Efficiency of ruminant organic farming systems

Specialised grass systems perform better than mixed crop-livestock

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Context, objective

BioRéférence project

Context

- The BioRéférence project (2015-2020) aims to produce structural, technical and economic references for organic ruminant livestock farms in the French Massif Central
- French massif Central: a mountainous, grassland area accounting for more than 30% of the French organic certified ruminants
- Professional stakeholders express a strong need for references to accompany organic farmers towards more efficient systems

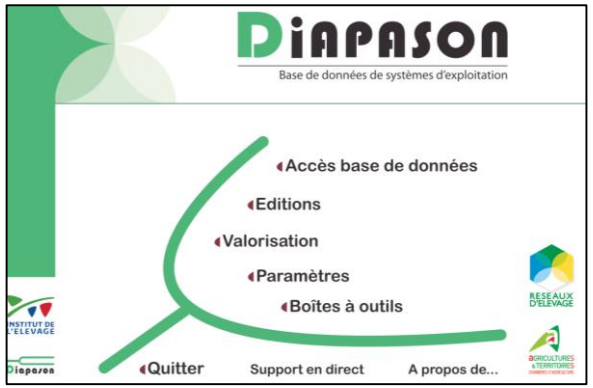
Objectives

- Evaluate and measure the efficiency of a ruminant farming system: indicator
- Identify the determinants of this efficiency indicator

