State of play, trends and success factors for French sheep-for-meat farming

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Abstract. Sheep-for-meat farming has experienced severe difficulties and profound change over the last thirty years, yet sector income still remains among the lowest in French agriculture. This study aims to explain the observed trends, highlight the diversity of farming systems and system performances, and identify factors for economic success. Increasing farm size has not improved income. In the long term, it is the technical results in terms of ewe productivity, coupled with control of feeding cost (concentrates) that secures a high gross margin per ewe. This criterion, again in the long term, remains the primary explanatory factor for net income, ahead of flock size and control of overheads. These technical control components can converge with limited environmental impacts in terms of energy consumption and greenhouse gas emissions per carcass kg. The paper also proposes a multivariate analysis-based method for depicting and characterizing farm trajectories over the long term.

Keywords. Livestock – Sheep – Meat – Farming system – Economy – Trajectory – Income.

État des lieux, tendances et facteurs de réussite pour l'élevage français d'ovins à viande

Résumé. *L'élevage ovin allaitant français a connu de graves difficultés depuis une trentaine d'années, a subi de profondes mutations, et son revenu reste encore parmi les plus faibles de l'agriculture française. Cette étude vise à expliquer l'évolution observée, à montrer la diversité des systèmes d'élevages au travers de leurs performances, et à identifier les facteurs de réussite économique. L'augmentation de la dimension des fermes n'a pas permis d'améliorer le revenu. Sur le long terme, ce sont les résultats techniques, en terme de productivité du troupeau, associée à une maîtrise des coûts d'alimentation (concentrés), qui permettent d'assurer un niveau élevé de marge par brebis. Celle-ci reste, sur le long terme également, le premier facteur explicatif du revenu, avant la dimension du troupeau ou la maîtrise des charges de structure. Ces éléments de maîtrise technique coïncident aussi avec un impact environnemental limité en termes de consommation d'énergie et d'émission de gaz à effet de serre par kilo de carcasse produit. Enfin, cet article propose une méthode de représentation et de caractérisation des trajectoires d'exploitation sur le long terme à base d'analyse multifactorielle.*

Mots-clés. *Elevage – Ovin allaitant – Système – Économie – Trajectoire – Revenu.*

I – Introduction

French sheep-for-meat farming, which is essentially localized in depressed areas, has been struggling through 30 years of economic turbulence due to changing business cycles, shifts in common agricultural policy, and the internationalization of sheep meat trade, which is a major shaper of national-operator commercial policy (Rieutort, 1995). Throughout this period, sheep farming systems have experienced their own radical change. Workload has become a recurrent issue, and farmwork evaluation methods have been developed to revise farm organization structure (Dedieu *et al.*, 1997). The generalized slide in national-scale farm headcounts has camouflaged a wholesale sector-wide overhaul in production, extending from specialization and farm size to production cycles and seasonality. This aim of this paper is to report the broad range of system performance levels recorded and to identify key factors for economic success.

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We also propose a method based on multivariate analysis that reveals and explains the diverse trajectories of individual farms over a 16-year period. We then move on to gauge the new political and societal dimensions, and conclude by pinpointing future directions for sector development.

II – State of play: economic turbulence and a sharp decline in sheep headcount numbers

1. Very low French-average income figures

The chronic economic turbulence that has caused Europe-wide upheaval across the sheep-for-meat sector is visible in the steady decline in sheep headcount numbers, down -17.3% over the 2000-2009 period (UE15, Institut de l'Elevage, 2010). This slide has only recently hit the UK and Spain (in the early 2000s) but has a more long-standing history in France, where sheep-farm headcounts have been halved over the last 30 years (France Agrimer, 2009).

A national database cross-representative of French agriculture and built around technical-economic farm types (the 'OTEX' system) can be used to track the time-course evolution of farm income (AGRESTE, 2009). OTEX class 44 aggregates farms qualified as "Other herbivores", essentially comprising sheep. Figure 1 shows that for nearly two decades now, OTEX 44-class farms have been posting lower revenues than any of the other major farm production types. The mean revenue of OTEX 44-class sheep-for-meat farms alone is even lower, reaching barely €7000 per worker per year between 2005 and 2008.

