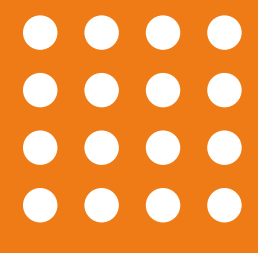


September,  
2020

## General context



*This infographic graphically summarizes and presents the opportunities for the transformation and use of (poultry and pork) manure in Colombia, by using Dutch technology and know-how.*

### Key facts - Colombia (2019)



Total area  
1.141.748 km<sup>2</sup>



Population  
48.200.000



Labor force  
22.200.000



GDP  
USD \$340,7  
billion



GDP Per Capita  
USD \$6.836



Inflation  
3,8%



Unemployment  
10,5%



Total exports  
USD \$39,5  
billion



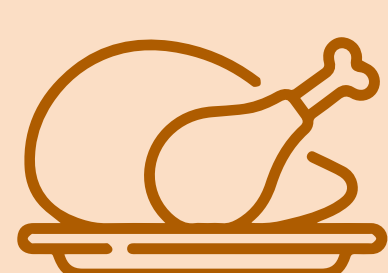
Total FDI  
USD \$14,58  
billion

## Poultry and Pork sector

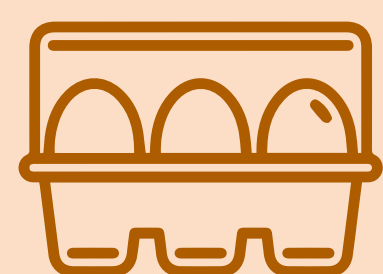
### Largest producers of poultry and pork meat metric tons in LATAM, 2019



### LATAM average per capita consumption



**32.7** kg  
per year



**270** units  
per year



LATAM average per capita  
pork consumption in 2019: **13.7** kg

For 2017, LATAM had approximately a total of 437.35 million egg-laying hens, of which the top 10 companies in the region held 24 % of this total.





## Best practices manure management projects in LATAM:

### Argentina



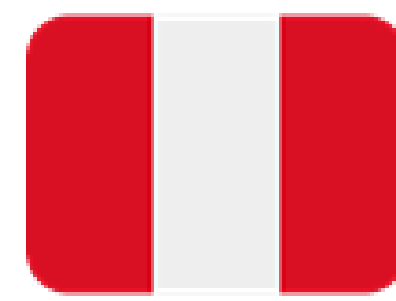
3 contracts for two solar technology projects and one for biogas for a total of 38 MW of power that benefits the province of Córdoba with supplies to more than 22,000 homes.

### Chile



150 km south of Santiago, a pig farm is producing the raw material necessary to generate electrical energy for 2,500 homes.

### Peru



A biodigester that produces biogas through anaerobic digestion of the waste of dairy cattle, pigs, sheep and layers. This biodigester is loaded with animal waste that, through anaerobic fermentation, converts it into biogas, organic fertilizer, Biol liquid, and Biosol soil improver.

Research Conducted by:



Government of the Netherlands



HOLLAND HOUSE  
COLOMBIA  
CAMARA DE COMERCIO COLOMBIO-HOLANDESA

More than Manure:  
Opportunities for Dutch know-how and technology in manure valorization in the **Colombian pig and poultry Sector**

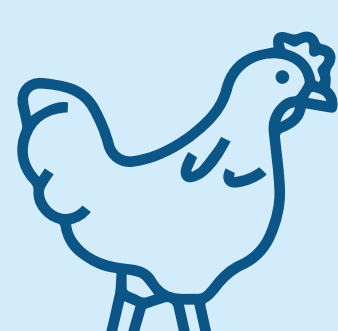
September, 2020

## Colombian context

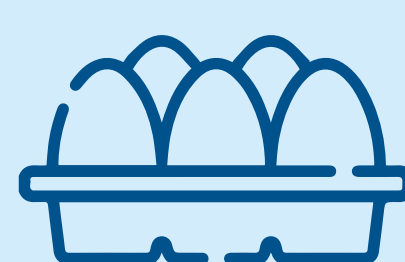
### Pork and poultry sector in Colombia



Record production of **452,000** tons in 2019  
**10%** more than 2018



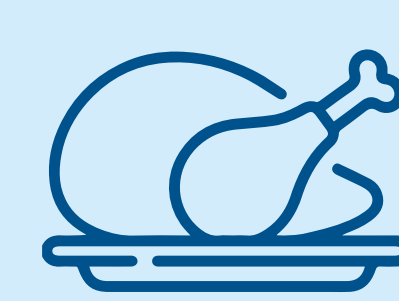
Production reached **1.7** million tons in 2019