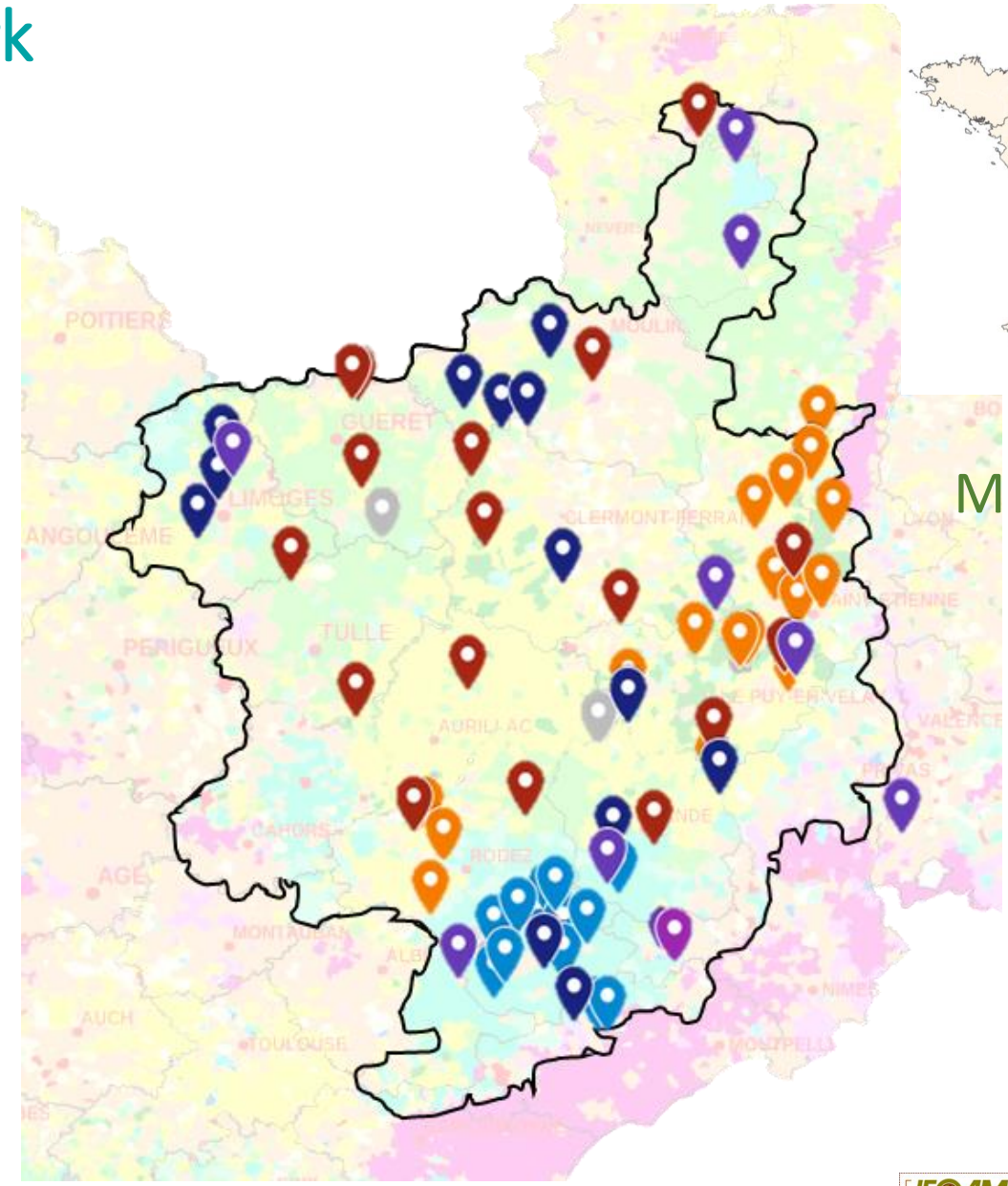
The livestock farms' network

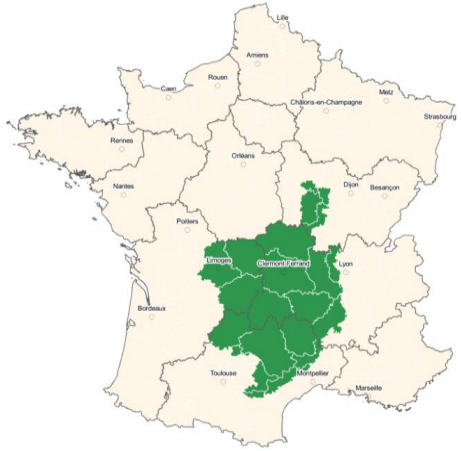
- 70 farms

20	Dairy Cattle
16	Beef Cattle
12	Dairy Sheep
13	Meat Sheep
9	Goat



- Constant sample 2014-2015
- 140 observations
- 120 ha – 77 LUs - 86% forage area – Hudge diversity