--▲--Suckler cattle ··△··Dairy cattle --●--Field Crops --□--Sheep+goat+other herbiv.
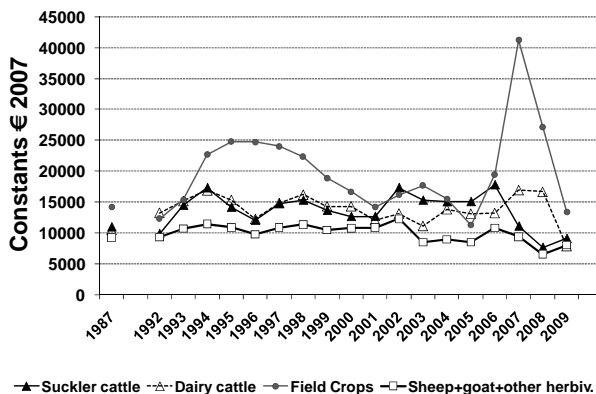
Fig. 1.   Earnings profit per family farmer from 1987 to 2009 for 4 'OTEX'-indexed technical-economic farm types. 2009 revenue figures are estimates based on French Ministry for Agriculture accounts (Agreste 2009).

2. Increasing size without increasing revenue

Observational surveys led on a group of farms that our research unit has been tracking since 1987 show that despite sheep farm labour productivity increasing 83% in upland zones and 32% in the plain, per-worker revenue (in constant euros) barely edged upwards in upland farms between 1987 and 2009, and even looks set to drop in the plain (Figs 2 and 3).
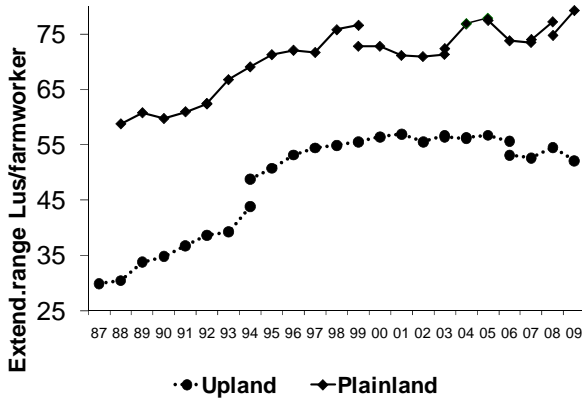
Fig. 2. Labour productivity (equivalent LUs per worker) in upland and plain-zone farms over time: 1987-2009 (source: INRA farm network).
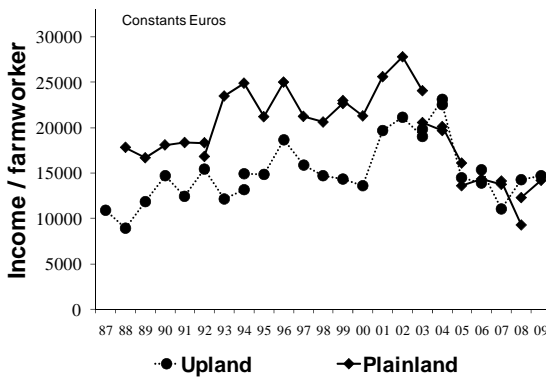
Fig. 3. Income per worker in upland and plain-zone farms over time: 1987-2009 (source: INRA farm network).

This time-course pattern can be explained by various factors, primarily three negative trends: (i) an 18% drop in sheepmeat prices in constant euros during the period; (ii) a major rollback of the financial support offered through sheepmeat regime premium payments, with the guaranteed baseline income under the sheepmeat premiums scheme losing 39% over the 1988-1998 period; and (iii) shifts in common agricultural policy, particularly the 1992 reform, which opened up price support schemes for crop farms, with a broad-range differential in subsidies between cropland and pastureland.

These negative trends have been partially offset by other factors, particularly the collapse of concentrate prices over this period (-40 to -50% in constant euros depending on farm region) in the wake of the 1992 CAP reform, but also the positive (although short-lived) effects of the national policy backing sheep farming from 2000 to 2006 through the 'CTE' regional farmland development contracts scheme.

That said, these mean patterns camouflage strikingly different income extremes, especially given the broad panel of production systems aggregated.

