



# NUTRI•KNOW



Learn more about us at [www.nutri-know.eu](http://www.nutri-know.eu)



**BIOREFINE**  
CLUSTER EUROPE

**Workshop at  
ESNI2024**



**NUTRI•KNOW**

**Accelerating Knowledge  
Transfer: A deep dive into  
the Results Amplification  
Methodology (RAM)**

Anna Bagó Mas | 19/09/2024 | Brussels





# Contextual Challenge

[Home](#) / [News](#) / [Agrifood](#) / [CAP reform](#) / EU is too dependent on animal feed and fertiliser imports, warns Parliament study

## EU is too dependent on animal feed and fertiliser imports, warns Parliament study

By [Sofia Sanchez Manzanaro](#) | Euractiv | Est. 3min

📅 7 mar 2024

MEPs want to bring down their prices

## "EU should be less dependent on imported fertilizers"

The European Parliament urges the Commission to ensure the supply of fertilisers, take action to bring down prices, and increase the EU's strategic autonomy in fertilisers.

## Europe's fertilizer demand struggling amid high gas costs, cheaper imports



★ Favorites Print Forward Share

Oct. 9, 2023

By [Deepika Thapliyal](#) (Deputy Managing Editor, Fertilizers), [Sylvia Tranganida](#) (Senior Ammonia Editor) and [Aura Sabadus](#) (Senior Journalist), ICIS

02 February 2024 by [Diego Giuliani](#)

## Reuse or let die. Crucial for life but threatening if in excess: the nutrient challenge



AA

Essential for life but threatening for the environment if in excess. The nutrient challenge and the circular response: turning them from waste into biofertilizers to tackle pollution and feed the world's growing population

## Recovering Nutrients To Save The Planet: The Fertilizer Challenge

📅 July 31, 2023 0 Comments

By [Eurasia Review](#)

[Home](#) / [News](#) / [Agrifood](#) / [Sustainable food systems](#) / EU stalls on strategy to curb nutrient losses

## EU stalls on strategy to curb nutrient losses

By [Julia Dahm](#) | Euractiv.com | Est. 4min

📅 8 nov 2023 (updated: 📅 13 nov 2023)



# Knowledge Challenge

## KNOWLEDGE

*What we know*



Recommendations Products  
Innovative Technologies Tools



## NUTRI-KNOW



collecting, translating, and sharing  
**easy-to-understand** and **practice-oriented** knowledge

## PRACTICE

*What we practice*



knowledge-to-application

# GAP

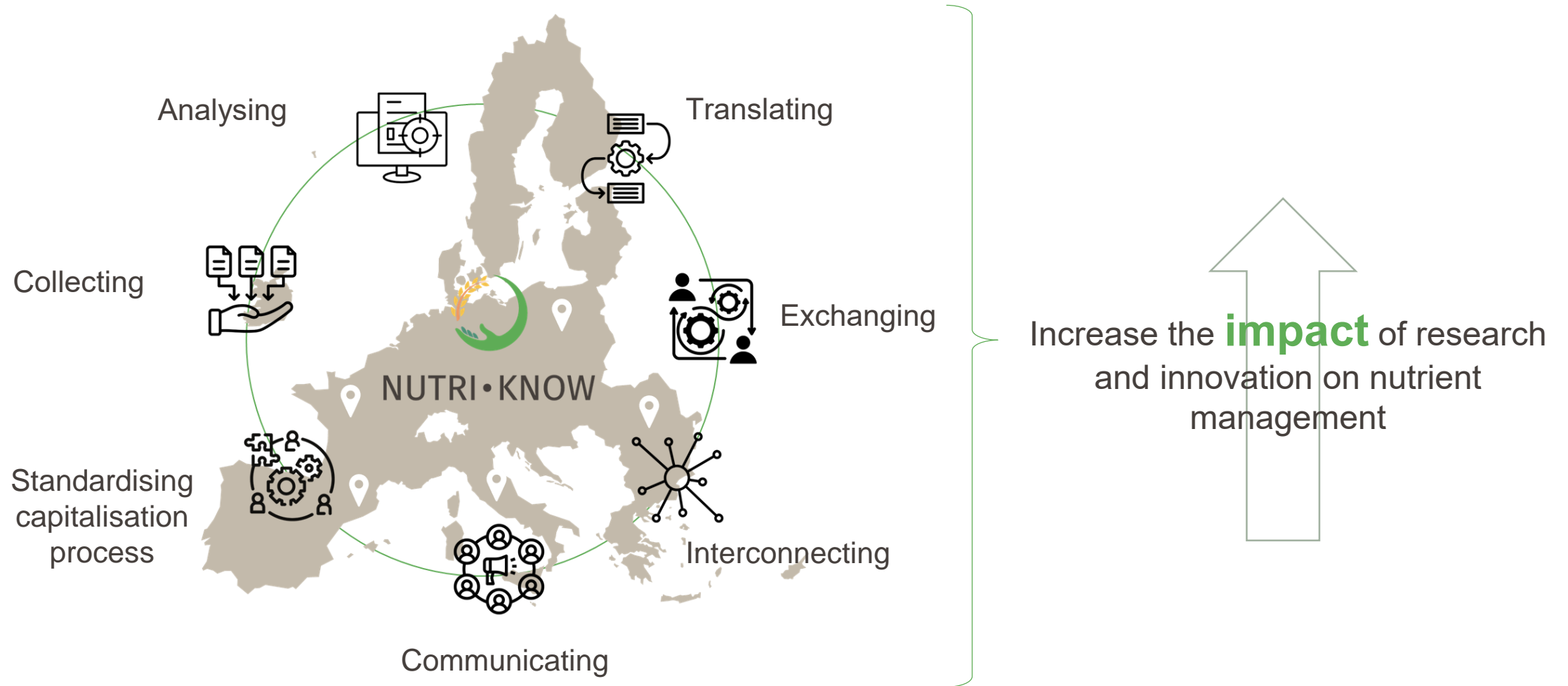


## NUTRIENT MANAGEMENT





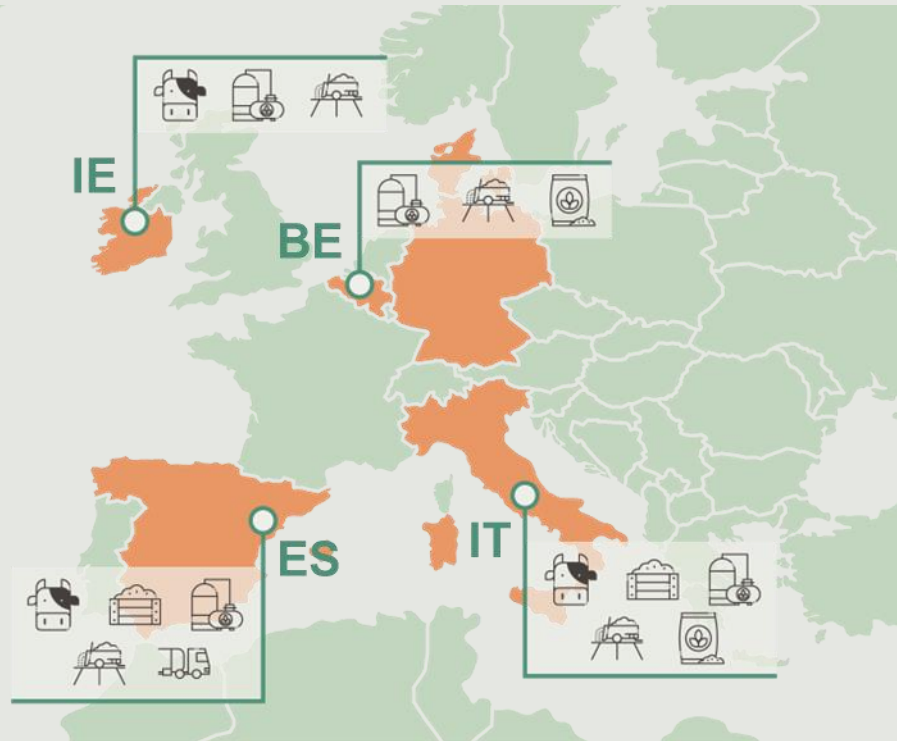
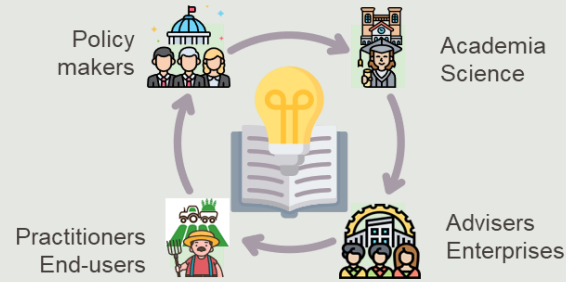
# NUTRI-KNOW as a tool