Massif Central

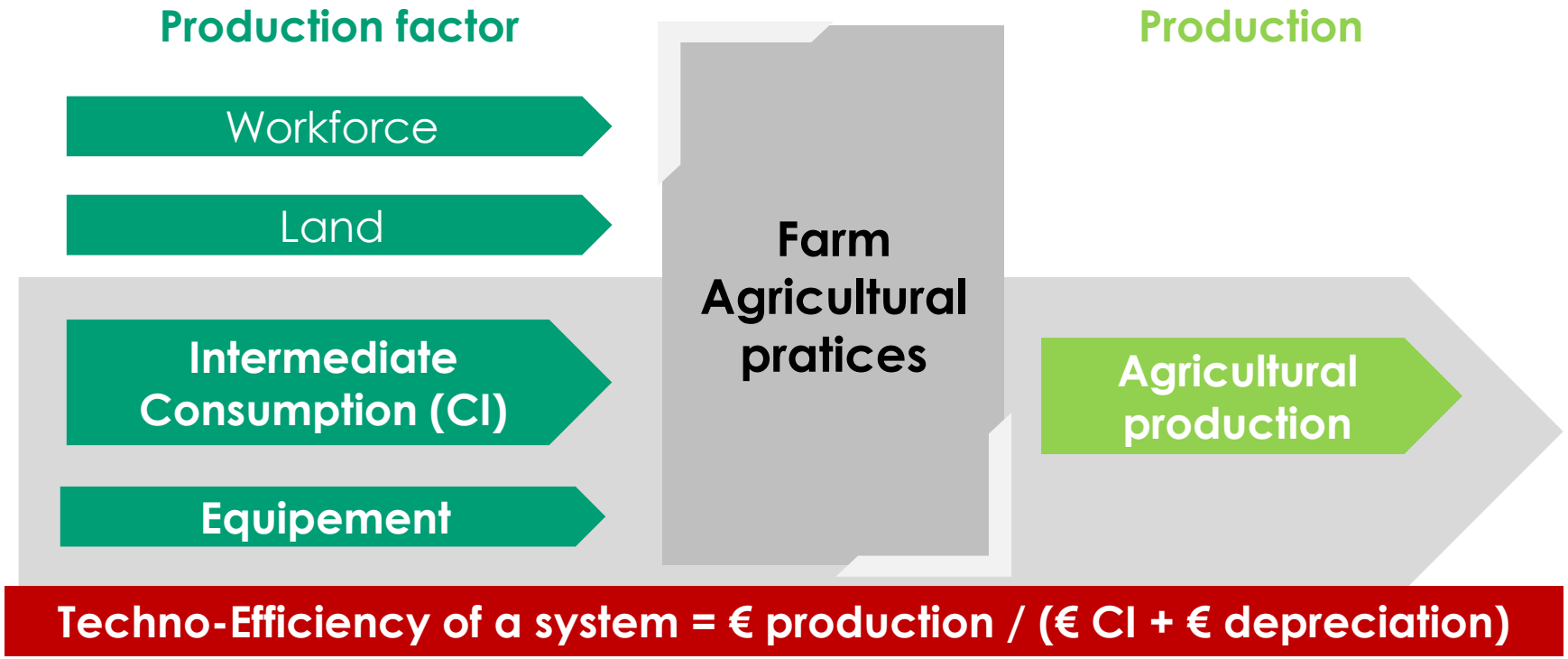
Method: techno-economic efficiency

Efficiency = output/input

- Efficient system: produce a lot with little, or produce little with nothing!

Factors productivity

- Measures the amount of factors of production used per unit of output. This definition can be connected to the concept of efficiency.



Method: data analysis & efficicency determinants

Link between the variability of structures, systems, practices and techno-economic efficiency

Principal Component Analysis (PCA)

43 Active
- 18 structural variables (labour, area, capital…)
- 20 system organisation variables (intensification, diversification, crop destination…)
- 5 technical variables (feed self-sufficiency, animal productivity…)

8 Additionnal
- 3 economic variables (gross farm income/GO, added-value/GO, farm income/worker)
- 5 partial productivity variables (labour, land, i.ter. cons., equipment, techno-eco. efficiency)

All data have been standardised by production and year, and individuals have been weighted by the production system to establish an equivalent weight for each production

Hierarchical Cluster Analysis (HCA)

