Life cycle assessment of heavy pig production in a sample of Italian farms

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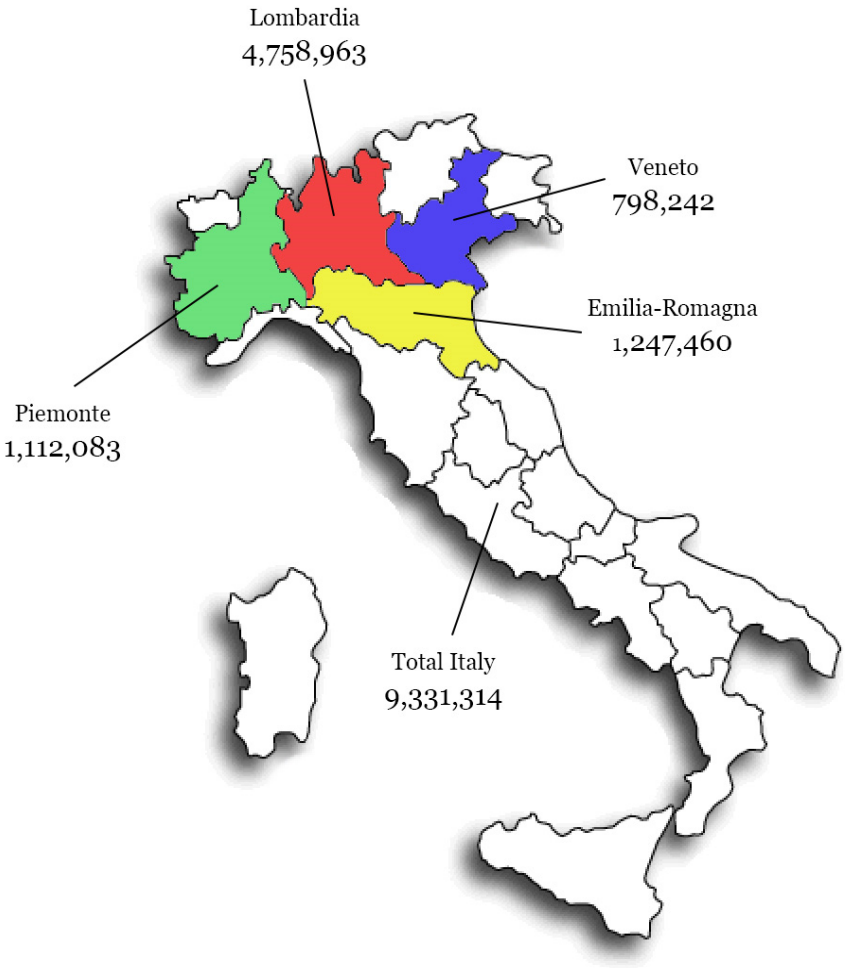
65th annual meeting of the European Federation of Animal Science

Copenhagen 25-29 August 2014

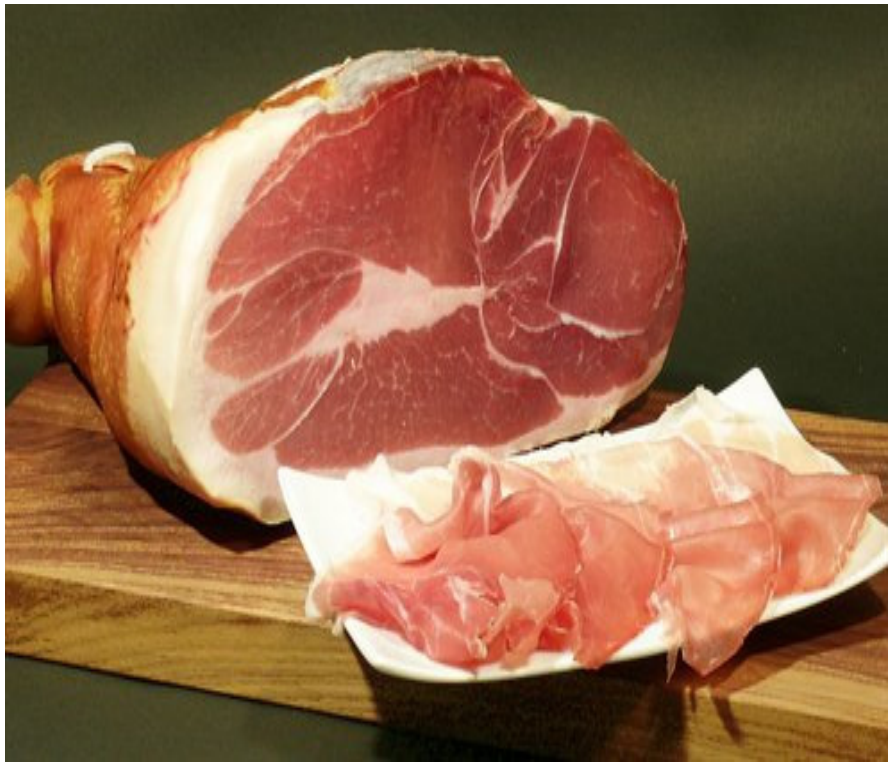
Pig production in Italy

- About 8,9 milions pigs in 2013
- 728 thousands sows
- Four northern regions account for about 83% of total pigs (Piemonte, Lombardia, Emilia-Romagna, Veneto)