III – Exceptionally broad range of systems, performances and trends

1. Farm structures and technical-economic performances show strong variation despite the same context-setting

Field surveys were led on a group of professional specialized sheepmeat production farms in and around the Massif Central region, some in the low upland zones (essentially exploiting local hardy breeds), and some in the southern Vienne and Allier plains. For the purposes of simplicity, from hereon in, these two farm groups are referred to as "upland" and "plainland".

Farm structure varies strongly between the two zones. In 2008, utilized agricultural area (UAA) on these 40 farms ranged from 43 up to 296 ha, while number of ewes ranged from 200 to 1140. Gross margin per ewe and income per worker also varied strongly: gross margin per ewe ranged from 0 to €110, while income per worker ranged from -€5000 to +€27000. This revenue is not drawn solely from the sheep flock, since there are other activities (intensive indoor production for example) in 6 of the 40 farms and an average 7 ha of cash crops.

The revenue variability is equally visible in upland and plainland farms, with no distinguishing revenue level between the two regions despite the fact they work with radically different soil-climate potentials, breeds, and land capital structures.

Strong variability is equally visible in technical-economic flock performances. Figure 4 shows that ewe productivity (EP) ranged from 1 to 3 while concentrate input ranged from 1 to 7. The differences reflect the diversity in reproduction policy (accelerated lambing with 3 lambings in 2 years, out-of-season breeding or, conversely, intensively spring-centric lambing) together with variability in technical process control or the technical performances targeted by the sheep farmers. Figures 4 and 5 illustrate the heavy influence of the EP and concentrate input criteria on gross margin (figures are for 2008, when concentrates were particularly expensive): farms maximizing EP at minimal concentrate input (arrows in Fig. 4) posted consistently higher gross margins that the all-farm population average (Fig. 5).
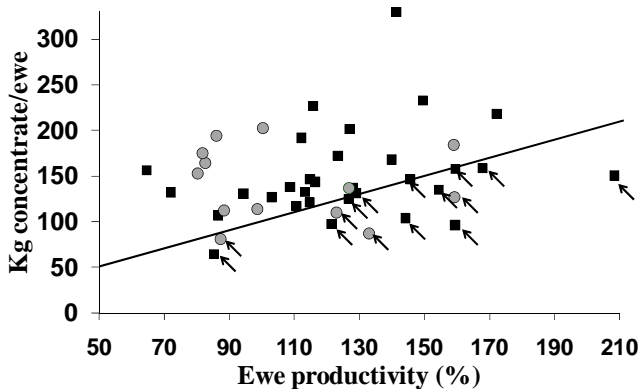

Fig. 4. Ewe productivity against concentrate input per ewe for a sample population of 46 farms in 2008: upland (black) vs plainland (grey). Arrows flag farms that kept concentrate input lower than ewe productivity.
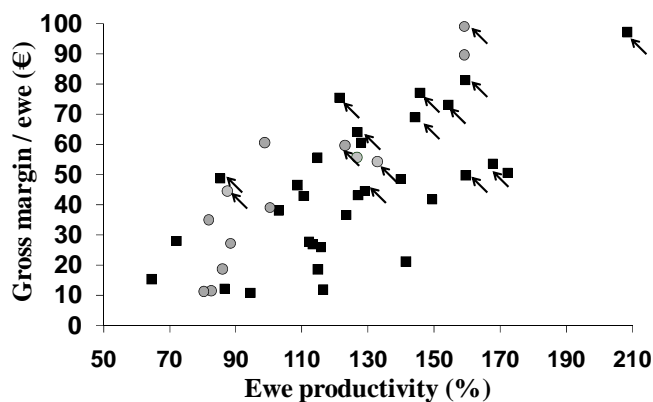
Fig. 5: Ewe productivity against gross margin per ewe for a sample population of 46 farms in 2008: upland (black) *vs* plainland (grey). Arrows flag farms that kept concentrate input lower than ewe productivity.

2. Highly-contrasted trends

Analysis of long-term mean performance and structural trends within the farm population (see 2.2) reveals underlying permanent developments in sheep farms. What kinds of dynamics are driving these changes? Is the change curve linear or does it show surges? These questions were addressed using a dataset on 36 farms tracked over the 1988 to 2003 period, giving a total of 460 farmer-years-in-business. Between 25 and 30 farms were surveyed annually, 15 of which formed an uninterrupted 1988-to-2003 sample. A total of 387 farmer-years-in-business came from farms tracked for at least 12 years, representing 84% of the entire dataset. Shorter timeframes of < 5 years were excluded from the core sector trends analysis.