# 1. Collection & Homogenisation: Knowledge

## MULTI-ACTOR APPROACH



## STRUVITE (IT)

## GAS LOOP (IT)

## RENURE (BE)

## SOS\_AQUAE (IT)

## POCKETBOER 2 (BE)

## FERTICOOP-GO (ES)

## Grass2Algae (BE)

## Manure Management Tool (ES)

## MOPS (IE)

## Slurry Concentrator (ES)

## Duncannon Blue Flag Farming (IE)

## Biorefinery Glas (IE)



# 1. Collection & Homogenisation: Knowledge



**METADATA-BASE**





# Learn more about our 12 OG innovations in nutrient management!



Hongzhen Luo  
Poster presentation

**UNLOCKING INNOVATION FOR SUSTAINABLE NUTRIENT MANAGEMENT IN LIVESTOCK INTENSIVE REGIONS**

Hongzhen Luo<sup>1\*</sup>, Anna Bagó-Mas<sup>2</sup>, Beatriz Medina<sup>3</sup>, Maria Pascual Sánchez<sup>3</sup>, Victor Carbajal Perelló<sup>2</sup>, Erik Meers<sup>1</sup>  
<sup>1</sup> Ghent University, Ghent, Belgium. \*corresponding author Hongzhen.Luo@UGent.be  
<sup>2</sup> BETA Technological Center, University of Vic-Central University of Catalonia, Vic, Spain.  
<sup>3</sup> Water, Environment and Business for Development, Sant Cugat del Valles (Barcelona), Spain.

NUTRI-KNOW is an EU-Horizon funded project engaging with 12 Operational Groups (OGs) on the theme of nutrient management, committed to fostering collaboration and knowledge exchange beyond national boundaries.

**Challenges**

- **Surplus of manure N and P** on cropland in livestock-intensive regions, notably in Flanders (BE), Catalonia (ES), and Emilia Romagna (IT), exert a high environmental pressure;
- **Low awareness** of research innovations by stakeholders across regions and nutrient value chain steps.

**Strategies**

- **Stakeholder approach** combining consultation surveys and individual interviews was employed to (i) identify the **barriers and enablers** in real practice, and (ii) matchmake the OG outcomes with insights of stakeholders involved in different value chain steps;
- A **meta-database** was established consisting of the knowledge obtained from the engaged OGs. **Manure as resource for nutrients and energy** has been highlighted in several innovations.

**Nutrient recovery**

- OG Slurry concentrator (ES) promoted a technology to concentrate the N and P in slurry at low cost and minimum energy consumption.
- OG Struvite (IT) developed a STRUVITE prototype treatment system to recover struvite from manure and digestate which helps relocate the surplus N&P to areas characterised by nutrient deficiencies.
- OG Gas Loop (IT) implemented an Ammonia Washing Machine (TRL 9) to reduce ammonia emission inside pig housing, with production of ammonium sulphate (4-6.4% N) as alternative for synthetic N fertilisers.
- OG RENURE (BE) promoted the implementation of ammonium salts recovered from manure through stripping and scrubbing as a priority candidate for RENURE products.

**Energy generation**

- OG POCKETBOER 2 (BE) created recommendations for implementation of pocket digesters to produce biogas as green energy from manure, supporting farmers to solve practical problems and improve the digestion performance.

**Manure application**

- OG Manure management tool (ES) and OG FERTICOOP-GO (ES) developed and implemented *in-situ* rapid testing systems and computer applications to quickly and accurately generate recommendations for livestock management and fertilisation plans.
- OG SOS-AQUAE (IT) optimised the application of 'renewable' fertilisers derived from livestock slurries and digestate by drip lines in sub-irrigation.

**Stakeholder integration**

Despite the continuous updating of knowledge, more actions are following to translate the research results into practice-oriented materials in easy-understandable language for the key stakeholders, i.e. farmers and practitioners.

Learn more about the project at [www.nutri-know.eu](http://www.nutri-know.eu)

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Funded by the European Union

Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or European Commission. Neither the European Union nor the granting authority can be held responsible for them.

Feel free to pick up flyers about our innovations!



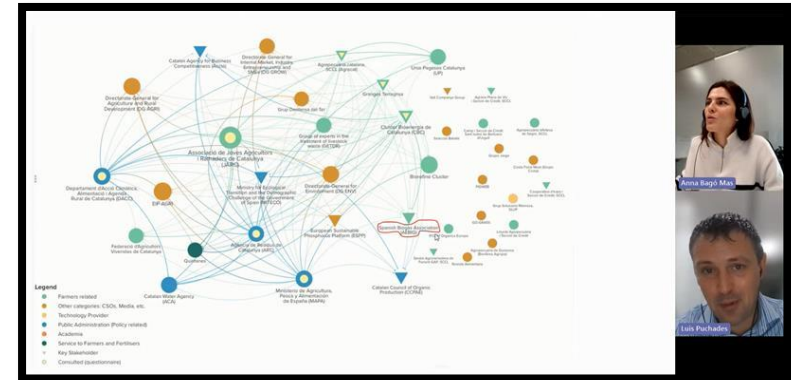




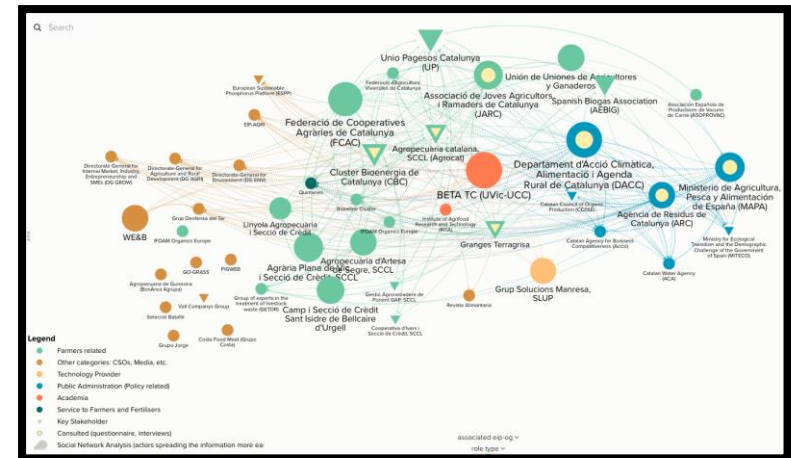
# 2. Multi-actor Analysis: Stakeholder Engagement



Fuzzy Cognitive Map Workshops



Interview with the Director of the Spanish Biogas Association



Regional stakeholder map



# 3. Consolidation and Translation: Easy-to-Understand and Ready-to-Practice Material

## Practice Abstracts

**NUTRI-KNOW**

**Struvite**

**Livestock manure and digestates treatment to reduce emissions and produce Struvite**

**Activities**

- Laboratory analysis and testing for optimal prototype treatment
- Development and implementation of the prototype treatment system (Struvite)
- Monitoring of the efficiency of the prototype in reducing the nitrogen and phosphorus content in livestock slurry and digestates
- Monitoring of emissions (ammonia, CO<sub>2</sub> and CO<sub>2</sub>e)
- Assessment of the economic and environmental sustainability of the treatment
- Dissemination of the results (workshops and training courses)

**Further details**

- Total budget € 185,222
- Total funding € 172,725
- Main funding source: Rural Development Program 2014-2020 for Operational Groups
- Rural Development Programme (Regional) (nr. 1604/2014-2020) - Italy
- Email: 09/04/2024 - 27/02/2022
- Italy, Emilia-Romagna Region
- Centre Research Production Project coordinator: Research network - (Region Emilia Romagna)

**Objectives**

The goal of the Struvite Operational Group (OG) was to decrease the nitrogen (N) and phosphorus (P) content in livestock effluent and digestates in order to reduce atmospheric emissions of ammonia, methane and nitrous oxide from both the storage and spreading phases compared to untreated manure or digestate. The nitrogen and phosphorus removal process is reversible, slow-release fertilizer (Struvite) that can replace chemical fertiliser's nutrient content.

