



PEGaSus

Phosphorus efficiency in Gallus gallus and Sus scrofa

Bridging the gaps in the phosphorus value chain

Klaus Wimmers



1ST SusAn COFUNDED Projects Seminar
23-24 November 2017, Bilboa (BC, ES)

EUROPEAN RESEARCH AREA ON SUSTAINABLE ANIMAL PRODUCTION



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- Phosphorus (P) is essential for all organisms (e.g. bone, nucleic acids, P proteins, P lipids, ATP, buffer)
- P is a limited resource
- Inefficient P usage causes high P content in pig manure displaying a serious burden for soil and water ecosystems



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BASIC DATA

Funding:



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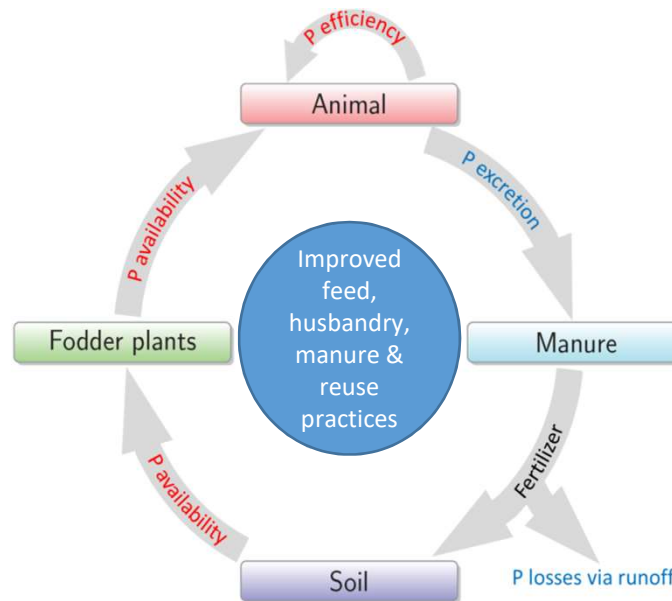
Start date:

1 September 2017

Duration:

36 months

5 European partners



- Balancing the P cycle by efficient usage of P in **animals** and plants, P storage in soils, P utilization of microorganisms and their interactions
- Provision of solutions to secure sufficient P supply to **animals** while preserving soil and aquatic ecosystems



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Consortium



Stockholm Environment Institute
(SEI); Dr. A. Rosemarin, P4

Agri-Food and Biosciences Institute
(AFBI); Dr. E. Magowan, P2

Aarhus University (AU);
Prof. H.D. Poulsen, P3

Leibniz Institute of Farm Animal
Biology (FBN); Prof. K. Wimmers, Dr.
M. Oster, P1