Record production of **14,606** billion units in 2018



Pork consumption per capita: **11.3** kilograms in 2019



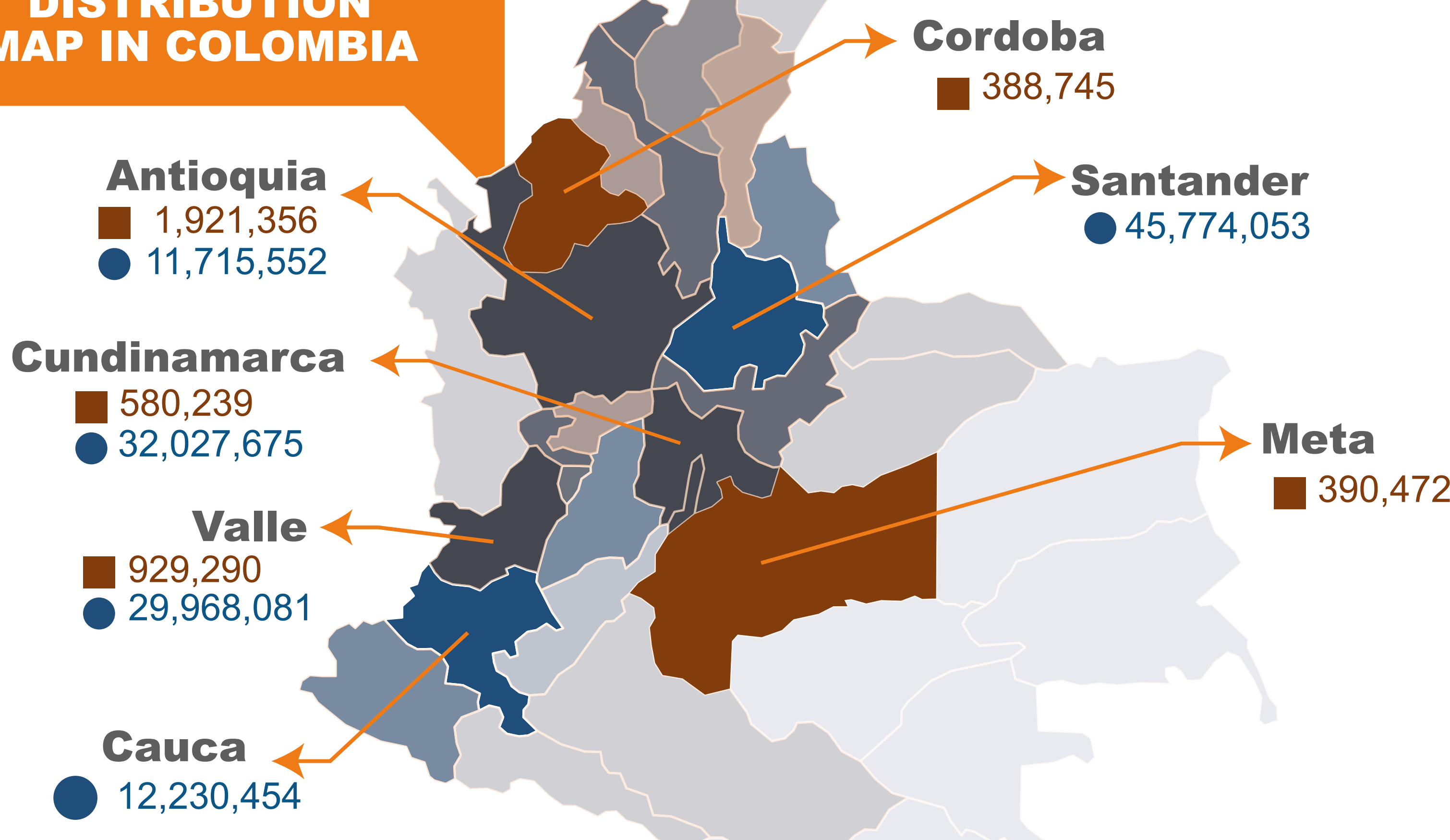
Chicken consumption per capita: **34** kilograms in 2019



Egg consumption per capita: **293** units in 2019

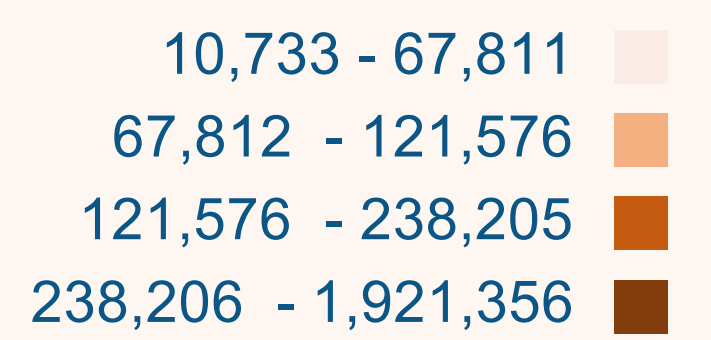


# POULTRY AND PORK LIVESTOCK DISTRIBUTION MAP IN COLOMBIA



## TOTAL PIG POPULATION PER DEPARTMENT, 2019

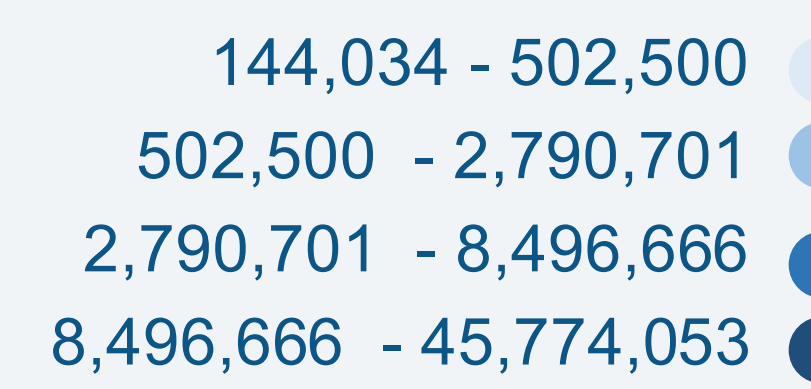
### TOTAL PIG POPULATION



Total pork population:  
**6,473,525**

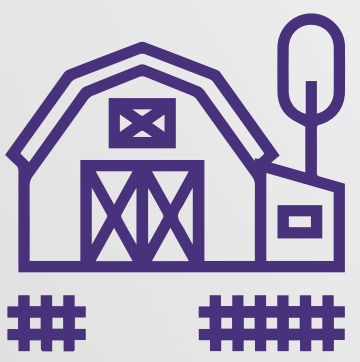
## TOTAL POULTRY POPULATION PER DEPARTMENT, 2019

### TOTAL POULTRY POPULATION



Total broilers population: 126,684,389  
Total layers population: 60,814,199

Total poultry population:  
**406,413**  
farms =  
**187,498,585** animals



Approximately  
**22,500** tons  
of poultry manure  
are produced per day\*.

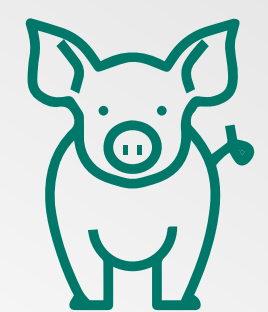
\* 1000 chicken produce  
120kg/day of manure



Approximately  
**15,200** tons  
of pig manure are  
produced per day\*.