Utilization

- 13.6 millions pigs slaughtered in 2006
- 85% heavy pigs: more than 160 kg LW
- Utilization: cured ham (Prosciutto di Parma, Prosciutto di San Daniele)



Pig production in Italy

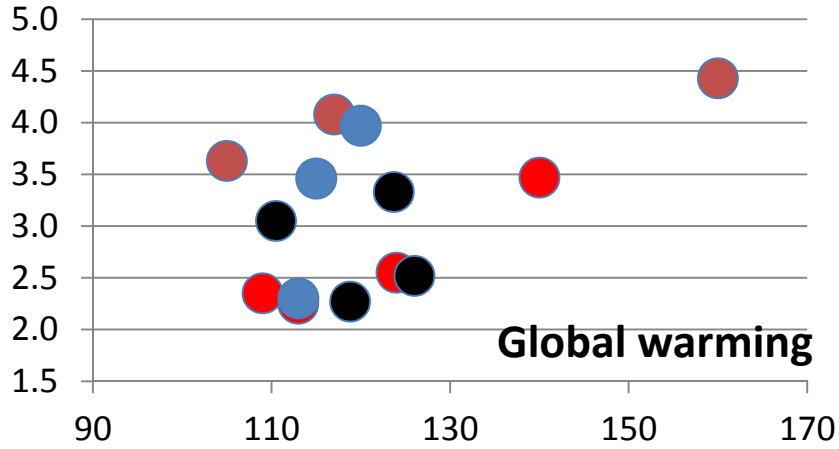
Area	Difference 1990-2010 (%)
Italy	+ 12.8
Piemonte	+ 63.1
Lombardia	+ 66.3
Veneto	+ 39.8
Emilia-Romagna	- 34.1

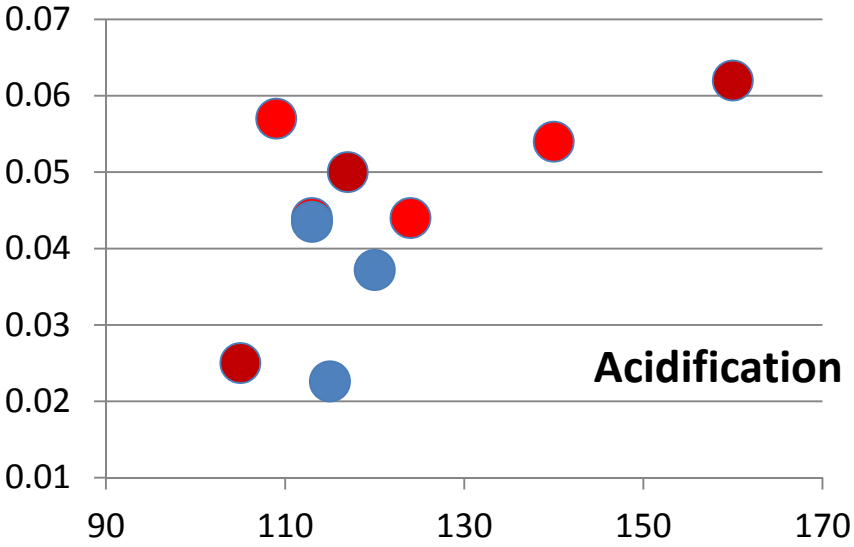
Some citizens' concerns due to intensification/concentration

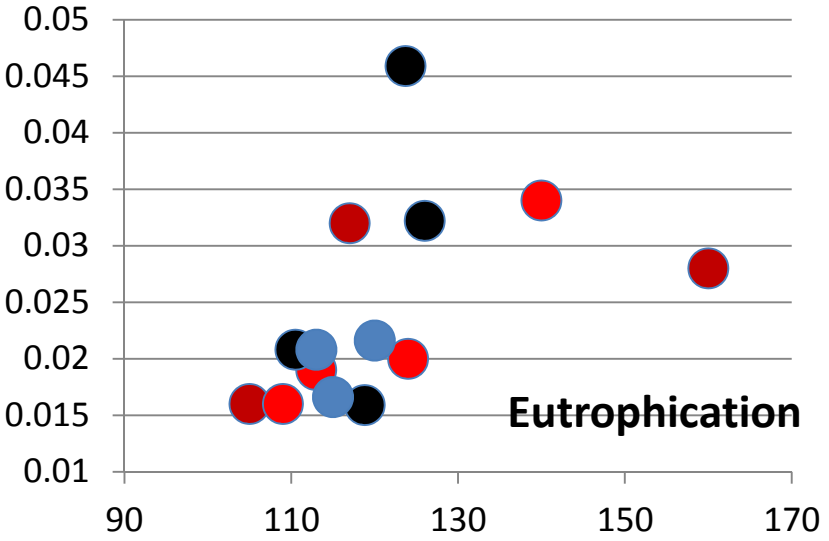
- Eutrophication
- Acidification
- Smell nuisance
- Noise
- Animal welfare
- GHG emissions
- Fuel and electricity consumption
- Worsening of air quality
- Heavy metals pollution

Relationships between LW and environmental impacts

- Cederberg and Flysjö, 2004
- Dourmand et al. 2012
- Pelletier et al., 2010
- Basset-Mens and van der Werf, 2005