University Piacenza (UCSC);
Prof. P. Sckokai, P5



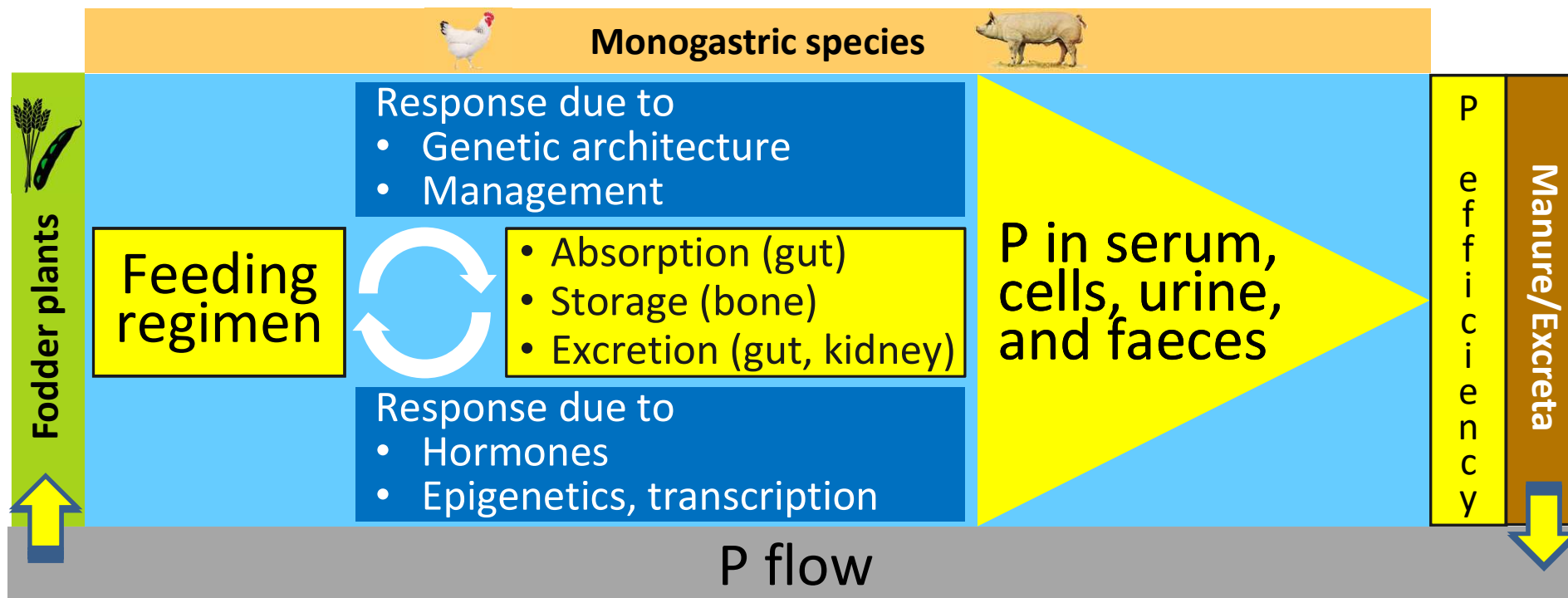
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Rational



- Feed stuff (Bio-availability)
- Genetics (Retention, Excretion)
- Recycling (Manure)
- Bio-economic potentials (Modeling)
- Phosphor governance and policy aspects