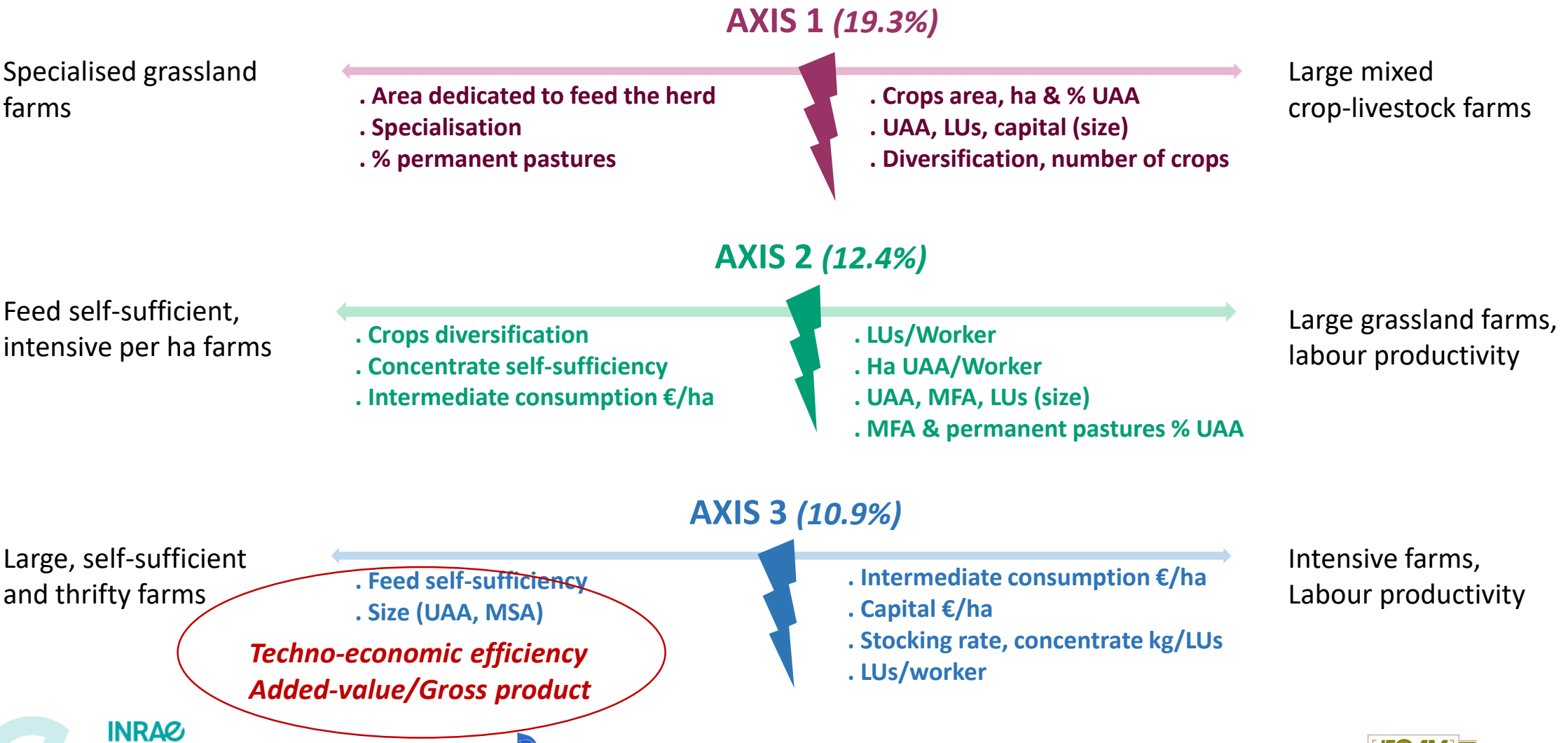
- Typology of farms

Partial Least Squares (PLS) regression

- Dependent variable: techno-economic efficiency
- Explanatory variables: structural, system organization and technical variables used for the PCA

Results: Farms variability

Principal Component Analysis (PCA)