Cases and objectives of LCA study

Case

1. Citizens' concerns on intensive livestock productions
2. Lack of estimates of environmental impact of heavy pig production (more than 160 kg LW and 9 mo of age)
3. Evaluation of what strategies can be taken for mitigating environmental impact

Objectives

1. To estimate some environmental potential impacts: global warming (**GW**), acidification (**AC**), eutrophication (**EU**), abiotic depletion (**AD**) and photochemical oxidation (**PO**)
2. To evaluate the most significant piggery characteristics that affect the environmental performances

Matherial and methods

- Two samples of 4 breeding and 8 fattening farms
- System boundaries: cradle-to-farm gate, encompassing feed production, breeding phase and growth-fattening phase up to slaughter weight
- Funtional unit:
  - 1 kg LW of piglet (breeding phase)
  - 1 kg LW of heavy pig (growth-fattening phase)
  - 1 kg LW of heavy pig (whole chain)
- Average piglet LW 37.2±8.2 kg, heavy pig 167±5 kg
- Economic allocation for culled sows

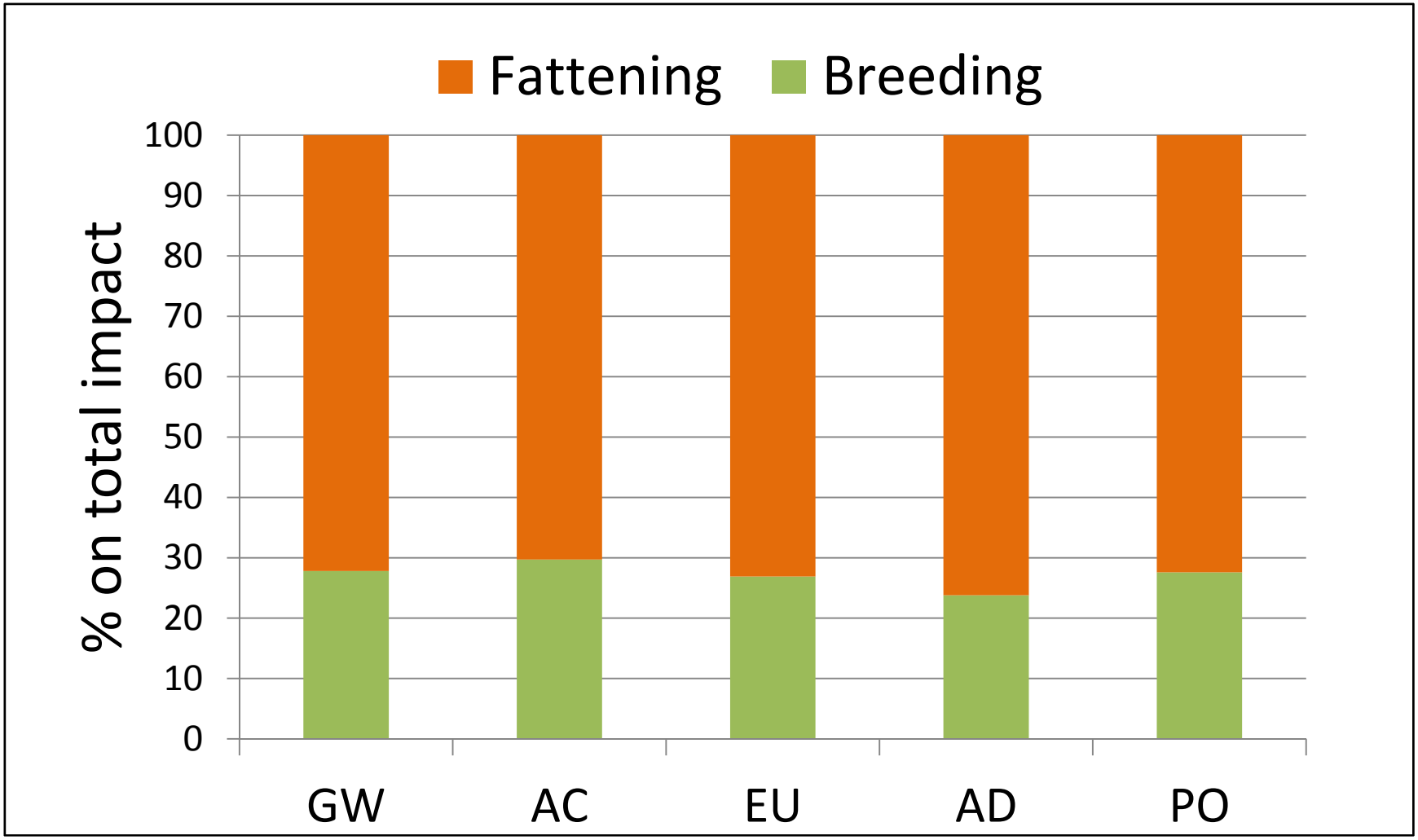
Results: breeding phase

Impact category	Unit	Piglet: breeding phase	
		Mean	CV (%)
GW	kg CO_2eq.	4.2	8.8
AC	kg SO_2eq.	6.5 E-02	5.3
EU	kg PO_4^{3-}eq.	3.7 E-02	8.5
AD	kg Sbeq.	3.9 E-03	22.9
PO	kg C_2H_4eq.	2.1 E-03	28.5