To achieve this goal the OG designed and implemented a prototype, farm-scale system capable of producing and extracting Struvite.

**Results**

The recovery of phosphorus and nitrogen from agricultural residues through the prototype process has been proved technically feasible; the prototype recovering Struvite may be further refined (e.g. by a further production) in order to efficiently reduce phosphorus emissions and nitrogen recovered from manure/digestate in accordance with the new European fertilizer regulation.

In terms with specification, distribution and implementation, the nitrogen and phosphorus for this reason the prototype treatment of digestate was effective in reducing emissions of ammonia and greenhouse gases from the management of digestate. The reduced nitrogen content has allowed ammonia emissions to be reduced by 42% from storage and 10% from spreading, while the limited organic matter content led to a reduction of methane emissions from the storage phase by 80%.

The high concentration of nitric and organic matter in the digestate, as well as carbon from the prototype treatment system used and used to reduce industrial fertilizer use by 20% and nutrient loss by 50% by 2030.

**Context**

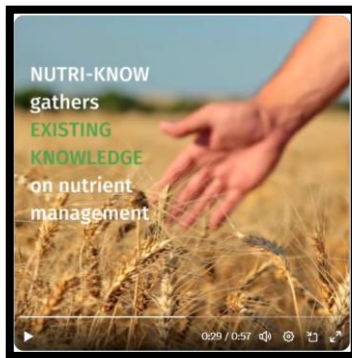
Animal manure is an excellent fertilizer matrix for crops and soils as it is rich in both macro and micro nutrients and organic matter, which are useful for the productivity of agricultural soils. The downside is the ammonia and greenhouse gases emission from slurry during storage and spreading.

The objectives of the Struvite project are covered on the following table.

In fact, the Italian agricultural sector determines about 7% of national GHG emissions, and of this share 80% comes from manure management. As for ammonia emissions, the agricultural sector accounts for 5% of national emissions with 42% of that share coming from manure management (SARA, reports 2002/2020 and 2021/2023).

In Italy there are areas with a high presence of livestock farms where optimal management of animal effluents and digestates could result in reduced emissions, but only if a manure treatment also aimed at recovering the nutrients contained could promote the reduction of nitrogen and phosphorus surplus from high livestock areas to areas instead characterized by chronic fertilizer demand. In conjunction with the principles of nutrient balance and Resilience and the farm-to-farm targets, the farm to farm strategy promotes a sustainable food system, the heart of the European Green Deal, one of the main goals of which is to reduce industrial fertilizer use by 20% and nutrient loss by 50% by 2030.

## Short-videos



## Flyers

**Gas Loop**

Emissions capture nitrogen cycle in p...

**Biorefinery Giás**

Small-Scale Farm Biorefinery

**Pocketboer II**

More performant treatment of pocket boer...

**Slurry Concentrator**

to enhance the efficiency of soil nutrient application

**Follow our journey!**

Gas Loop has developed and patented the first solution. This increases animal health the pig housing.

Approach: Sustainable solutions aimed at reducing ammonia emissions and green gases, while simultaneously increasing animal and worker welfare, are provided in the list of Best Agri-Techniques (BAT) for pig farming.

Biorefinery Giás focuses on the development in South West Ireland to address challenges in traditional agriculture.

Mobile Biorefineries: The feedback scale required for integration with anaerobic digestion will not be achievable.

Alternative Approach: Using nutrients that remain in the following raffinate and allowing these to be recycled back to the land in the form of a substrate.

Field trials were established to assess the approach by comparing slurry back to slurry and untreated pigs.

Pocketboer 2 aimed to find digesters. It encouraged impact and future plans to improve pig Sustainability.

These small-scale digesters produce biogas from pig slurry, biogas for local or nearby conditions. The biogas is used for heat and electricity. Slurry is separated from the digester and the remaining nutrients are used as fertilizer.

Biogas and digestate are produced directly. The digestate is separated from the digester and used as fertilizer. The biogas is used for heat and electricity. The digestate is used as fertilizer.

Field trials were established to assess the approach by comparing slurry back to slurry and untreated pigs.

Challenge: Biogas management is a significant challenge for farmers, particularly those operating small-scale farms. Systems are needed to improve their use of biogas and ultimately support their economic resilience.

Results: The system enables small-scale farmers to be supported and excited to share their ideas. Nutrients are not available, and a liquid phase can be used to support production. It is best practice using the same material to be applied in a nearby field.

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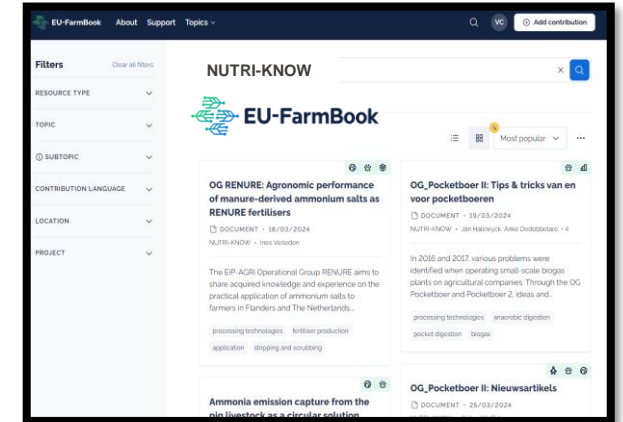
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Materials available to EU open repositories such as EU-Farmbook



## Booklets

**Livestock Farming**

Technologies, tools and recommended practices from NUTRI-KNOW's EP-AGE Operational Group

**Processing Technologies**

Technologies, tools and recommended practices from NUTRI-KNOW's EP-AGE Operational Group

**Transport**

Technologies, tools and recommended practices from NUTRI-KNOW's EP-AGE Operational Group

**Storage Systems**

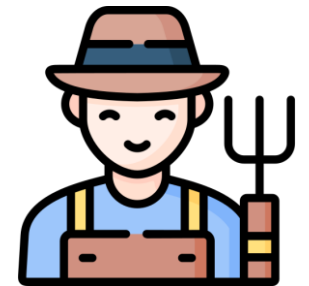
Technologies, tools and recommended practices from NUTRI-KNOW's EP-AGE Operational Group

**Fertiliser Production**

Technologies, tools and recommended practices from NUTRI-KNOW's EP-AGE Operational Group

**Application**

Technologies, tools and recommended practices from NUTRI-KNOW's EP-AGE Operational Group





# 4. Deployment & Transfer: Activities & Initiatives

Trainings targeting practitioners (In-person + Online)



Recording You are viewing Patrick Forrester's screen View Options

**Also significant losses of ammonia-N during animal housing and storage**

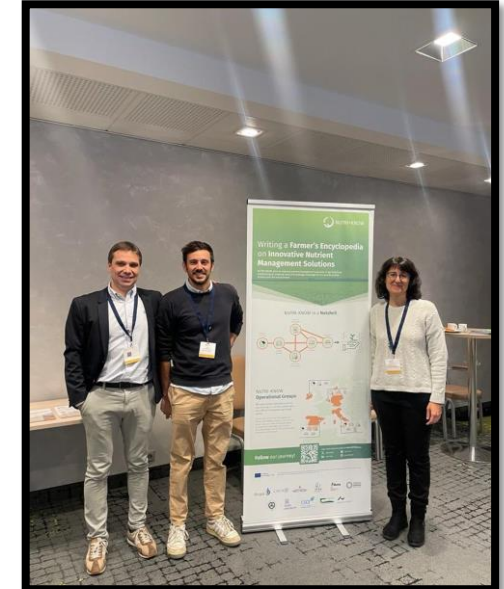
**NUTRI-KNOW** Funded by the European Union