\* 1 pig produces 2,35kg/-  
day of manure

Total pig population:  
**237,380**  
farms =  
**6,473,525** animals



## SOIL AND CROP FERTILIZATION

### Agricultural production and potential use of organic fertilizers

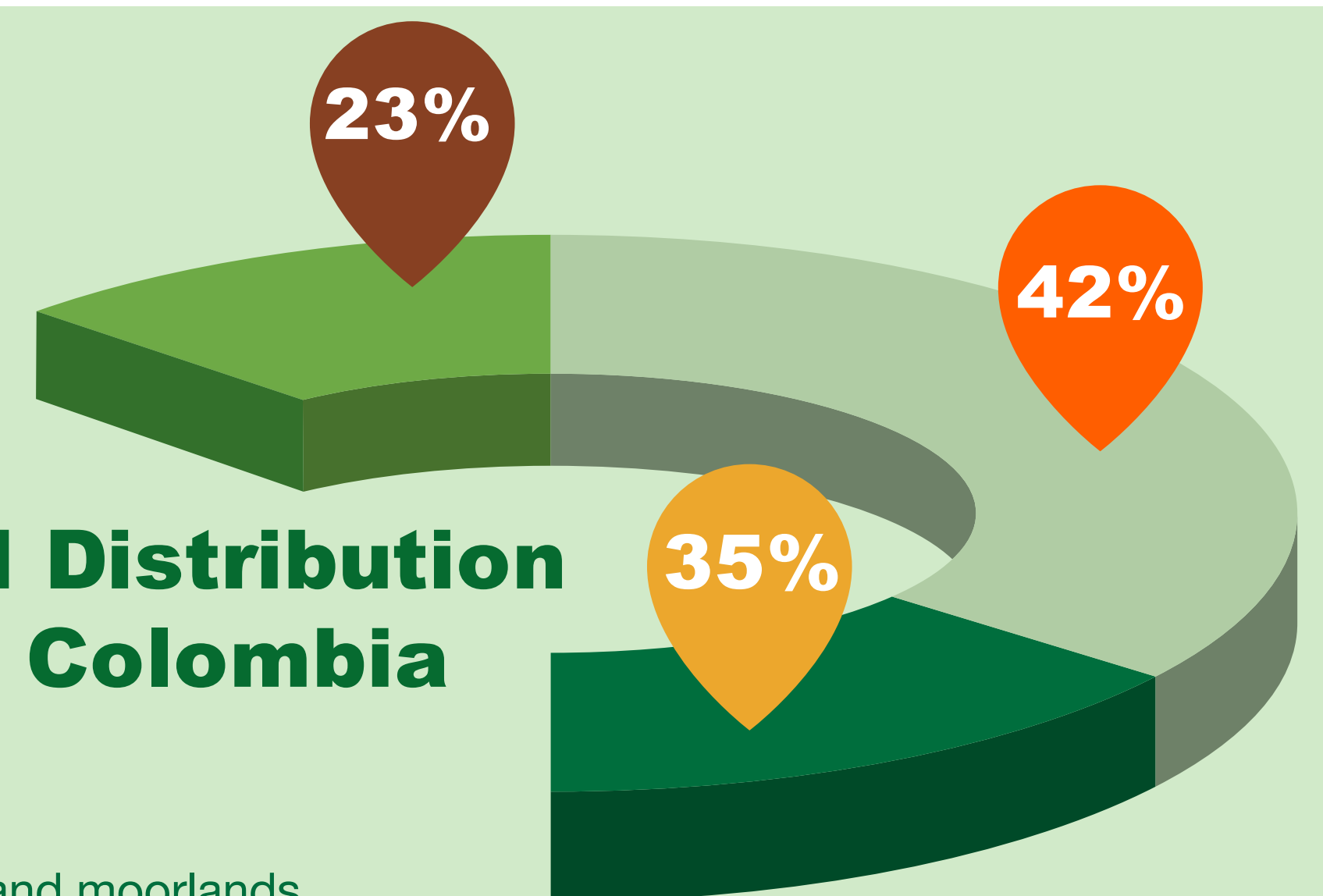
Colombia's soils suitability for agriculture, as an indicator for the potential demand for fertilizer (organic and synthetic):

- Agricultural national frontier\*
- Legal exclusions\*\*
- Forests and non-agricultural areas

\*Potential area allowed for agriculture.

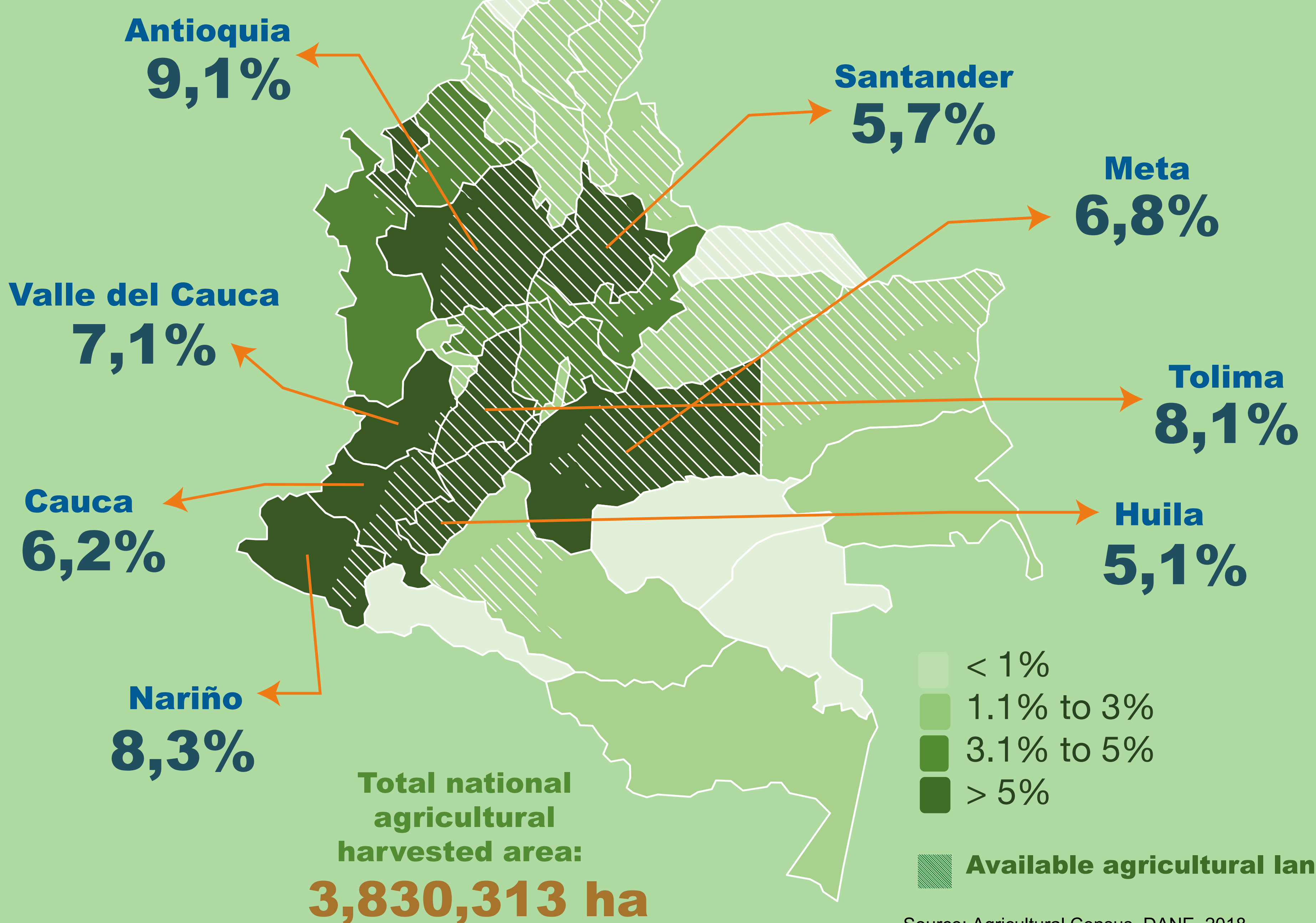
\*\*Natural parks, forest reserves, archeological areal and moorlands.