The purpose of this analyses was to illustrate and interpret core long-term trends in sheep farms via multivariate principal component analysis (PCA) led on the total 460 farmer-years-in-business dataset, using 14 descriptive variables characterizing the structure and operating systems of the farms (see Inset 1).

Inset 1: Principal Component Analysis – Variables used (Benoit, 2006)

(i) Total hectarage (UAA), Stocking rate, Labour productivity: (LU+1/2 ha of crops)/LabUnits, Proportion of sheep LU per total LU, Proportion of on-salary LabUnits.

(ii) Proportion of overall operating margin (excluding general support payments) made on fodder area, Infrastructure costs per structural unit (=LU+ha of crops), Debt ratio, Gross margin per ha on crops.

(iii) Gross margin per ewe, Fodder area costs per ewe, Quantity of concentrate input per ewe, Proportion of out-of-season lambings (out-of-season index), Proportion of fat lambs finished entirely or partly on pasture.

Results

F1 (18.3% of variance): sheep stock management system (out-of-season index, type of lambs produced, concentrate input = 58% of F1) and type of farm activity (sheep or crops) = 18% of F1.

F2 (15.5%): size (UAA), fodder area intensification level (stocking rate)

Annual data for each sheep farmer was projected along the plane defined by the first two PCA factors and connected as trend curves smoothed over 3 years (Figs 6 to 9). The results output emerges two types of core trend: (i) long-term structural trends, which for a given farm translate as dispersed positions between period-start and period-end on the PCA axes; and (ii) shorter-term trends, which essentially reflect operating system changes in the sheep stock (calculations on mean distance between two consecutive years based on single farm coordinates over the 14 PCA-identified factors).

These two trend criteria were not inter-related: strong year-on-year variations were able to match to good long-term stability, whereas strong long-term variation could prove steady and gradual. The trend timeframes (from 8 to 16 years) were clustered into 4 type-groups reproduced in Figs 6 to 9, where the upsized points flag the last year of the timeframe for a given farm.
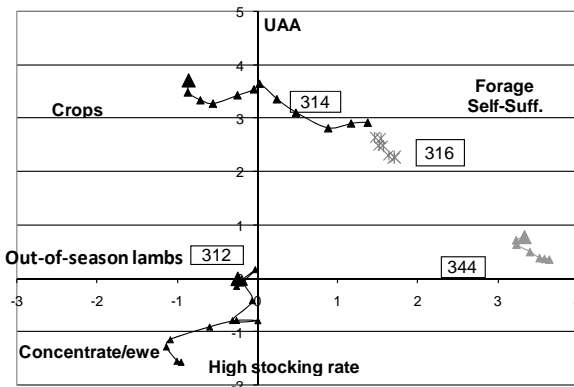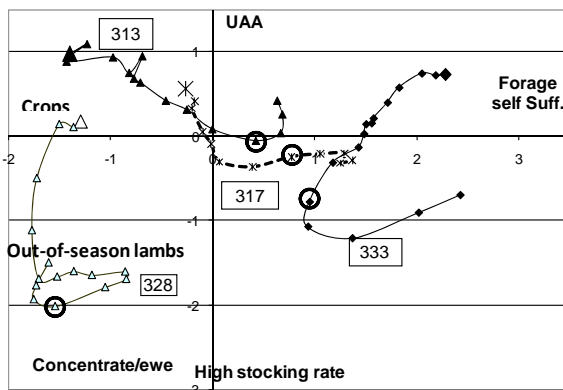

Fig. 6. Weak year-on-year trend.