In Italy an EIP-OG producing Ammonium Sulphate liquid fertiliser by capturing ammonia losses from storage

Patrick Forrester

Audio Settings Chat Raise Hand Q&A Show Captions Leave

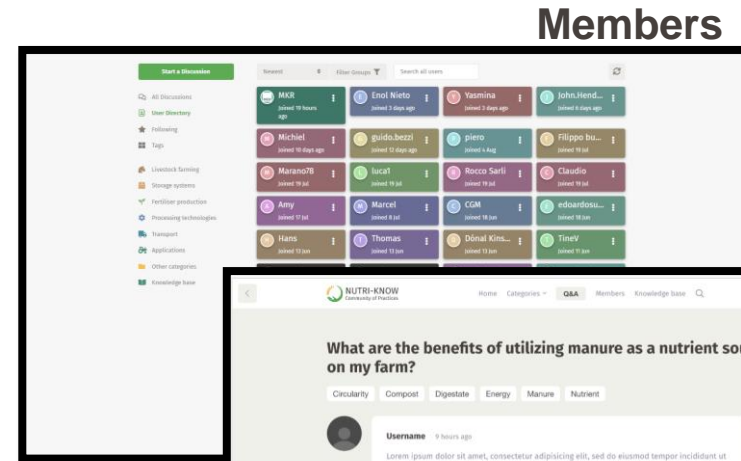
International Positioning



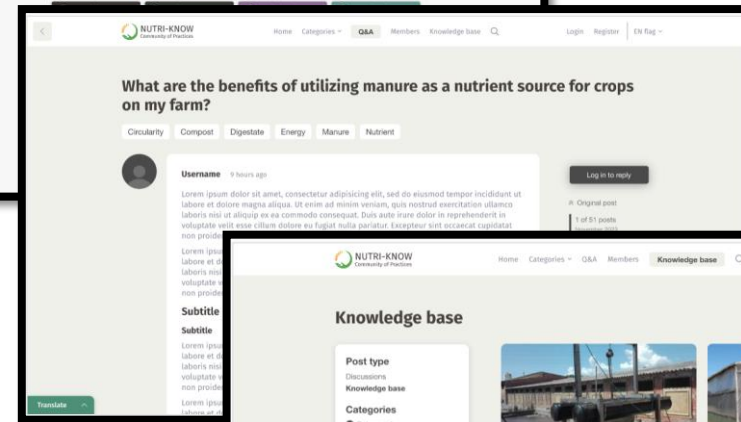


# 5. Interconnection: Community of Practice

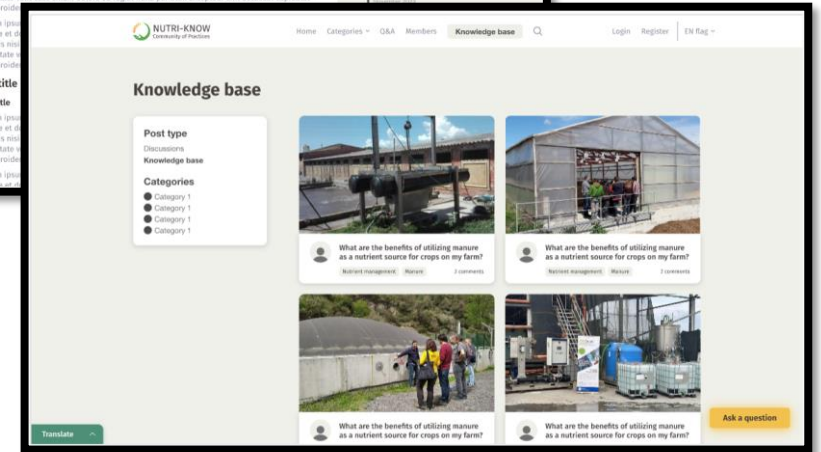
Sign up and explore!



Members



Q&A



Knowledge base



# Results Amplification Methodology to efficiently broaden EIP-AGRI OGs outcomes



**NUTRI-KNOW** as a pilot test to validate the “knowledge capitalisation methodology”

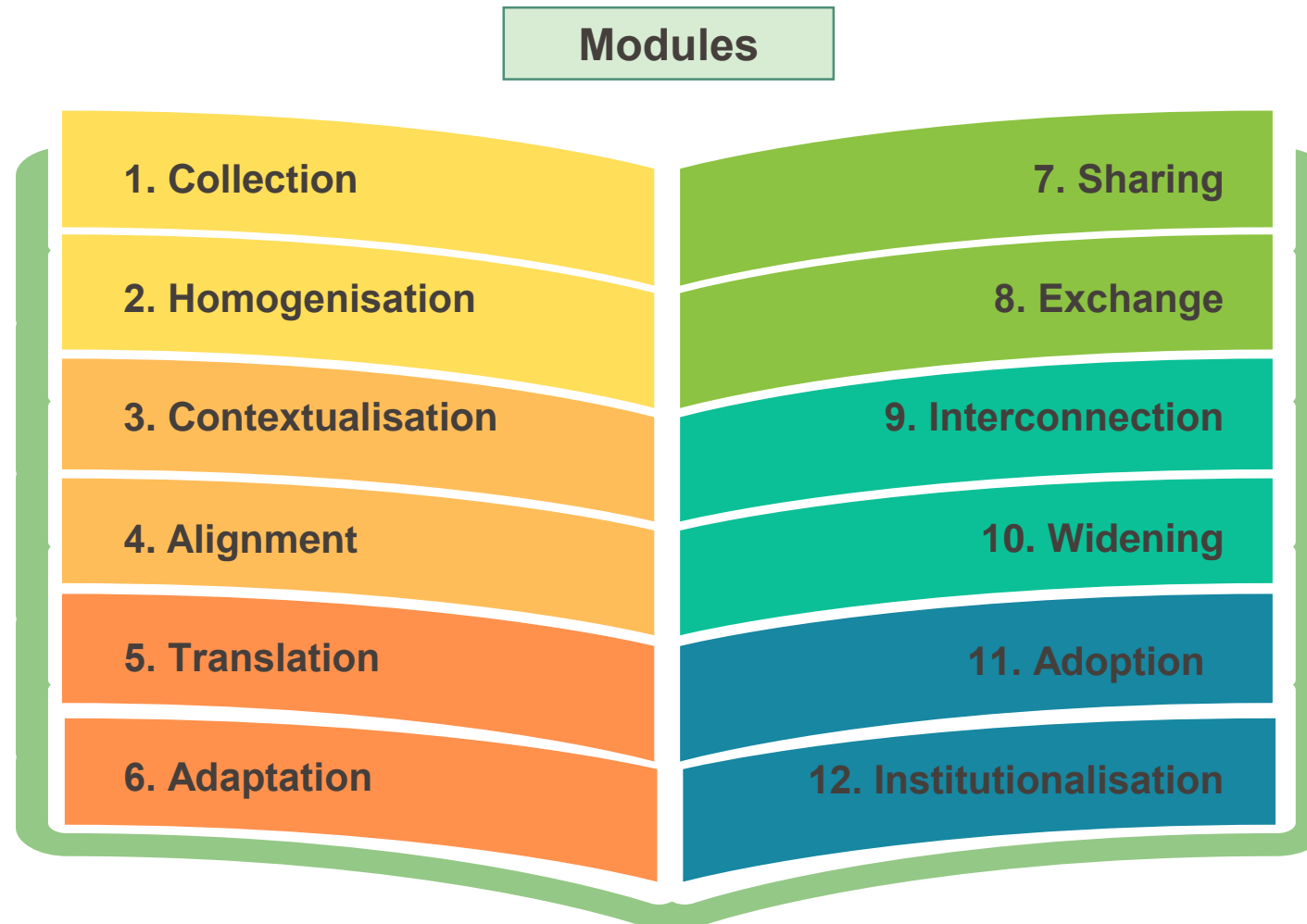
**Co-creation process** with different stakeholders