### Land Distribution in Colombia



## COLOMBIA AS AN AGRICULTURAL COUNTRY

### Actual distribution (%) of harvested agricultural area (ha)



Source: Agricultural Census. DANE, 2018

## PRODUCTION



Agricultural production (including animal husbandry): **6.4%**  
(approx. USD \$ 17.8 million) of national GDP

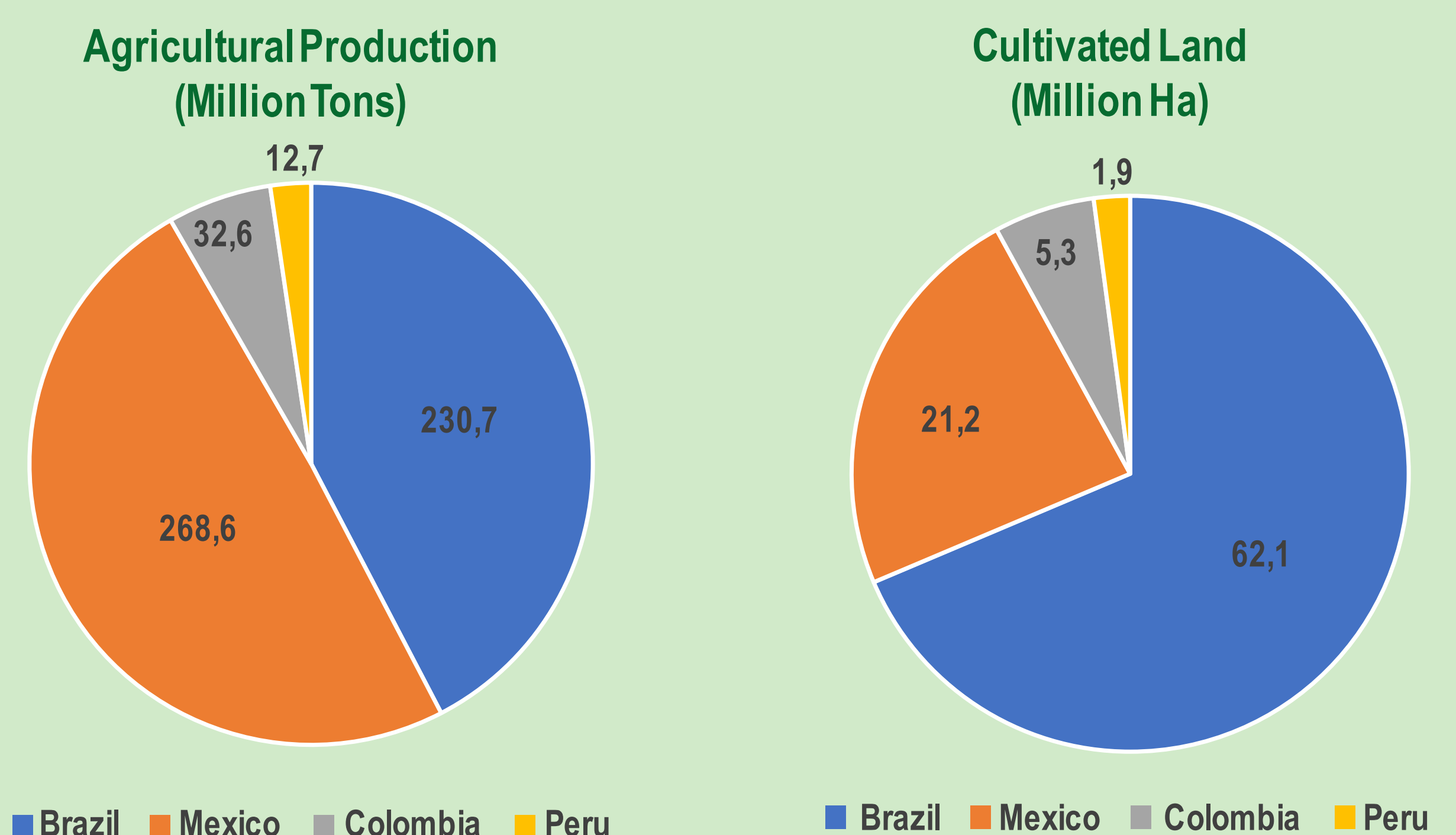


Available agricultural land: **40,075,960 hectares**, of which **13%** is currently cultivated



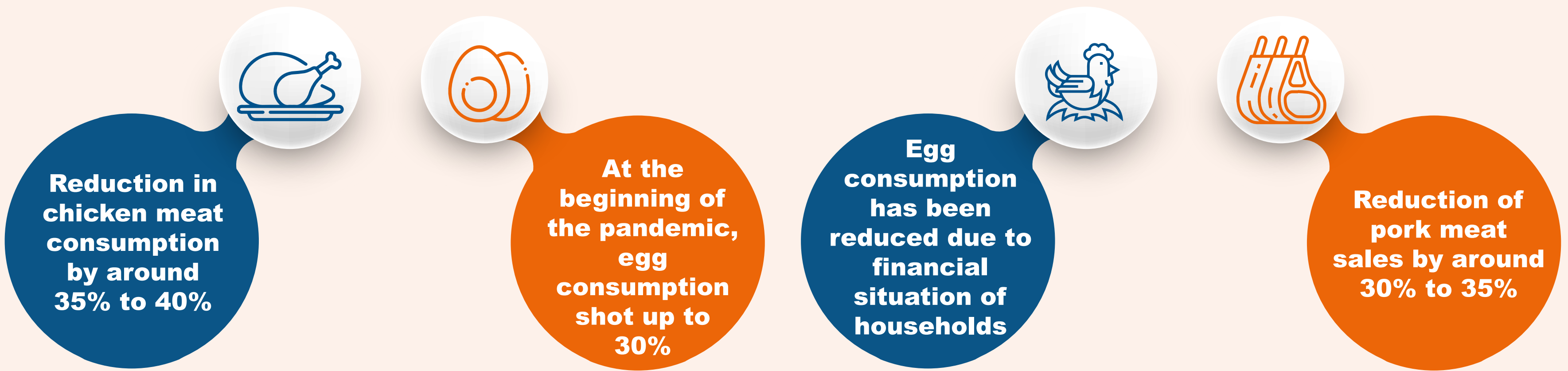
Agricultural production grew **2.2%** in 2019, **2.8%** during 2020