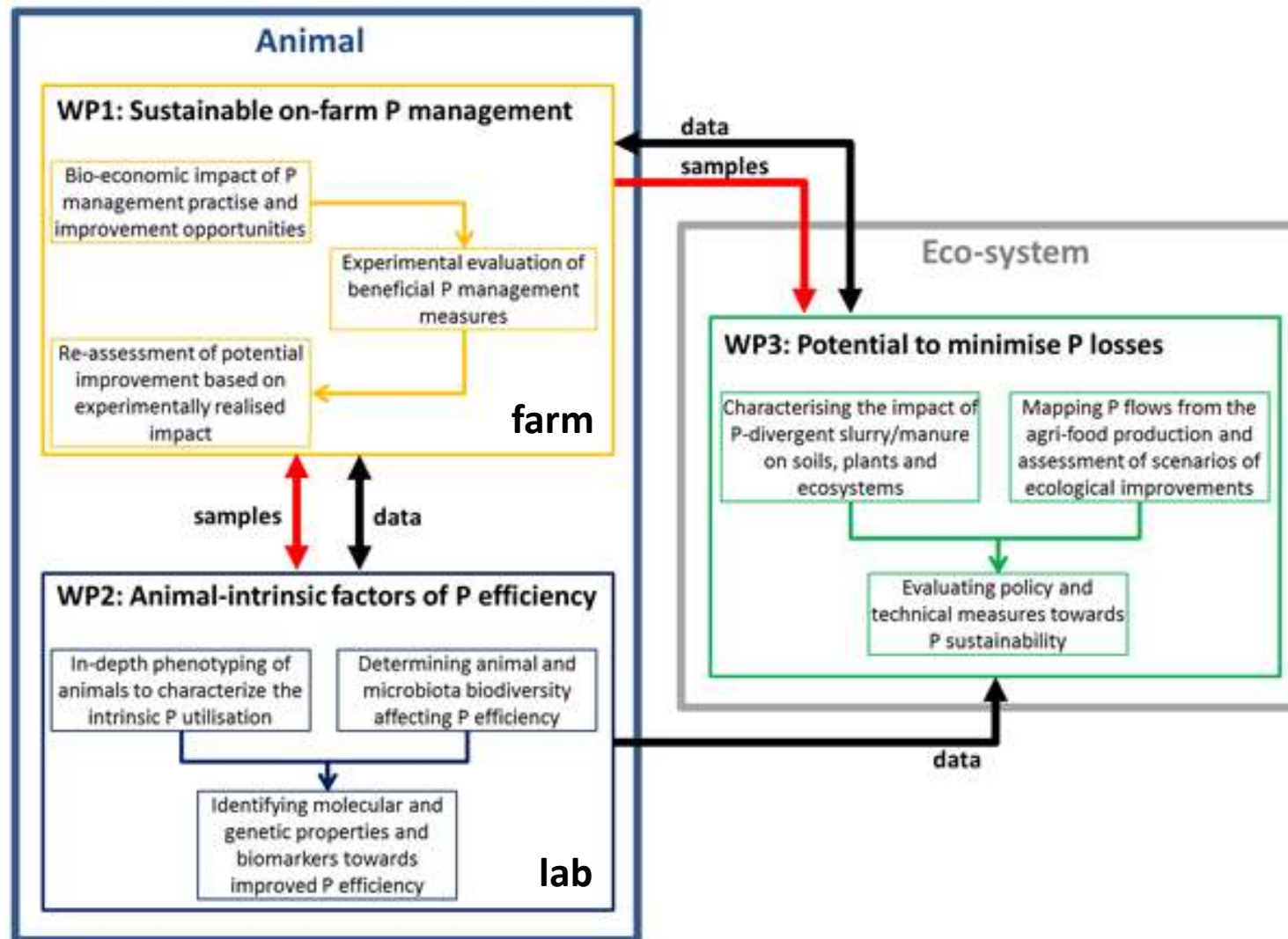
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Work packages



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Partners and tasks

FBN: Co-ordinator; animal experiments (P conditioning, alternative P sources) , transcriptom & microbiome

AFBI: Deputy coordinator; animal experiments (feed additives, enzymes), trial-derived slurry samples analysed in mesocosm systems

AU: Leader WP2; animal experiments (feeding regimes, liquid feeding of pre-digested feed stuffs; regional cereals with different phytate profiles),

SEI: Leader WP3; technical data, systems descriptions and policy directives to control P runoff from farms and deduce policy aspects

UCSC: Leader WP1; bio-economic models referring to a knowledge-warehouse of public data and historically grown animal-derived data