**RAM** with clear modules and steps



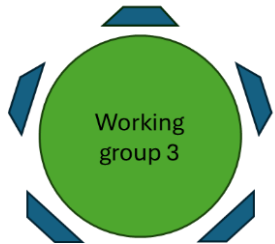
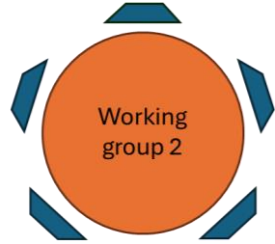


# Results Amplification Methodology





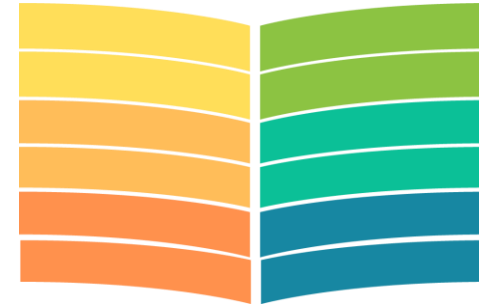
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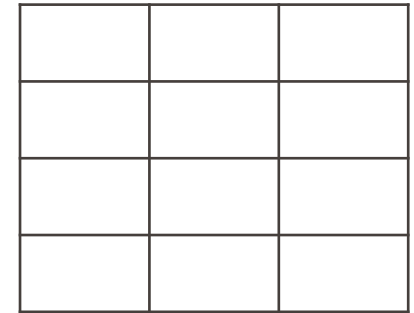
MATERIAL:



a large cardboard



cards with the RAM modules



cards with the steps of each module



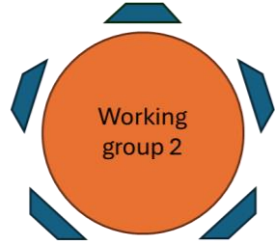
Pens and post-its



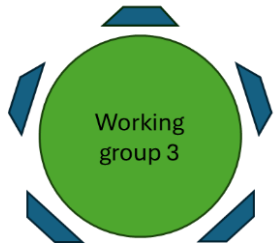
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Working group 1



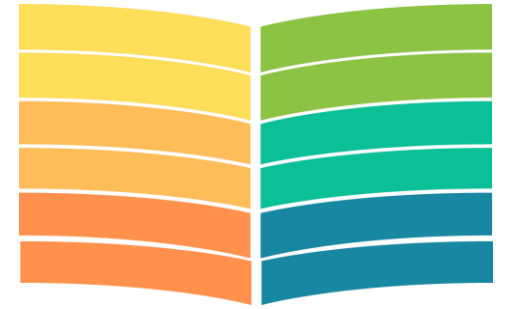
Working group 2



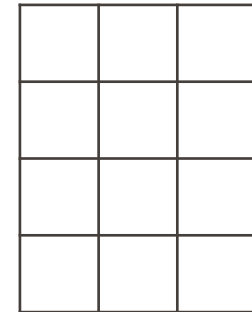
Working group 3



FUNCTIONING:



cards with the RAM modules



cards with the steps of each module



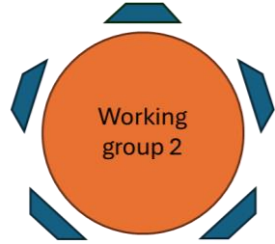




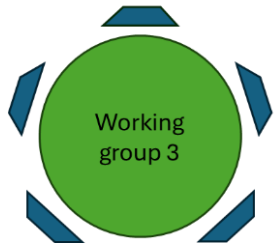
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Working group 1



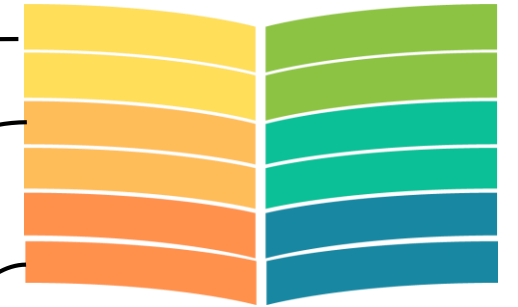
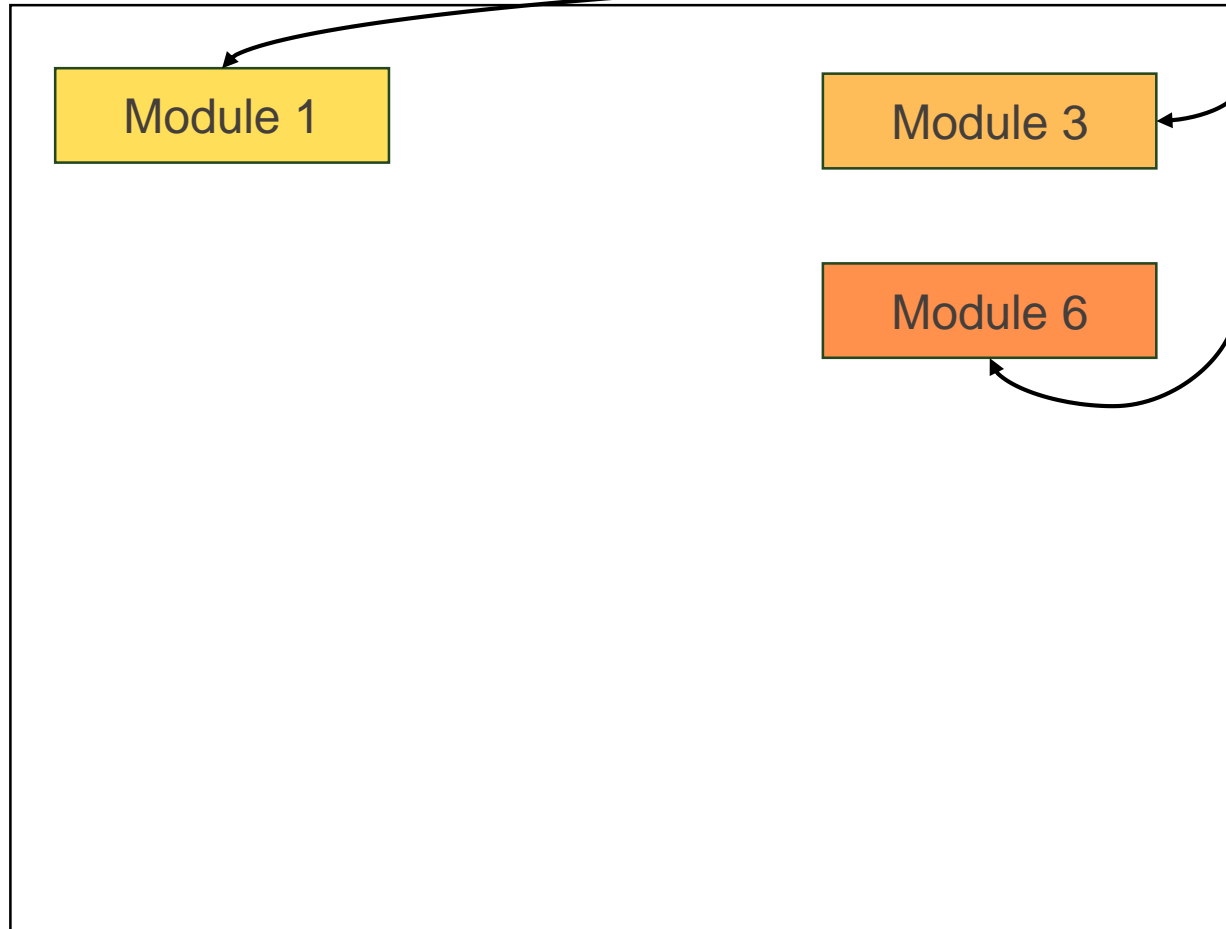
Working group 2