## COLOMBIA COMPARED TO THE REGION:

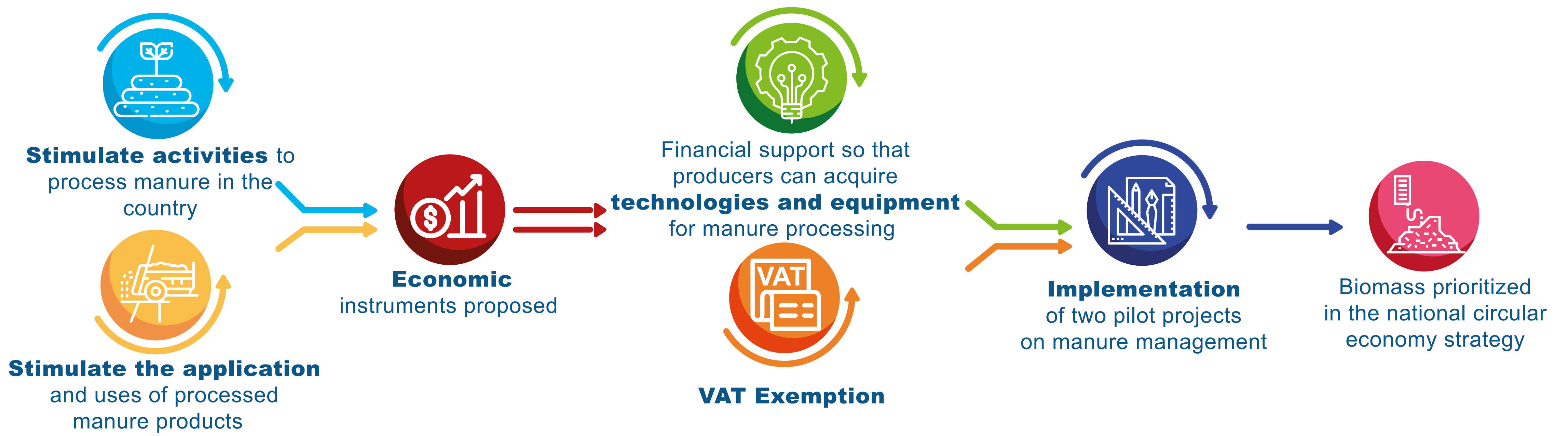




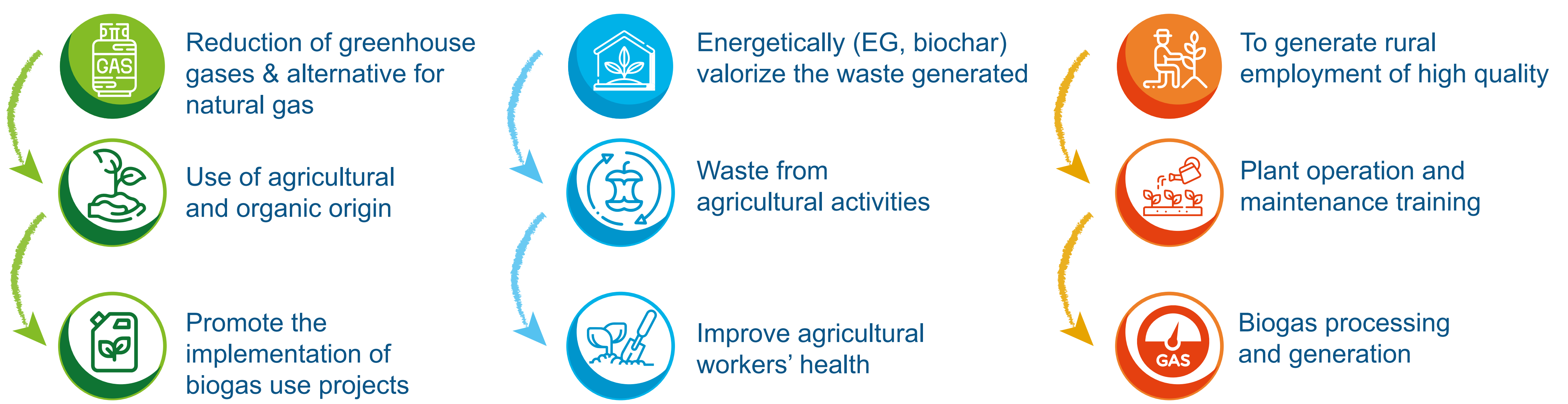
# COVID-19 impact on poultry and pork sector 2020



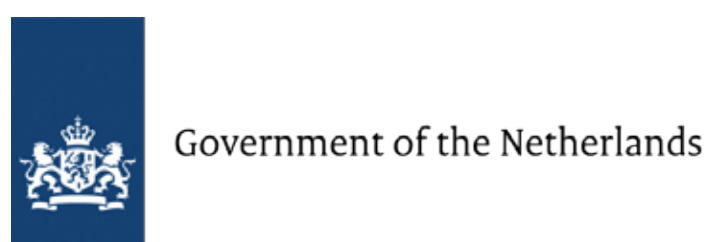
## Vision of the Colombian Ministry of Environment and Sustainable Development for promotion of processing and using of animal manure:



### PLAN FOR THE IMPLEMENTATION OF THE NATIONAL APPROPRIATE MITIGATION ACTION (NAMA) from 2019 on biogas:



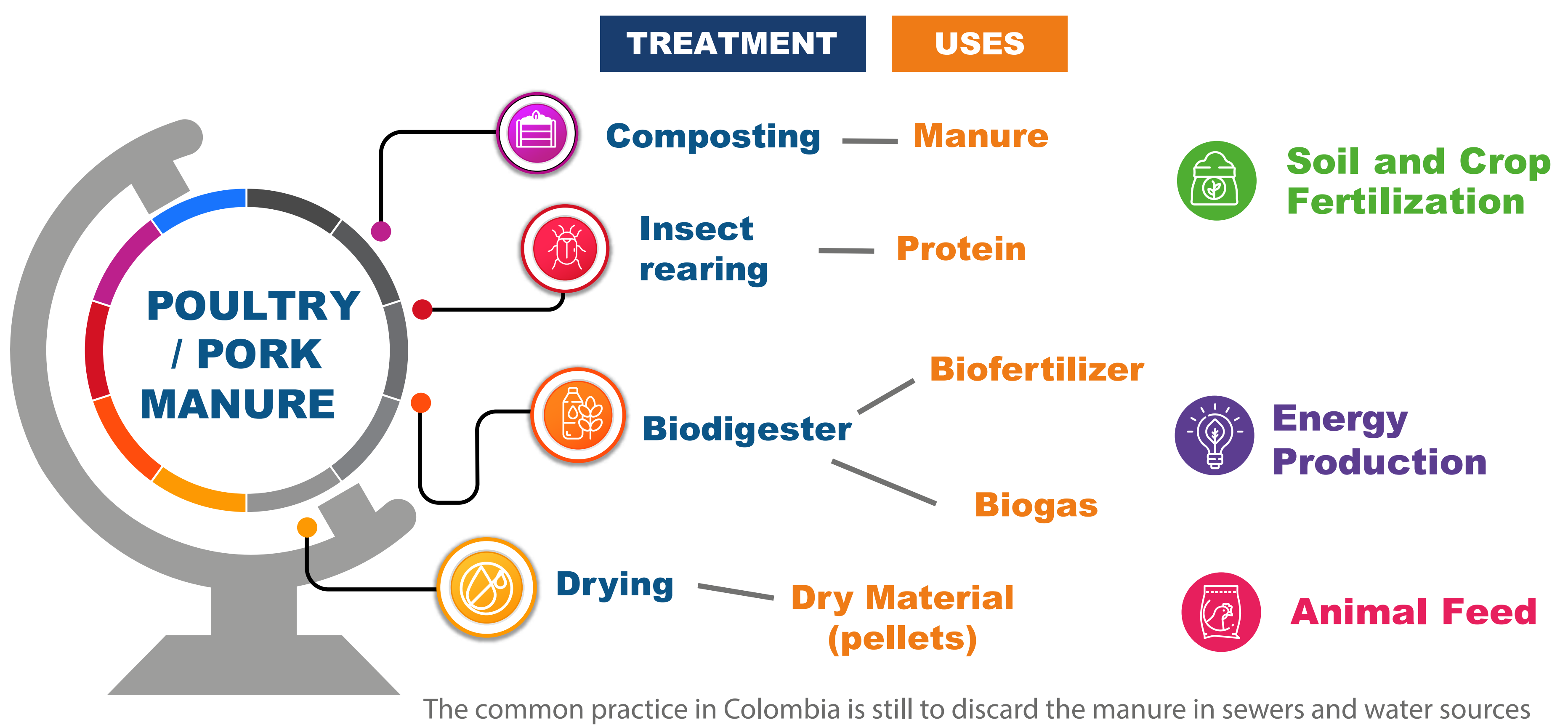
Research Conducted by:



More than Manure: Opportunities for Dutch know-how and technology in manure valorization in the **Colombian pig and poultry Sector**

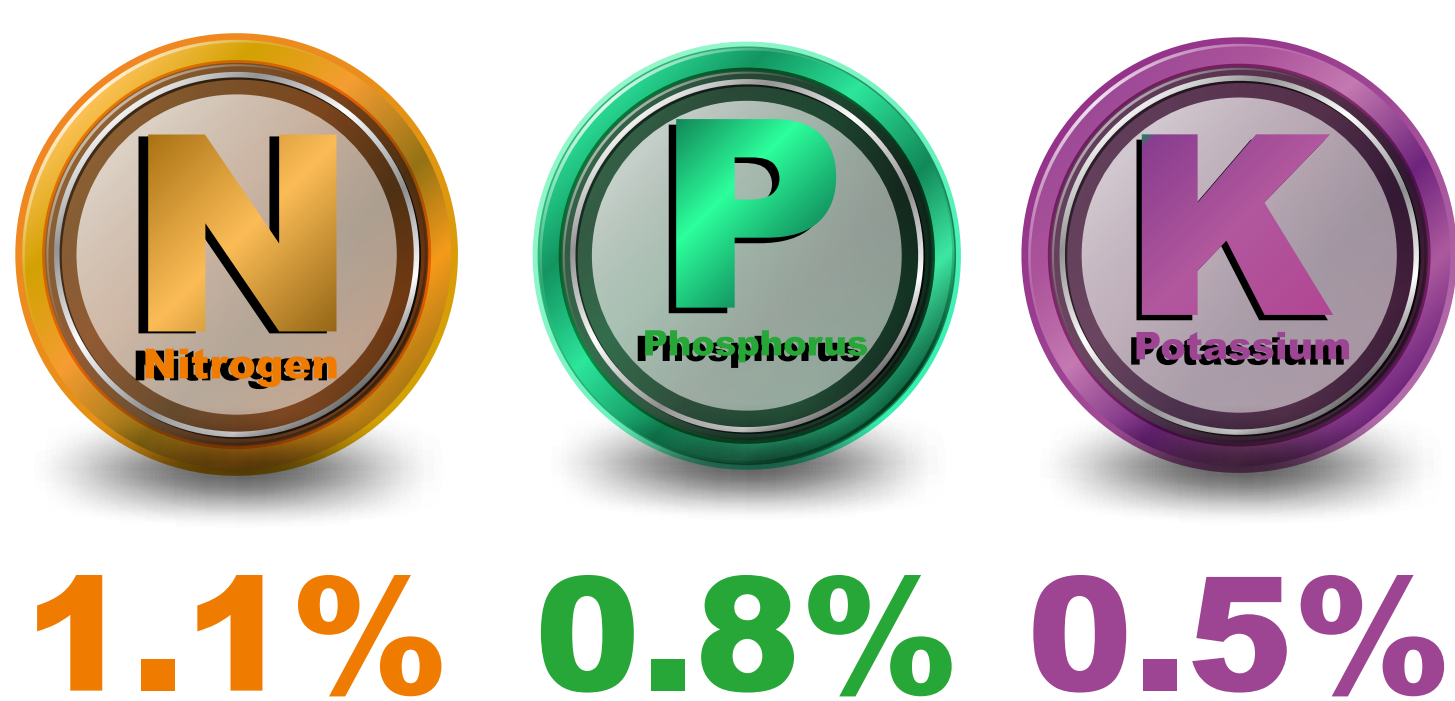
## Current & potential uses of manure worldwide