Fig. 7. Mean year-on-year trend and significant changes (bold circles on curve plots mark 1992).
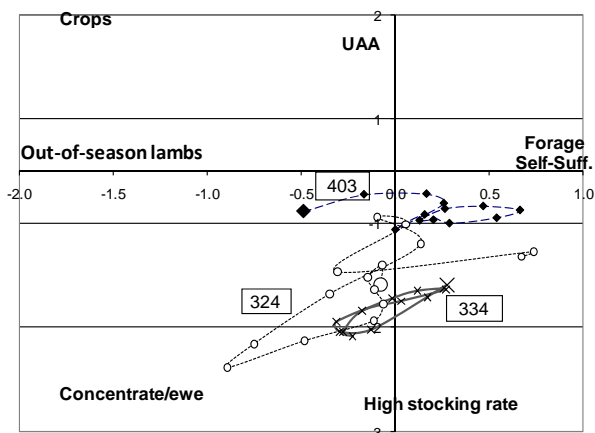
Fig. 8. Strong year-on-year trend and weak changes.
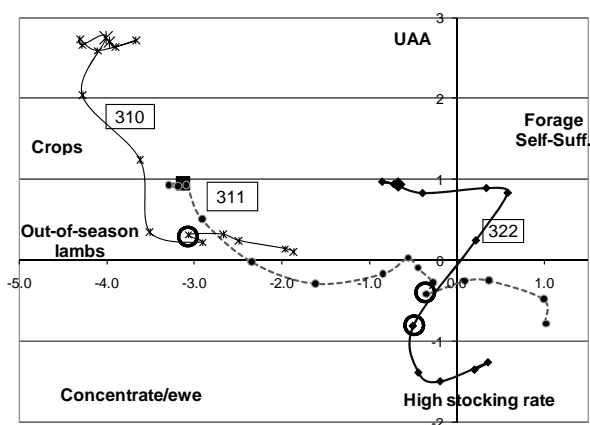

**Fig. 9.   Strong   year-on-year   trend   and   significant
               changes (bold circles on curve plots mark 1992).**

To illustrate, farm #333 (Fig. 7), which was initially highly grassland-centric (95 ha, 600 ewes
and 2 farmworkers), increased its share of out-of-season lambings while increasing concentrate
input, with the result that when the farm expanded (+40 ha), it returned to high autonomy, but
this time with 1000 ewes. Farm #311 (Fig. 9) counted 400 ewes on 80 ha in 1988, but in 1992
had reached 600 ewes on 100 ha by phasing in out-of-season lambing. After 5 years of relative
stability (1994-1998), with 620 ewes and 15% crops, there was a complete turnaround in
strategy prompted by workload constraints. The new balance was achieved at 300 ewes with
maximum out-of-season breeding plus 55% of UAA under cash crops.

IV – Decisive factors determining long-term revenue

In addition to the strong trends recorded, the objective of this study was to run correlations

analysis to identify the factors shaping long-term revenue (1988 to 2009). The tracked farms integrated into the 22-year dataset (averaging 49 farms per year) were relatively evenly split between upland and plainland. The sample did, however, vary over time, despite our efforts to keep as many long-term dataset farms as possible. The coefficients were smoothed over 3 years in order to more clearly emerge core trends (Fig. 10).
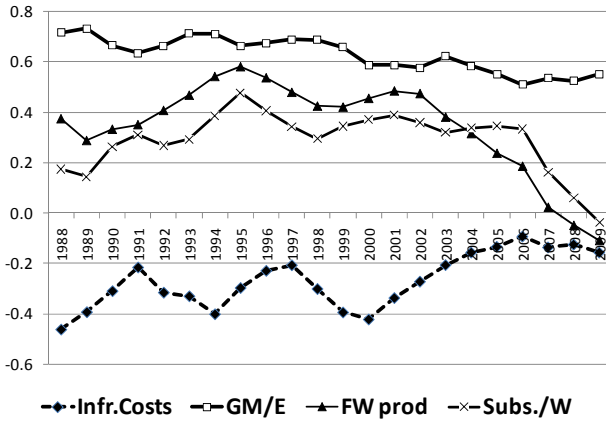
Fig. 10. Time-course trends in correlations between income per worker and (i) infrastructural costs per LU equivalent ('Infr Costs'), (ii) gross margin per ewe ('GM/E'), (iii) farmworker productivity ('FW prod'), and (iv) subsidies per worker ('Subs./W').
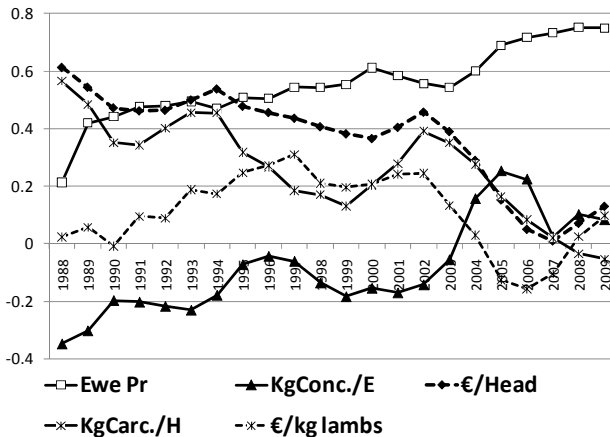
Fig. 11. Time-course trends in correlations between gross margin per ewe and (i) Ewe productivity ('Ewe Pr'), (ii) concentrate input per ewe ('KgConc./E'), (iii) lamb prices ('€/Head'), (iv) lamb carcass weight ('KgCarc./H'), and (iv) lamb price/kg ('€/kg lambs').