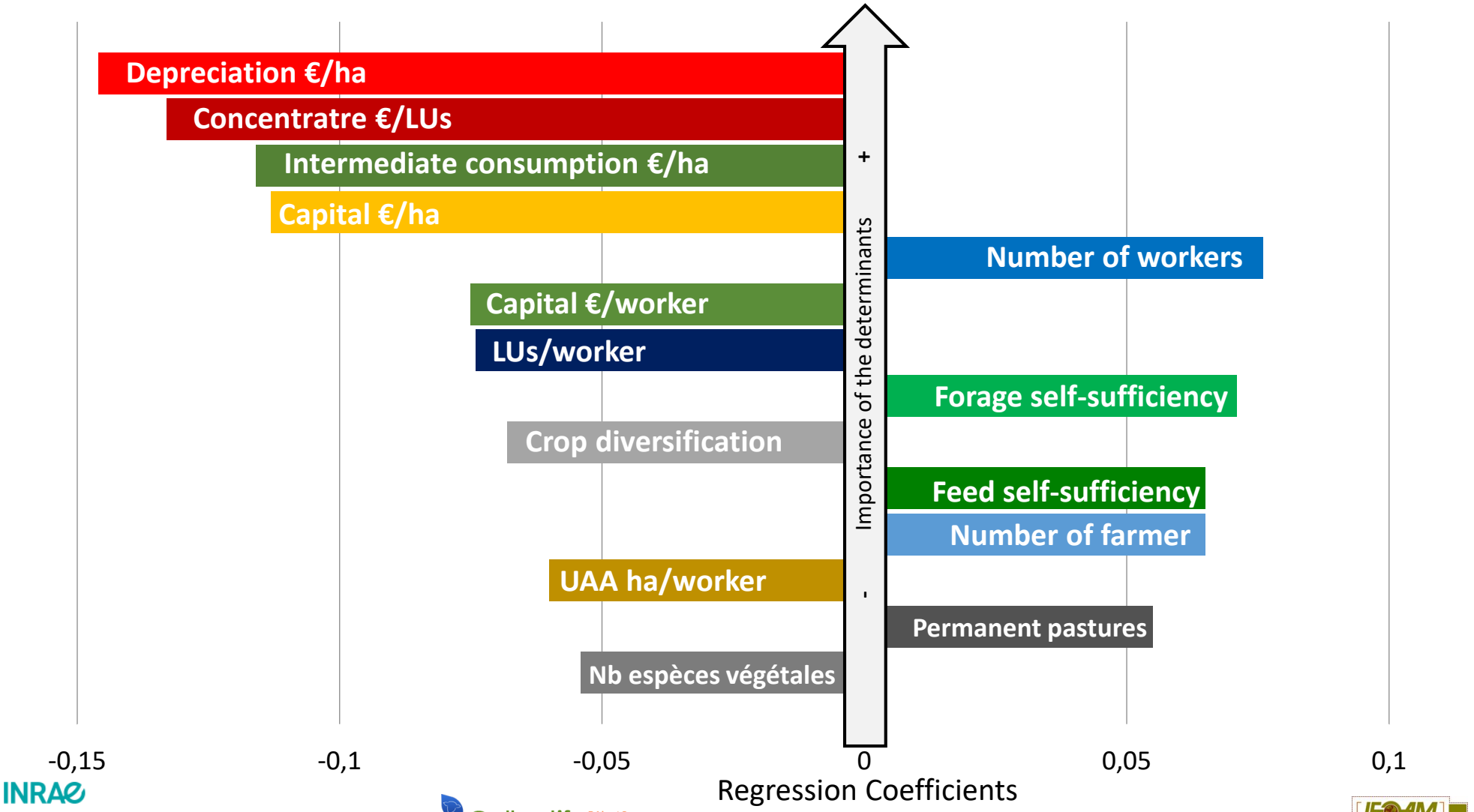
Results: Farms typology

Hierarchical Cluster Analysis (HCA) – 6 groups of farms, 4 presented

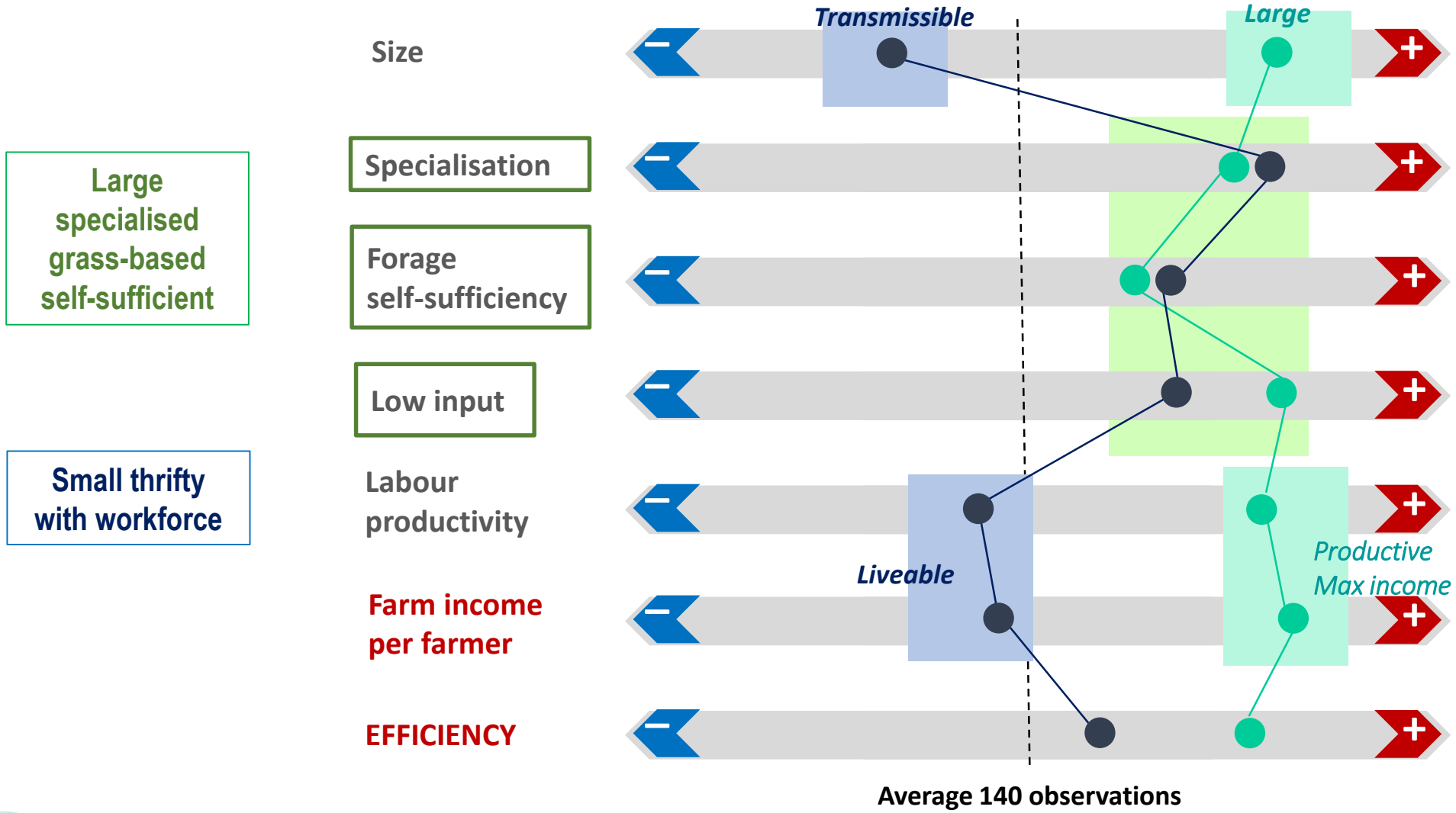
All productions are present in each type	70 farms x2 years (n=140)	Small thrifty with workforce	Intensive Hight labour productivity	Large specialised grass-based self-sufficient	Large mixed crop-livestock Labour productivity
Number of workers (AWU)	2.1	2.0	1.6	2.4	2.6
Usable Agricultural Area, UAA (ha)	89	57	76	142	145
Main Fodder Area (% UAA)	88	84	84	95	79
Stocking Rate (LUs/MFA)	1.03	1.09	1.08	1.04	0.95
UAA ha/AWU	46	31	50	61	61
Intermediate Consumption €/ha	1160	1150	1600	840	890
Concentrate self-sufficiency (%)	45	59	23	23	74
Feed self-sufficiency (%)	87	92	77	85	90
Added-Value/Gross product (%)	30	29	23	41	23
Farm Income per Worker (k€/AWU)	29.0	24.3	24.0	41.8	29.3
Techno-economic Efficiency	1.57	1.60	1.26	2.14	1.52

Results: determinants of the efficiency

PLS regression coefficients



Results: typology * determinants → 2 efficient profiles



Discussion

Determinants of the ruminant systems' techno-economic efficiency

- The productive specialisation, grass-based systems, the feed self-sufficiency and input savings are positive determinants of the systems' techno-economic efficiency.
- Intensification of agricultural land, animal productivity through concentrates are negative determinants of efficiency
- Farm size and labor productivity affect efficiency but positively or negatively depending on the combination of other factors

Crop diversification and size

- Crop diversification and mixed farming seem to limit the techno-economic efficiency

➲ A large grassland specialised farm can be very efficient, while a similarly sized farm in a mixed system has some probability of being less efficient

➲ Smaller farms seeking to increase production by intensifying see their efficiency degraded

Conclusion

- Mixed crop-livestock farming is generally seen as a system enabling the construction of eco-efficient production systems.
- Diversification often entails enlarging farms. Purchased feed and equipment are the key factors that often increase with enlargement
- Farmers' choices in terms of work organisation, equipment investment on these large, diversified farms should be studied to objectively assess the trade-offs made and their impact on the sustainability of the systems.

Thank You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