### Most common uses of manure worldwide

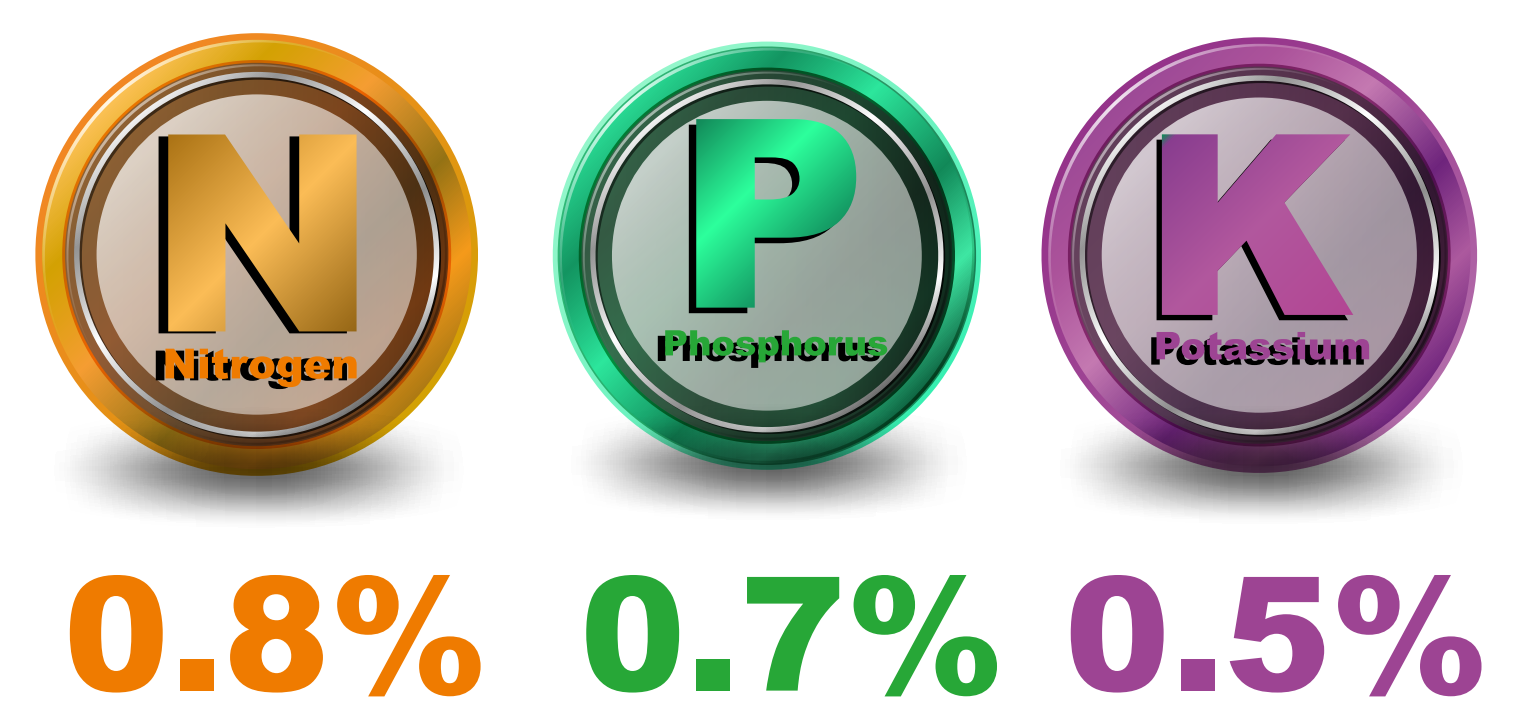


## Poultry & pork manure indicators

Poultry manure contains:



Pork manure contains:



All essential nutrients for plant growth

*\*These values may vary as they depend on animal diet, manure fermentation period, among other variables.*



# SOIL AND CROP FERTILIZATION

## ORGANIC FERTILIZER VS. SYNTHETIC FERTILIZER


### ORGANIC


- ✓✓ Derived from biomass of living organisms (manure)
- ✓✓ Nutrient levels can fluctuate and are generally lower than synthetic fertilizer
- ✓✓ Micronutrients are typically present, which are essential for plants
- ✓✓ Soil microbes release the nutrients
- ✓✓ Plant growth over time
- ✓✓ Requires fewer applications
- ✓✓ Contains organic matter which improves soil structure and water retention, provides micro-organism with food and increases nutrient utilization


### SYNTHETIC

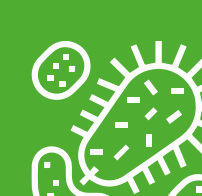
- ✓ Typically made from petroleum or natural gas derivatives, and other materials obtained from mining.
- ✓ Nutrient levels can be formulated for specific needs
- ✓ More water needed in order to release the nutrients
- ✓ Rapid plant growth
- ✓ Requires more frequent applications
- ✓ Increase chance of over-fertilization, which can lead to burning, leaching and runoff
- ✓ Contains no organic matter to improve soil structure

