowledge boost in OA

WEAK EU	GREEN AND FAIR

Weak EU scenario narrative

As market globalisation processes unfold, they increasingly highlight a noticeable polarisation between the Western and Eastern hemispheres. This trend deepens existing economic divides and underscores disparities in opportunities and access to resources. Amidst these shifts, food preferences play a pivotal yet concerning role. Despite growing awareness of the importance of sustainable and nutritious diets, prevailing food choices often turn towards convenience over health, contributing to the prevalence of unsustainable and unhealthy dietary habits worldwide.

Conflicts over water allocation persist among diverse users engaged in various activities within shared spaces. Corporate interests predominantly influence governance structures, although the EU government exerts some oversight. Meanwhile, alternative sustainable and organic aquaculture standards compete for dominance, complicating regulatory frameworks. The abundance of fishery resources does not significantly impact organic aquaculture production. The pricing dynamics further highlight the disparity between organic and conventional products, with organic farmers requiring substantially higher farm gate prices to justify conversion or maintain organic standards for aquaculture. The high cost of organic inputs, coupled with inefficiencies in production systems, hampers the attractivity of organic aquaculture, leaving it in a nascent stage.

Moreover, the regulatory framework in the EU remains fragmented and burdensome, impeding the sector's growth and leading to concerns of "greenwashing" as environmental and ethical considerations are overshadowed. With societal influence on the decline, lobbying efforts are concentrated in a handful of countries, limiting broader advocacy for organic aquaculture. Consequently, the knowledge system surrounding organic aquaculture remains marginalised within this complex ecosystem.

Green and Fair scenario narrative

In the vision of Fortress EU, the European Union remains a formidable economic entity but increasingly isolates itself from global trade, erecting higher tariff and non-tariff barriers. This protectionist stance aims to shield domestic industries from international competition. Meanwhile, public investments in water infrastructure across EU nations alleviate water scarcity, promoting water reuse, particularly in organic aquaculture. This supports sustainable practices while ensuring sufficient water for production.

Consumers within this fortress prioritize organic and healthy food sourced sustainably, favouring certified products. Organic aquaculture gains primacy, with alternative standards failing to gain legal recognition. Consumers increasingly perceive organic aquaculture as the superior environmental and biodiversity conservation choice.

However, challenges arise as fishery resources diminish due to climatic shifts, overfishing, and potential policy interventions. In response, seafood preparation methods diversify, including preservation, drying, smoking, and canning, while the frozen chain facilitates the distribution of farmed fish.

Despite increased availability, organic premium prices erode slightly, yet cost efficiency improves for organic aquaculture, enabling profitability despite higher input costs. Supply chains integrate small and medium-sized enterprises into organic districts or cooperatives, enhancing profitability through economies of scale.

EU policies establish common rules and regulatory frameworks to ensure uniformity, emphasising safety and quality standards for organic aquaculture. Societal, environmental, and ethical concerns drive a green and fair agenda, supported by organic marketing campaigns and lobbying efforts.

However, challenges persist in differentiating research, training, and advisory services between organic and conventional aquaculture, highlighting the need for further development in this area within the organic sector.

ORGANIC TARGETS 4EU

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