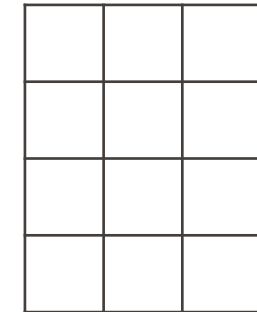
Working group 3



FUNCTIONING:



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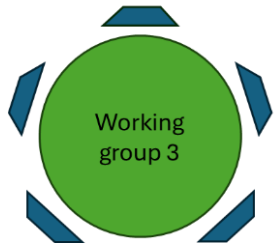


cards with the steps of each module



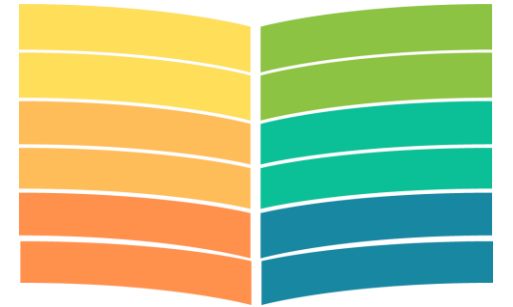
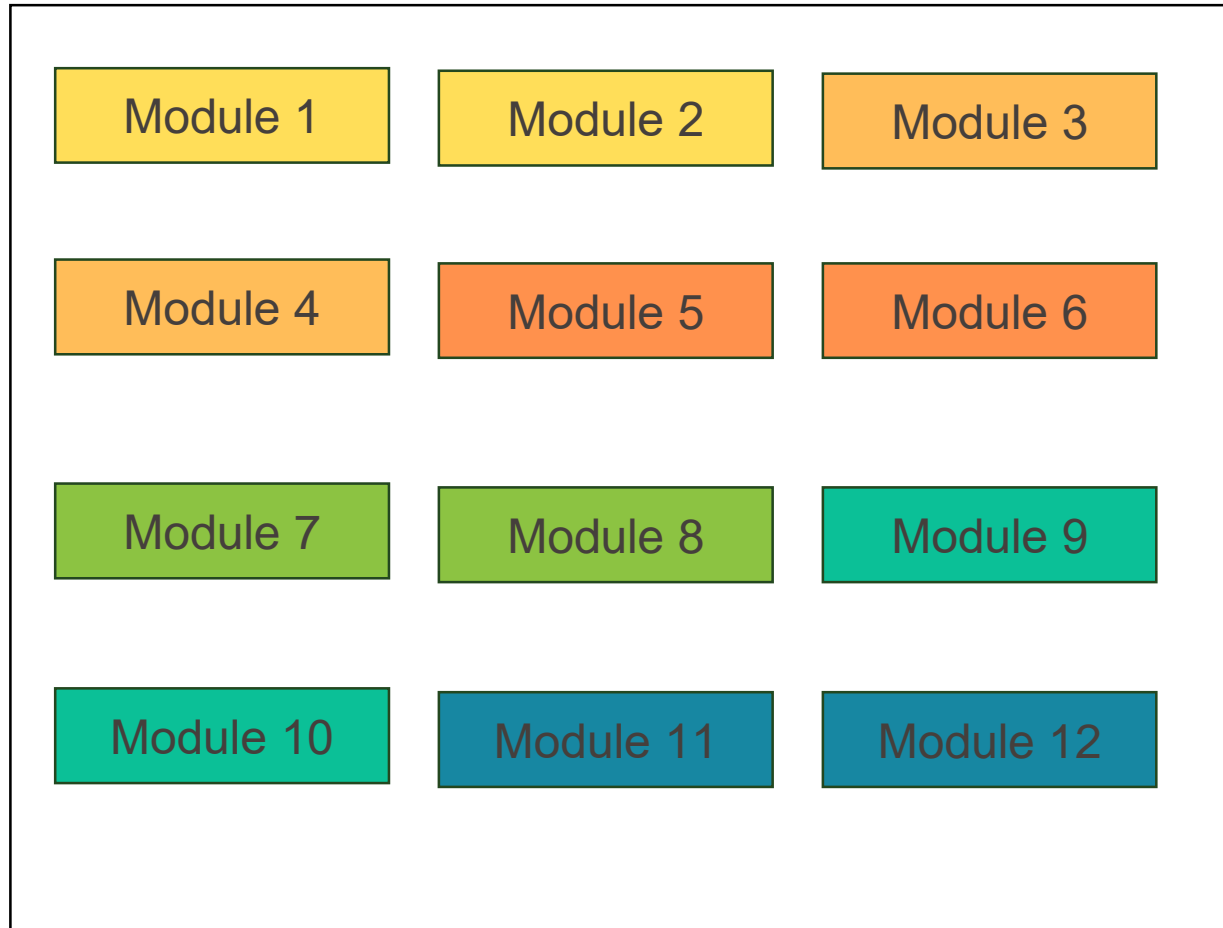


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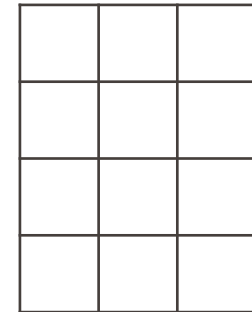


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FUNCTIONING:



cards with the RAM modules



cards with the steps of each module

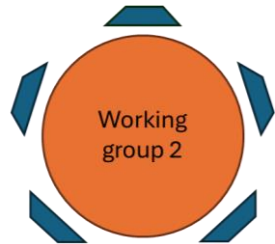




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Working group 1



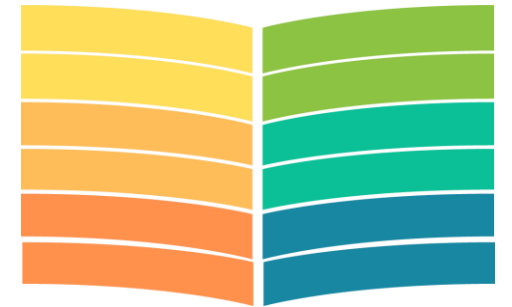
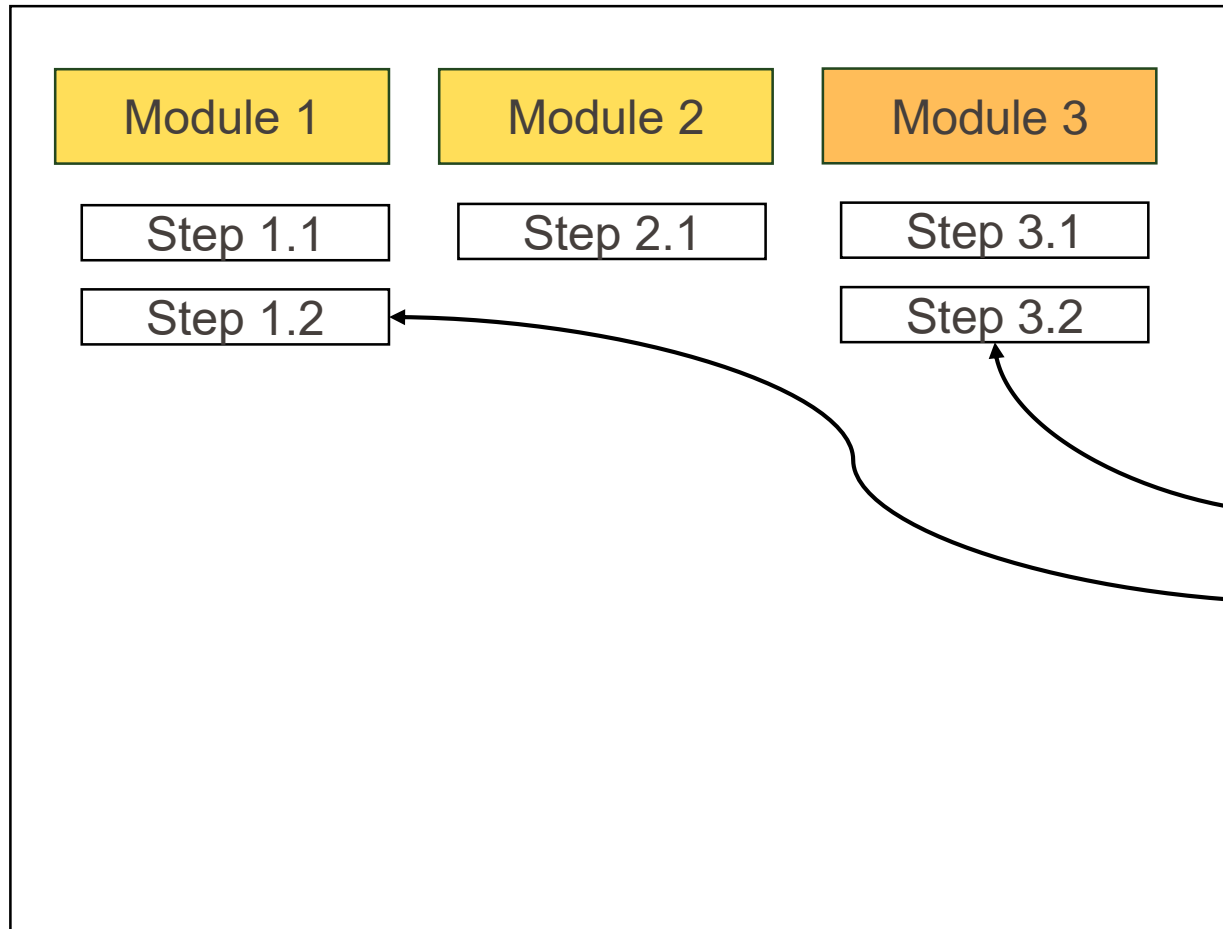
Working group 2