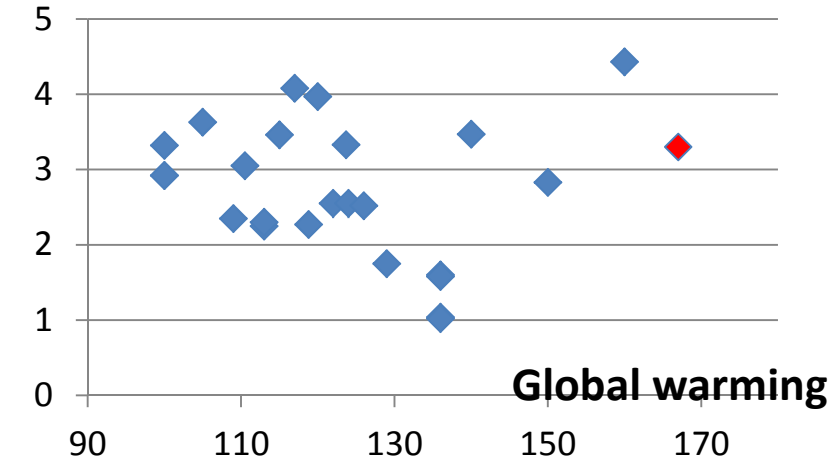
Results: growth-fattening phase and whole chain

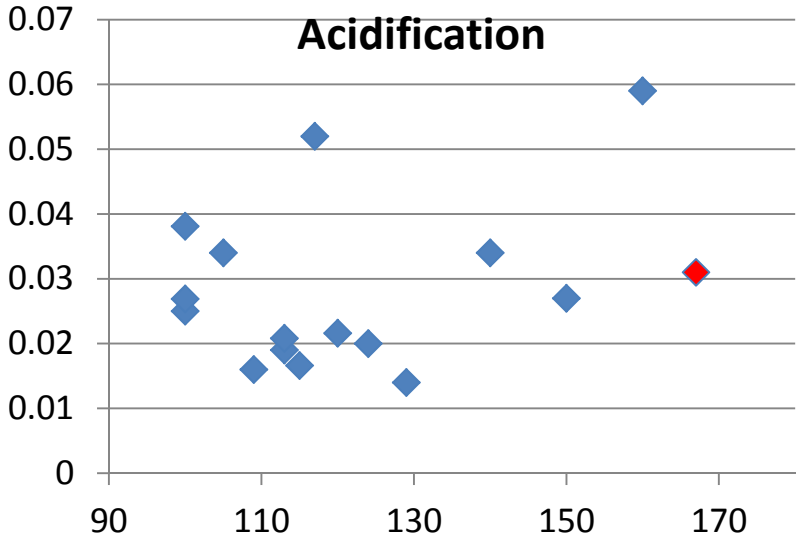
Impact category	Unit	Heavy pig: growth – fattening phase		Heavy pig: whole chain
		Mean	CV (%)	
GW	kg CO_2eq.	3.1	9.6	3.3
AC	kg SO_2eq.	4.3 E-02	16.2	4.9 E-02
EU	kg PO_4^{3-}eq.	2.9 E-02	11.1	3.1 E-02
AD	kg Sbeq.	3.8 E-03	29.3	3.7 E-03
PO	kg C_2H_4eq.	1.6 E-03	28.0	1.7 E-03