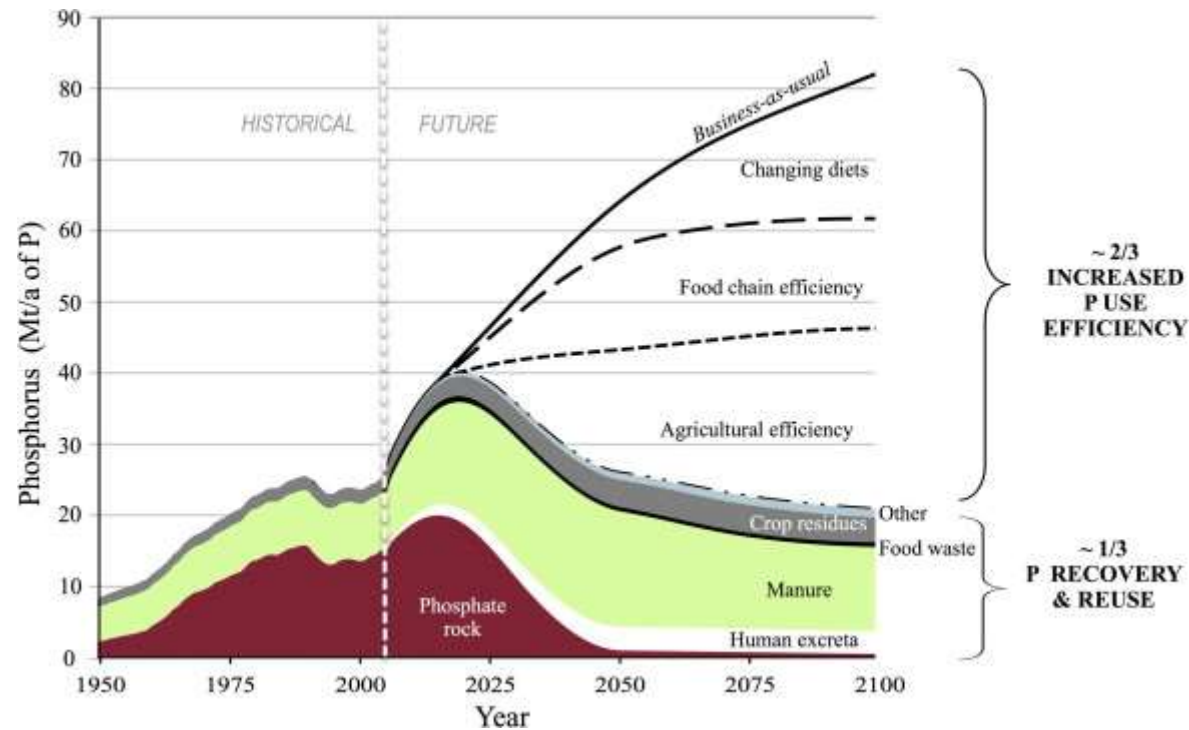


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Models and scenarios



Cordell D, Rosemarin A, Schröder JJ, Smit AL. Towards global phosphorus security: a systems framework for phosphorus recovery and reuse options. Chemosphere. 2011;84(6):747-58.

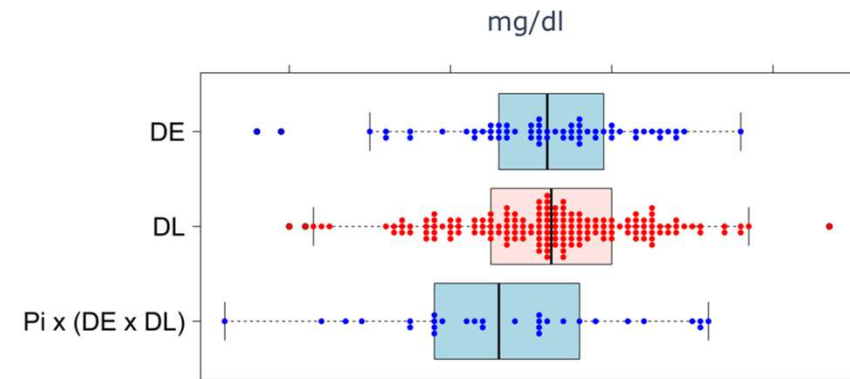


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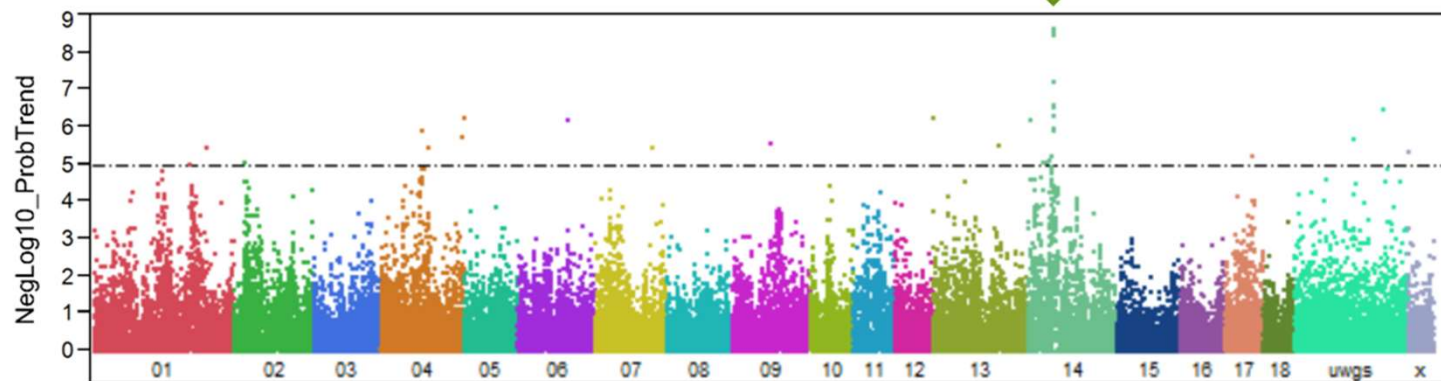