Figure 10 reveals that over the long run, gross margin per ewe remains the factor most strongly correlated to income per worker, even though the correlation coefficient declined (from 0.70 to 0.55). Labour productivity (integrating all on-farm activities; Benoit *et al.*, 2006) was increasingly correlated with revenue from 1992 on, with a major dip occurring in 2002. This curve dynamics may be connected to the 1992 CAP reform, which combined the introduction of the pasture premium designed to promote land expansion, and with the introduction of support subsidies indexed to ha of crops, which initially strongly favoured revenues on farms with cereal cash crops. This prompted a fair share of the farmers in the plainland farm network studied to physically expand with cereal crops. Over the 2004-2006 period, plummeting cereals prices hit the large-scale cereal farms hardest. Furthermore, certain specialized sheep-breeder farms that had strongly upped their flock headcount experienced a drop in technical performance and have heavy infrastructure costs, whereas small-to-medium-sized farms were able to optimize certain subsidies (such as hill livestock compensatory allowances). They also posted respectable technical performance with little investment input. The correlation with support payments per worker followed the same trend (the "Labour productivity" and "Support payments per worker" variables were 74% correlated over 22 yrs).

Infrastructure costs were initially (weakly) negatively correlated with income, but this correlation then disappeared. In the sheep-for-meat sector, in the settings studied here, we found that farms turning in good technical performances are able to absorb high infrastructure costs while generating respectable revenue.

As gross margin per ewe proved a decisive factor determining revenue, we went on to study the decisive factors determining gross margin per ewe. Figure 11 showed that ewe productivity (EP) has always been a major factor, especially after 2006. The relatively good business cycle for the sheep sector galvanized this correlation by leveraging the advantages of a high EP. Concentrate input per ewe was initially negatively correlated to gross margin, but this trend reversed over the 2004 to 2005 period, with low cereal and concentrate prices (before the 2008 price hikes), thus swinging in favour of productive and more concentrate-dependent systems. However, it should be underlined that sample composition evolved over the years. Over the first 10 years, "grassland" farms in plainland zones, which bred heavily on-season, posted excellent economic returns built on good EP and low concentrate input while still managing to produce exceptionally high-weight and high-value lambs. Within-sample change partially explains the correlations between 1988 and 2000: these systems were progressively relegated, as the farms turned towards size expansion, investment input, out-of-season lambings, increased concentrate quantities, and more often than not, a drop in EP. This shift can partially explain the drop in correlation between gross margin and lamb price-per-head, if not weight per lamb. The plainland farms studied, which market high-value lambs (high weight and high per-kilo price), tend today to post lower technical performances and gross margins per ewe than upland farms due to lower EPs and high concentrate inputs.

V – Shortlist of strategies for the future

1. Short-term strategies: the "Plan Barnier"

French sheep farms have long struggled with a relative lack of support compared to other livestock production sectors. In February 2009, the then French Minister for Agriculture Michel Barnier proposed a set of reforms to the subsidy payments scheme for farming, which was to be

realigned towards livestock farmed using fodder area, with sheep given priority[1]. These measures are brought in for 2010 and will run to 2013. Studies all converge on a jump in revenues. We ran a simulation using the 2007 results for 46 farms to model the effects of these measures. The analysis showed a mean 100% jump in revenue (from €9,700/LabUnit to €19,400/LabUnit).