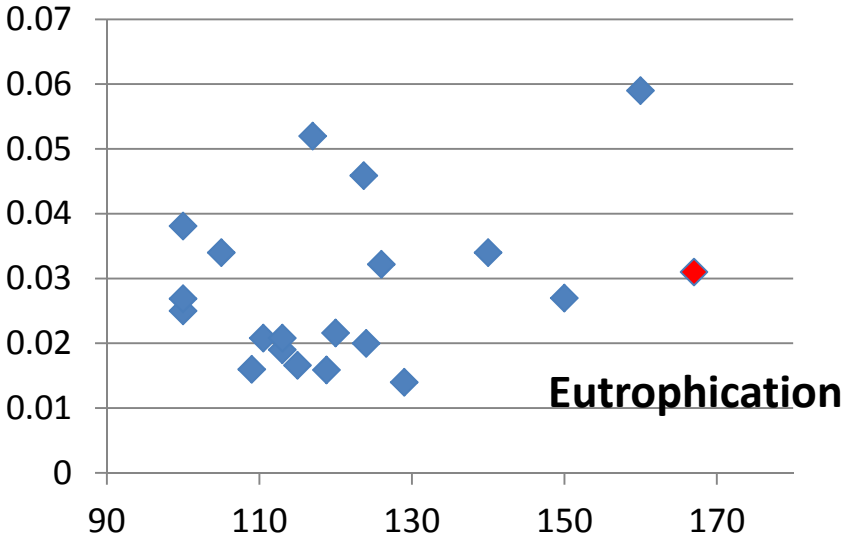
Contribution of the phases



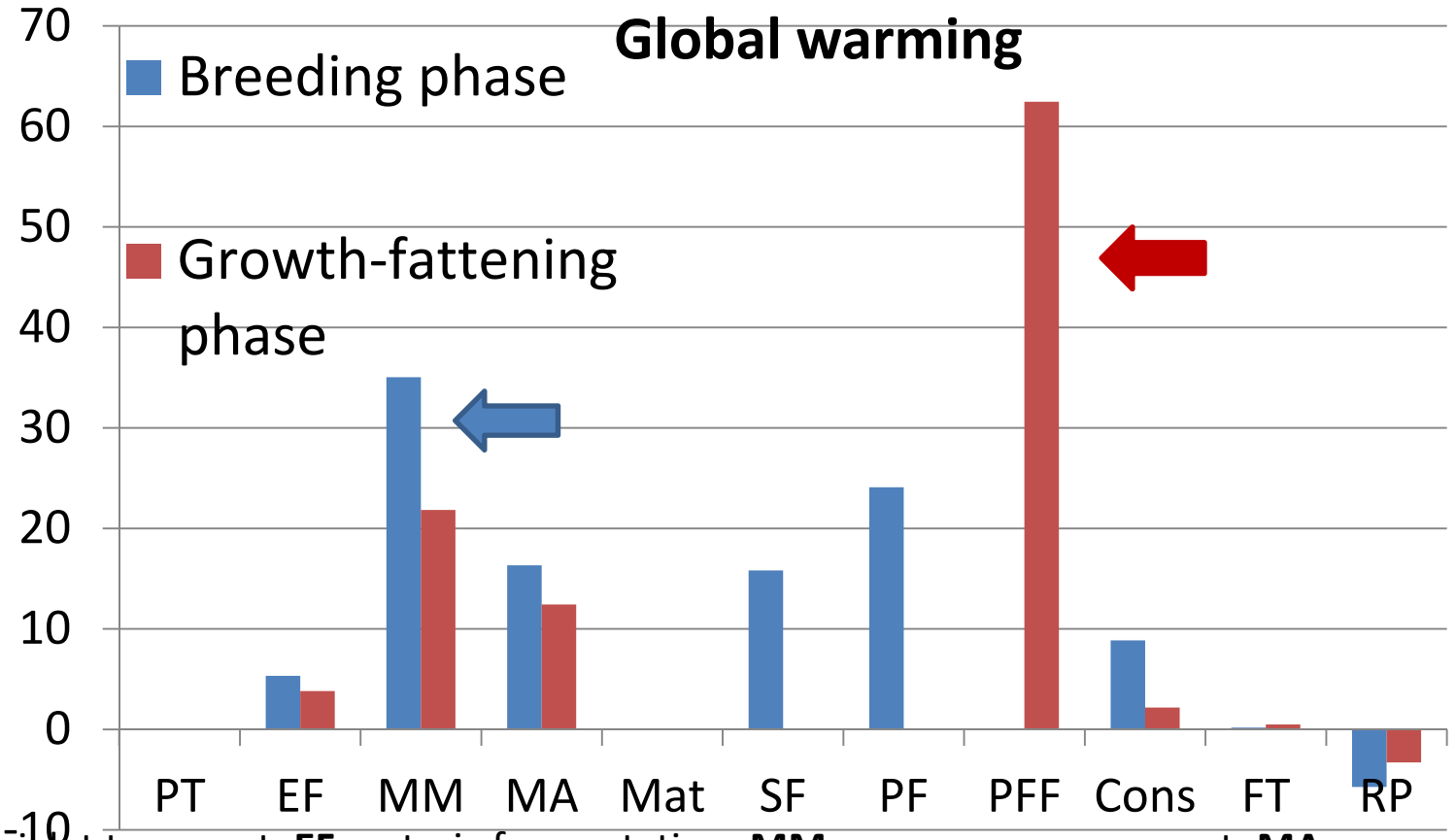
Comparison with other LCA studies





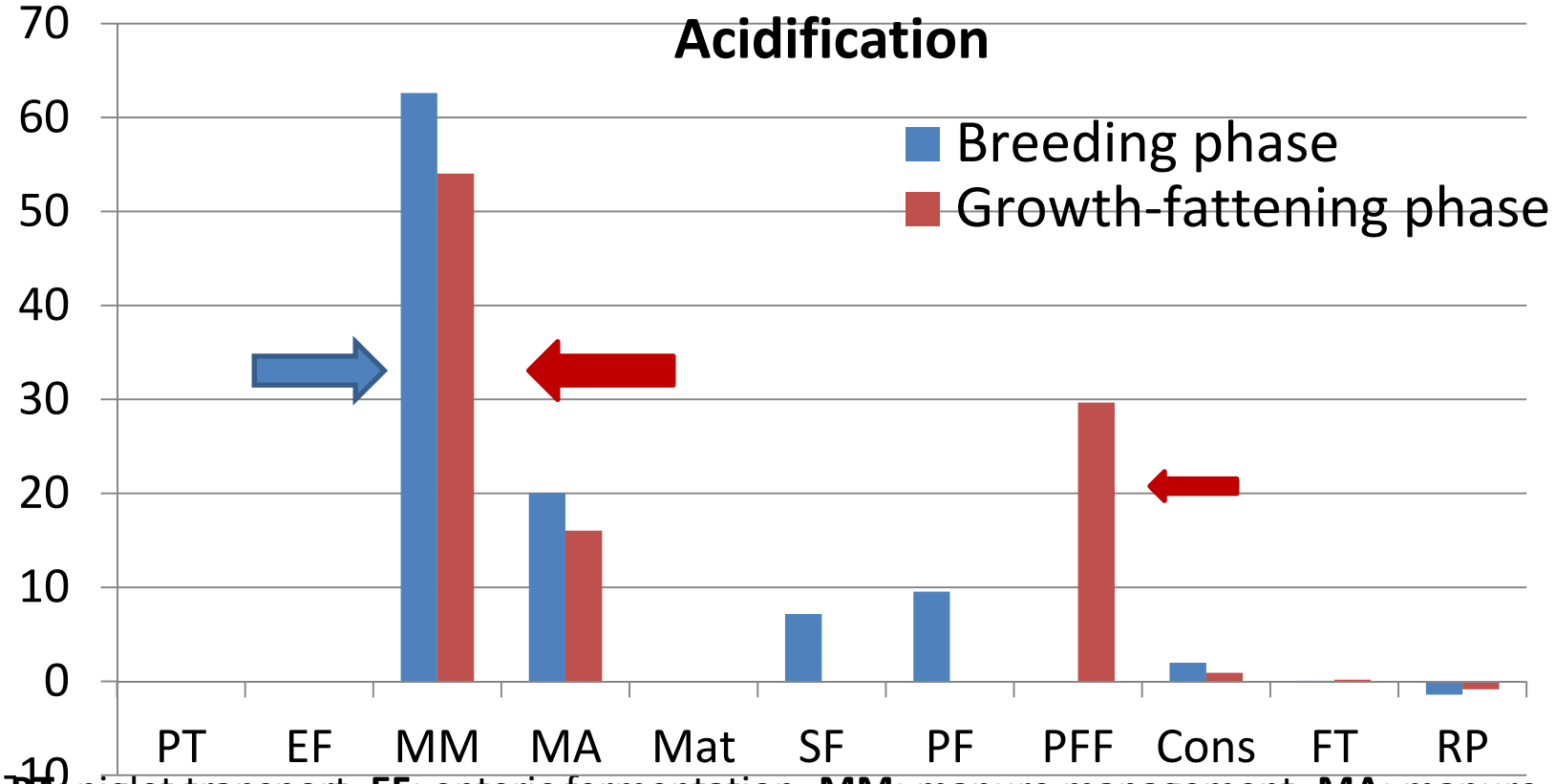


Contribution of farm activities (% of total CO_2eq.)



PT: piglet transport; **EF**: enteric fermentation; **MM**: manure management; **MA**: manure application; **Mat**: materials; **SF**: sow feeds; **PF**: piglet feeds; **PFF**: growing-fattening pig feeds; **Cons**: fuels and electr. for anim. Husb.; **FT**: feed transport; **RP**: recyclable products

Contribution of farm activities (% of total SO_2eq.)



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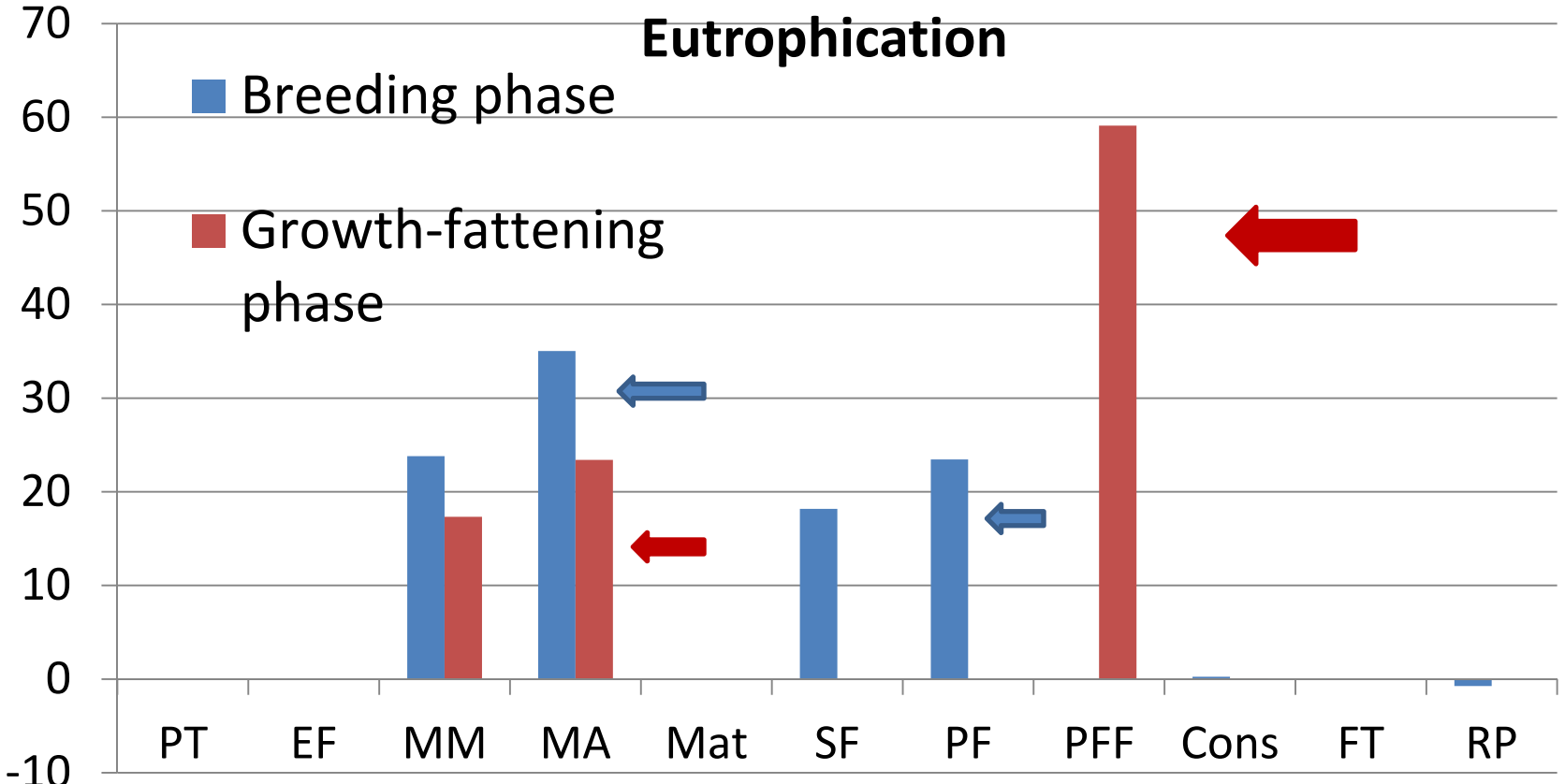
Contribution of farm activities (% contribution of PO_4^{3-}eq.)