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Genetic architecture of serum P levels

Candidate:
TRAJD1



Trait	N	Mean \pm SD	Min	Max	h^2
Serum P (mg/dl)	579	8.4 ± 1.0	6.0	12.7	0.45

Ponsuksili S, Trakooljul N, Hadlich F, Haack F, Murani E, Wimmers K. Genetic architecture and regulatory impact on hepatic microRNA expression linked to immune and metabolic traits. Open Biol. 2017 Nov;7(11).



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Impact of diets with variable P content

► Analysis of gene expression

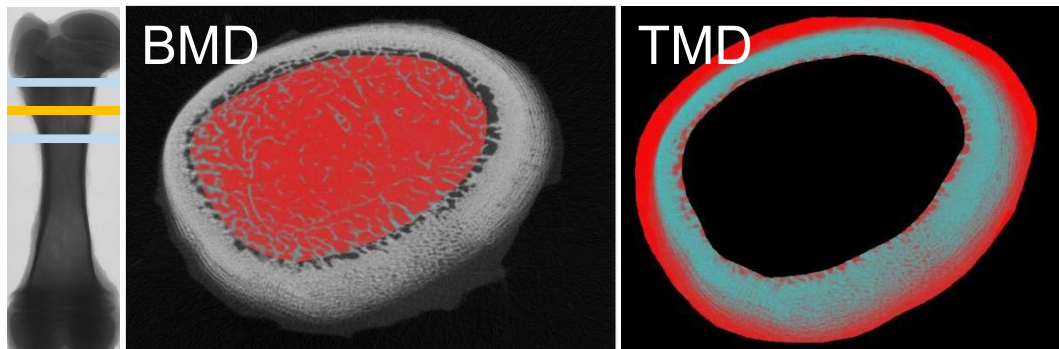
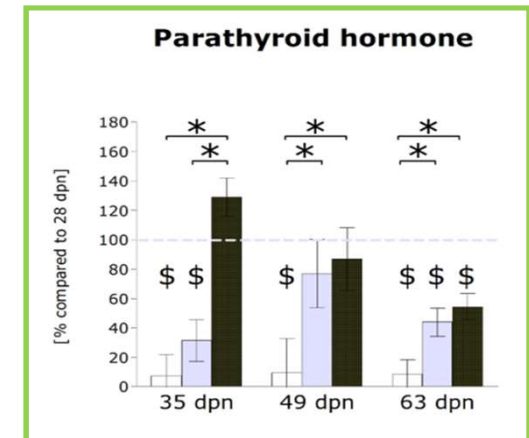
- Expression profiles of blood, gut, kidney
- Pathways of P homoeostasis, immune response

► Analysis of endocrine parameters

- P, Ca, PTH, Vit D, AP, RANKL...
- Regulation towards compensation and maintenance of plasma levels