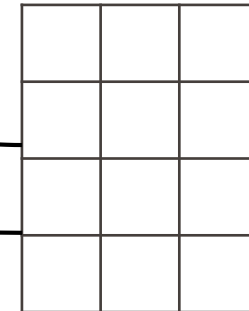
Working group 3



FUNCTIONING:



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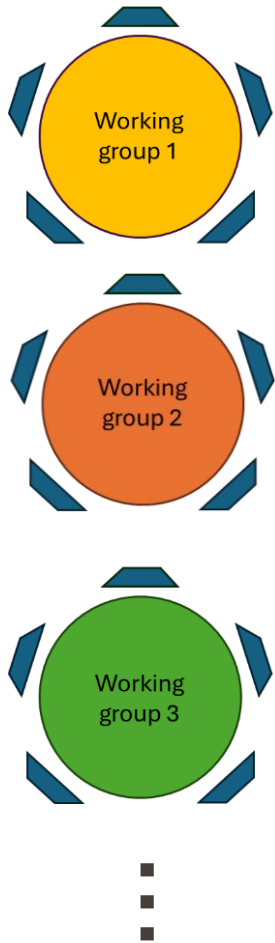


cards with the steps of each module

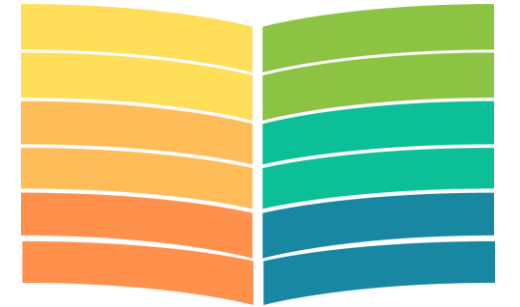
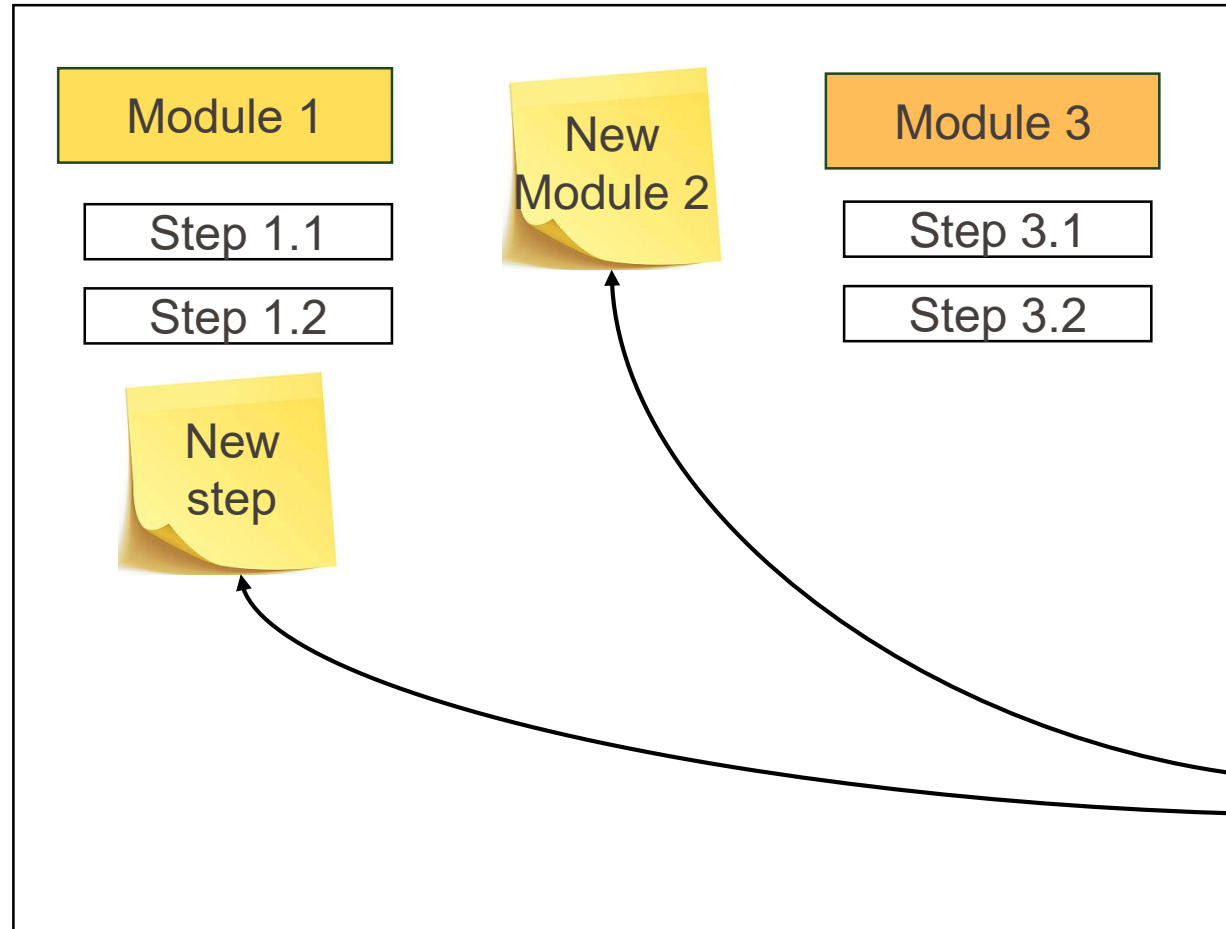




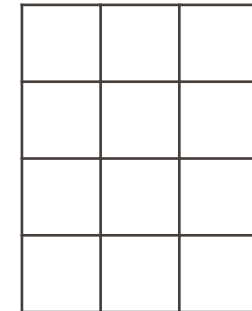
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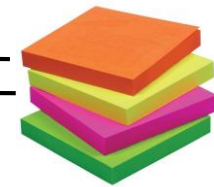
FUNCTIONING:



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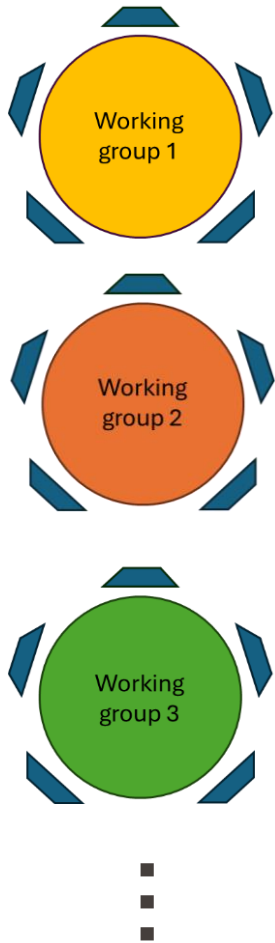


cards with the steps of each module

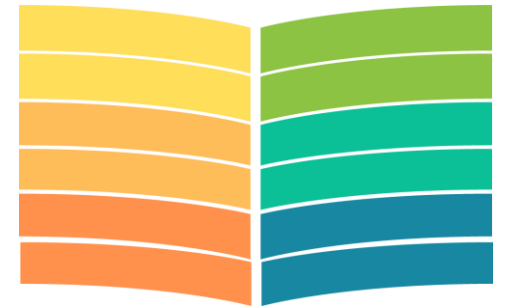
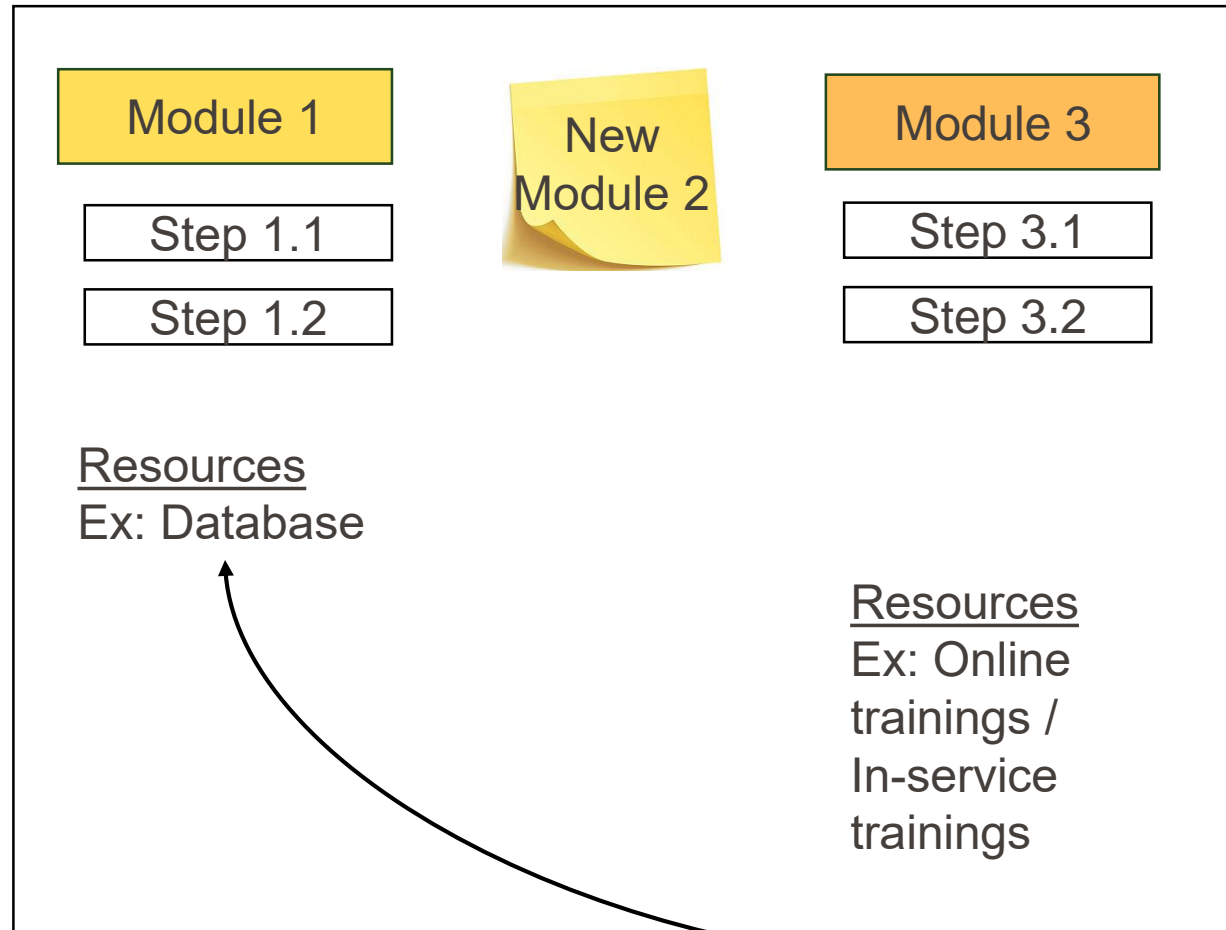




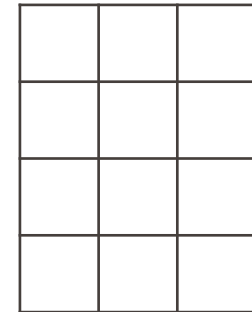
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## FUNCTIONING:



cards with the RAM modules



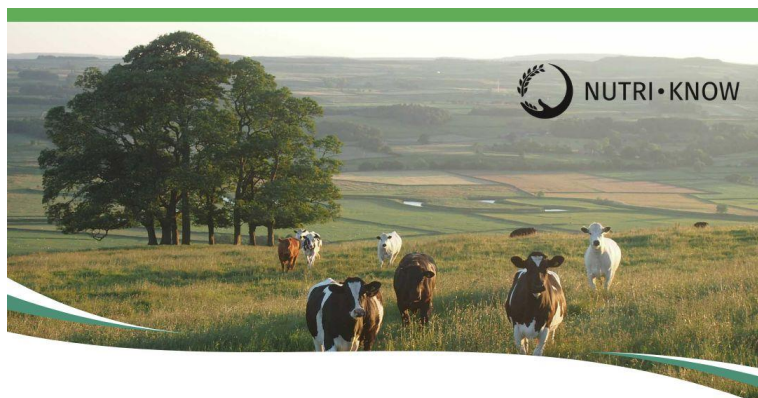
cards with the steps of each module





# Follow our journey!

Register for  
**NUTRI-KNOW Webinars!**



## NUTRI-KNOW WEBINARS



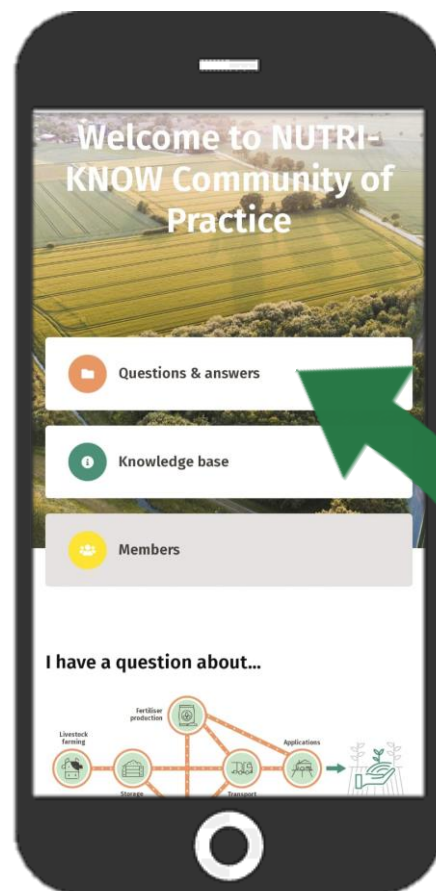
EVERY TUESDAY  
starting October 8



10:30 AM-  
11:30 AM

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