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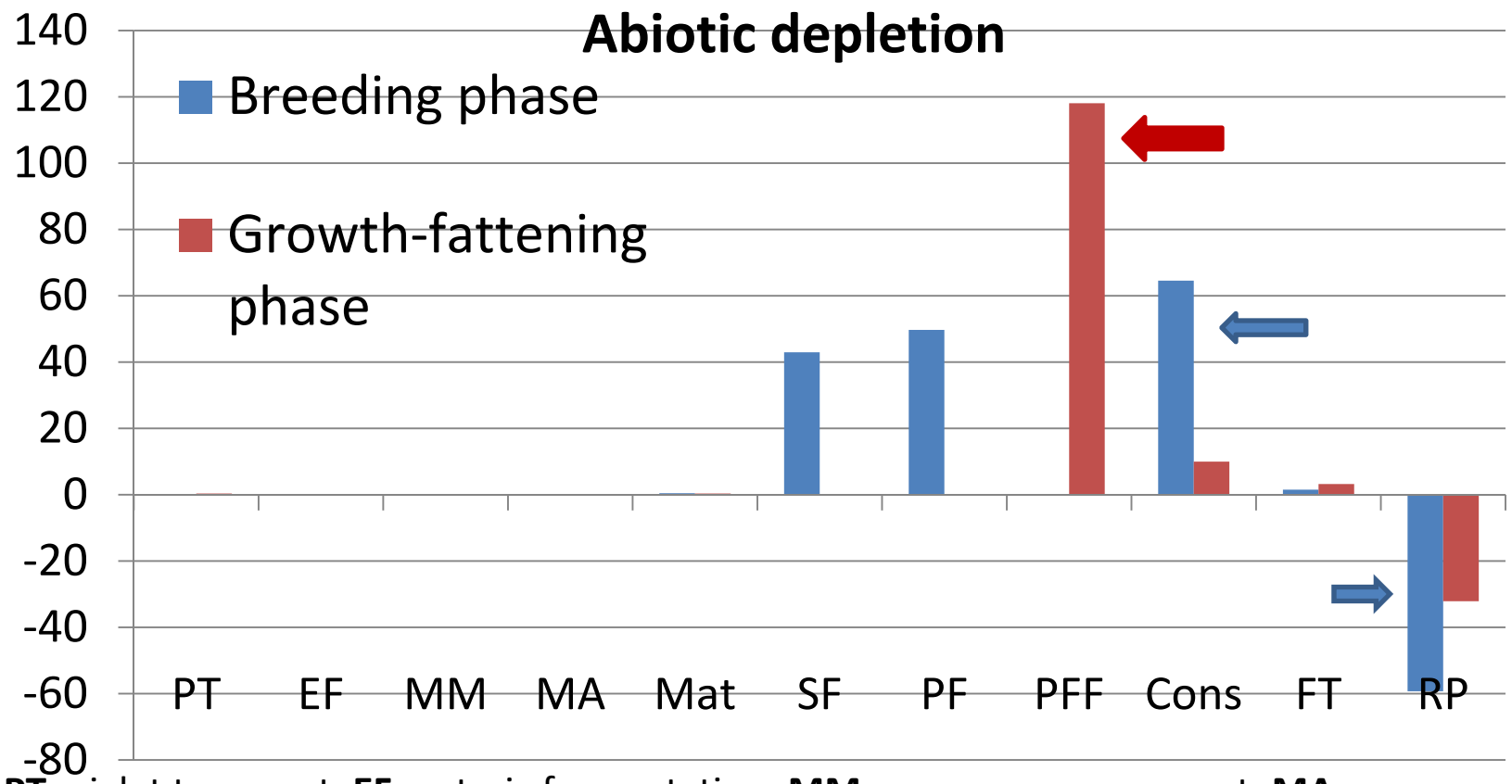
Contribution of farm activities (% of total Sb eq.)