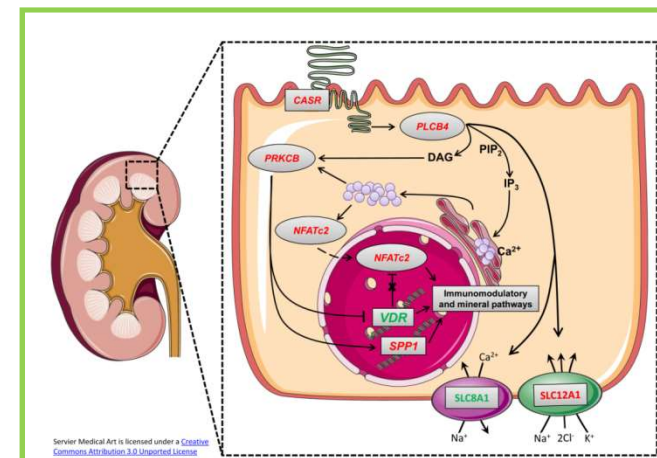
► Measurement by microCT analysis:

- 3d reconstruction of the bones at defined area (800 slides)
- Trabecular structure of bones is influenced but not corticalis



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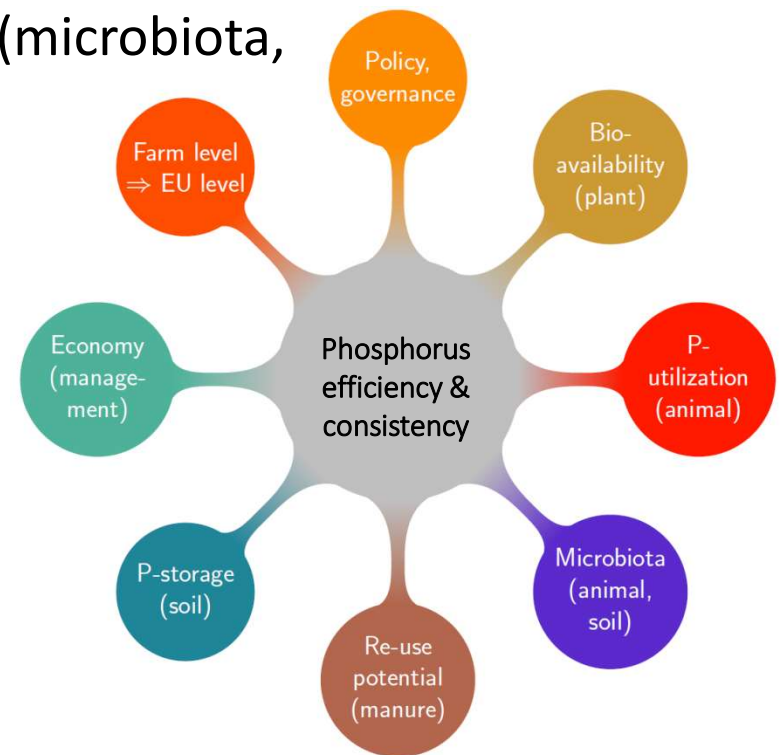
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Expected outcome and impact

- Environmental impacts of feeding strategies considering economic goals
- Biodiversity of the phosphorus utilization (microbiota, genetics, epigenetics, gene expression)



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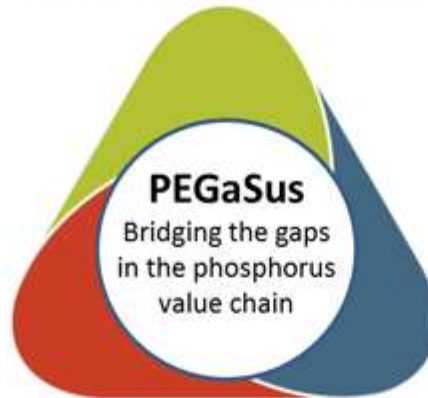


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Improve the productivity, resilience and competitiveness of European Animal Production

Research Area 1

- Improved profitability
- Higher independency on imports
- Scientific-based policy measures



Research Area 2

- Reduced phosphorus losses
- Reduced eutrophication
- Reuse products

Research Area 3

- Improved acceptance
- Environmentally friendly
- Secured animal health and welfare

Improve and manage resource use to reduce waste and enhance the environmental sustainability of European Animal Production

Improve on-farm practices to enhance consumer acceptability and address societal challenges associated with animal welfare, product quality and safety, biodiversity and provision of ecosystem services



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stakeholders



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Thank you for your attention!



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