2. Longer-term horizons

In-depth analyses of recent business cycles, prospective studies, and early outline proposals for the CAP post-2013 all point to several trends. As a generalized pattern, farms look set to face more frequent turbulence, not just climatic events but also market turbulence tied to extremely volatile raw material prices, which overall will tend to climb. Furthermore, the EU-wide deficit in sheepmeat production together with the generalization of quality labelling schemes could well keep sale prices relatively high. Finally, there is very little chance the total volume of EU support payments for the farming sector as a whole will be upped at any point in the post-2013 era.

Taking account of these trends, the farm systems that look best positioned will be those that manage to remain relatively productive while staying relatively non-reliant on outside resources for flock feed. They would have to produce a large share of their concentrate input on-farm, or in an even better scenario, minimize concentrate use by maximizing fodder area use –with the added bonus that fodder area may continue to benefit from government subsidies (grassland maintenance and upkeep schemes).

To round up, the findings reported earlier appear to show that the biggest farm structures (in terms of labour productivity) are not necessarily the most profitable. They are also reliant on major capital investment, which may prove a handicap for farm expenditure and business recovery plans (succession).

Consequently, productive, feed self-sufficient, medium-sized, family-run farms could be well positioned for the mid-term outlook. The key lies in finding optimum EP while using relatively little concentrate inputs (especially if concentrates have to be bought in), as demonstrated in the results for 2008 (see Figs 4 and 5) with concentrates trading at relatively high prices.

Environmental concerns over fossil fuel consumption and greenhouse gas emissions also affect the farming sector, touching on sheep-for-meat production and breeding. Studies show that the leading factor for minimizing non-renewable energy consumption is forage self-sufficiency (the share of flock energy requirements derived from on-farm forage resources) (Benoit *et al.*, 2010). Focusing on GHG emissions per carcass kg, the primary reduction factor is the ability to achieve a good enough EP to dilute the ewe's methane emissions through high-meat-gain production. Thus, there is a convergence between economic success factors (high EP, forage self-sufficiency) and positive environmental impacts (energy and GHGs) in systems now dubbed as "ecologically intensive".

VI – Conclusion

The drop in sheep headcount numbers in France and Europe-wide is the net result of several decades of sector-wide economic struggle. The last 20 years have seen a fair share of sheep farms transition towards other production subsectors, via highly diverse trajectories. However, government authorities are showing signs that they recognize the need to safeguard sheep-for-meat farming in Europe, not just to meet population demand for sheepmeat but also for the

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[1] Keynotes: decoupling the "PBC" (ewe and she-goat premium) and the crop premium payments, creation of a new €21-per-ewe subsidy, creation of a "productive grassland premium" of €20 to €80 per ha, reassessment of the hill livestock compensatory allowances scheme (+15% on the first 25 ha).

maintenance and upkeep of grassland, sometimes in harsh areas that would be impracticable for other herbivores.

As confirmed by the trends analyses proposed here, many plainland sheep farms have adjusted their farm systems in response to sector recommendations to switch a fraction of their lambings to out-of-season production. This trend has entailed greater production costs and less forage utilization, and possibly also decreases in ewe productivity –illustrating potential antagonism between farmer's interest on one side and subsector marketing policy on the other.

The prospective data available (especially inflation in raw materials costs) emphasizes the need to consider the notion of coherence in farming systems. Coherence has to ensure good technical and economic performances, which can translate into positive environmental impacts on non-renewable energy consumption and GHG emissions. Furthermore, coherence must necessarily take into account both the characteristics of the environment (soil and climate) and the characteristics of genotypes used. Genotypes need to be considered in terms of counter-season lambing ability, conformation of their end-products, ability to use forages (including grazing), level of prolificacy and maternal qualities. More generally, a context marked by increasing uncertainties and the search for self sufficiency will make hardiness and flexibility a crucial factor (Sauvant and Martin, 2010). Thus, the needs of the national sheep industry (particularly regularity of supply) will probably lead to policies designed to strengthen the complementarities between production areas and production systems by exploiting the wide range of sheep genotypes available in France. Furthermore, the return to mixed systems (sheep-cattle, sheep-crops; Rouel *et al.,* 1995) warrants consideration, as these systems offer synergies between agronomic activities while optimizing the use of farm resources*.*

Establishing a relationship between ecological and economic science suggests that diversity in farming systems could correlate positively to stability, adaptability and resilience in the sheep sector (Matutinovic, 2002).

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