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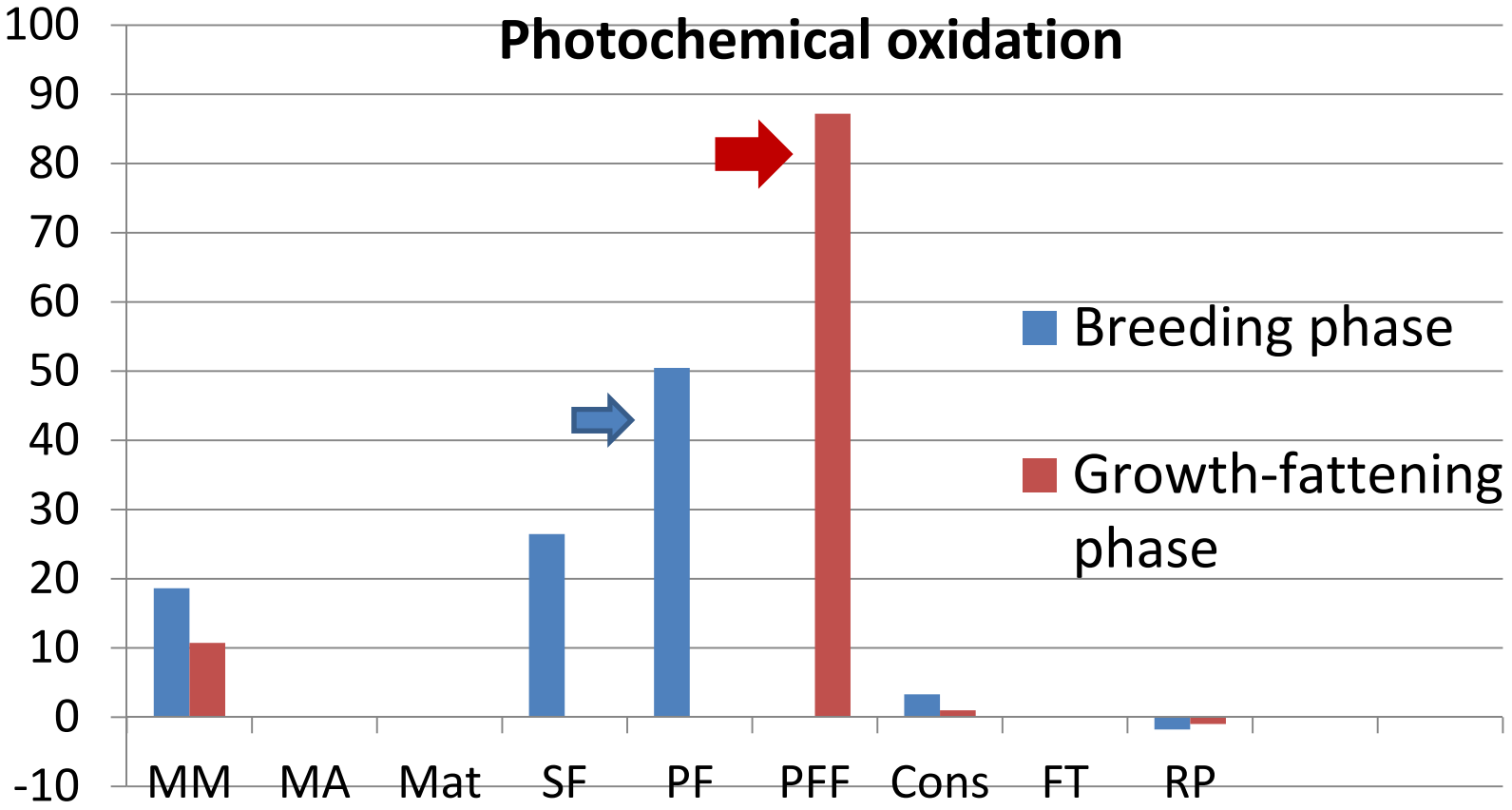
Contribution of farm activities (% contribution of total C_2H_4eq.)



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Relationships between farm characteristics and environmental performances (breeding phase)

				R^2	P	
GW	Diesel - Piglet weight			0.93	0.20	- -
AC	Daily weight gain			0.82	0.09	-
	Daily weight gain - Piglet weight			0.96	0.20	- -
EU	Mortality rate			0.91	0.05	-
	Mortality rate - Daily weight gain			0.99	0.03	- -
AD	Piglet weight			0.83	0.09	+
	Piglet weight - Daily weight gain			0.99	0.02	+ +
PO	Mortality rate			0.99	0.05	+
+ positive - negative correlation						

Relationships between farm characteristics and environmental performances (growth-fattening phase)

				R^2	P	
GW	Diesel		Electricity	0.47	0.21	+ +
AC	Phase length		Initial weight	0.74	0.04	+ -
EU	Phase length		Initial weight	0.64	0.10	+ -
AD	Live weight gain		Final weight	0.43	0.24	+ +
PO	Final weight		Mortality rate	0.99	0.05	+ -
+ positive - negative correlation						

Final remarks

- Despite the heavier final weight, results of this study are similar to those of literature previous works
- Contrasting effects of farm characteristics on environmental performances
- A larger and more detailed study is required to evaluate possible mitigation strategies

Acknowledgments

Study funded by the Italian Ministry of Agricultural, Food and Forestry Policies

Project: Development of animal model for sustainability (SOS-ZOOT)