### PORK & POULTRY MANURE

  
Increases plants water-holding capacity and lateral water movement

Rich source of nutritional elements for plants  


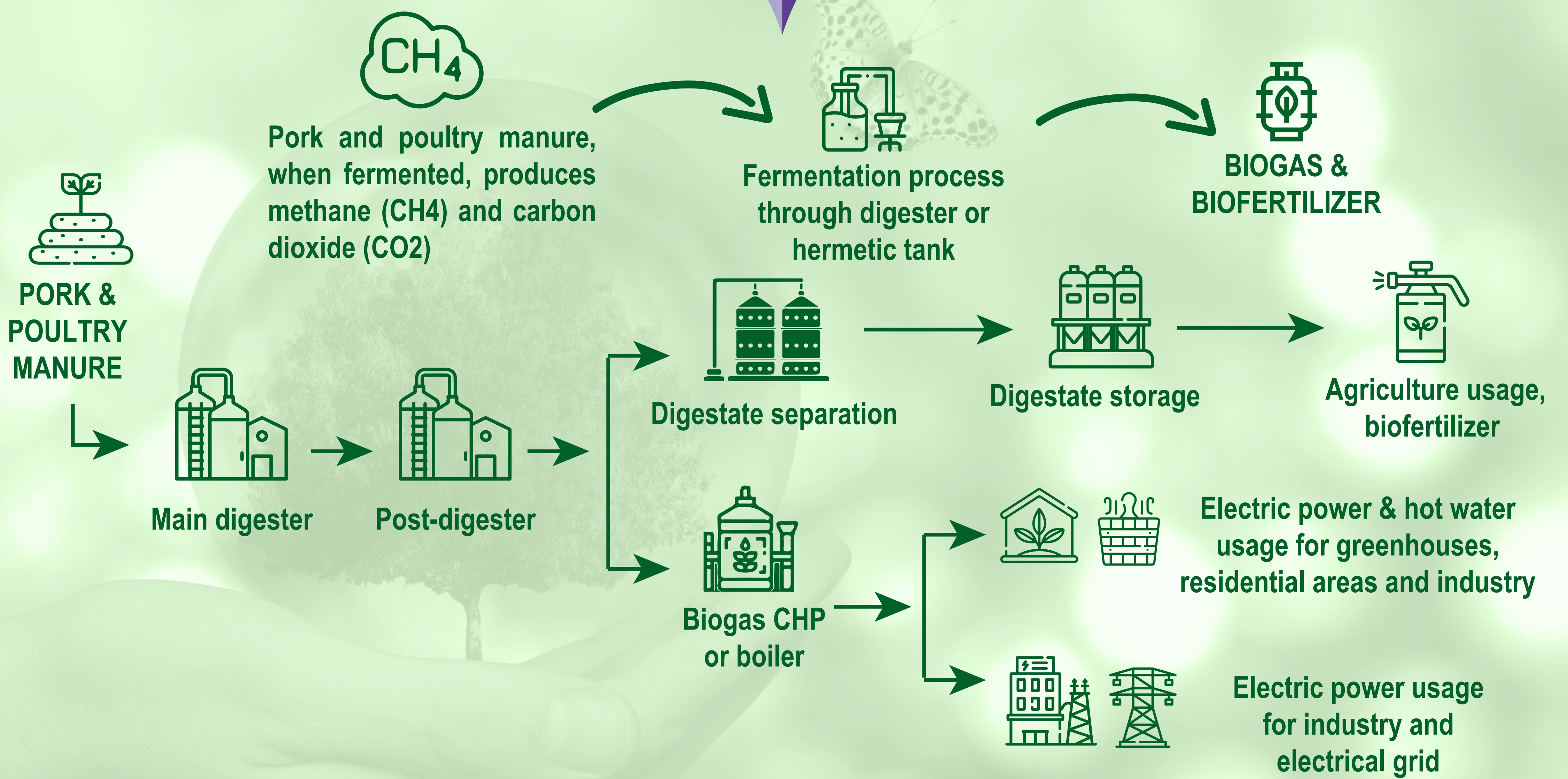
  
Aeration capacity of the soil

Increases the number and diversity of soil micro-organisms  


  
Form of natural recycling  
  
Low cost

# SOIL AND CROP FERTILIZATION

# ENERGY PRODUCTION



# ENERGY PRODUCTION

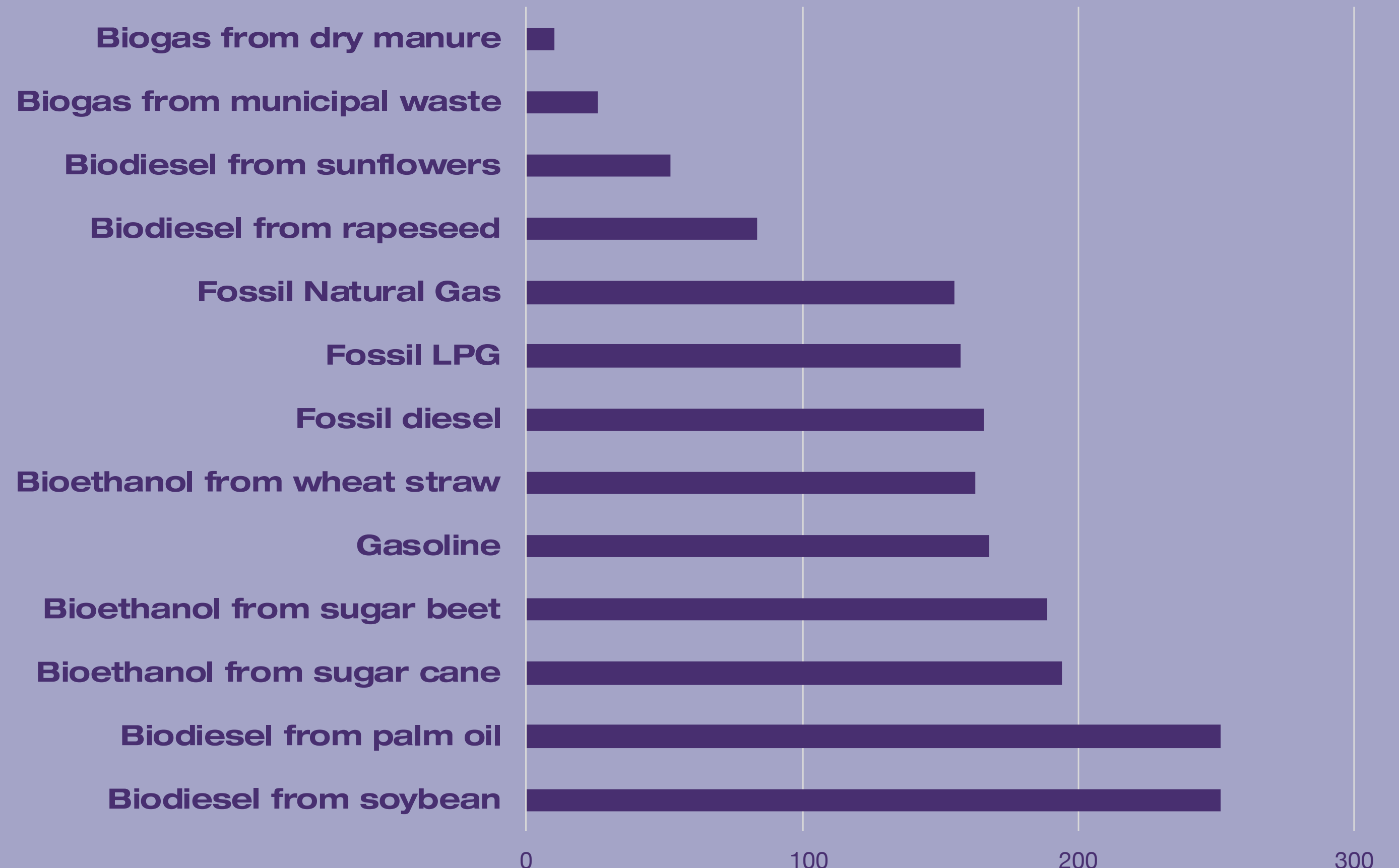
## Sustainability of biogas production



*Biogas from dry manure is more sustainable than the rest because of its low emissions*

Source: EBA's strategy to respond to the challenges facing the European biogas industry. Jan Stambasky, 2014

Emissions: Grammes of CO<sub>2</sub> equivalent per km<sup>2</sup>

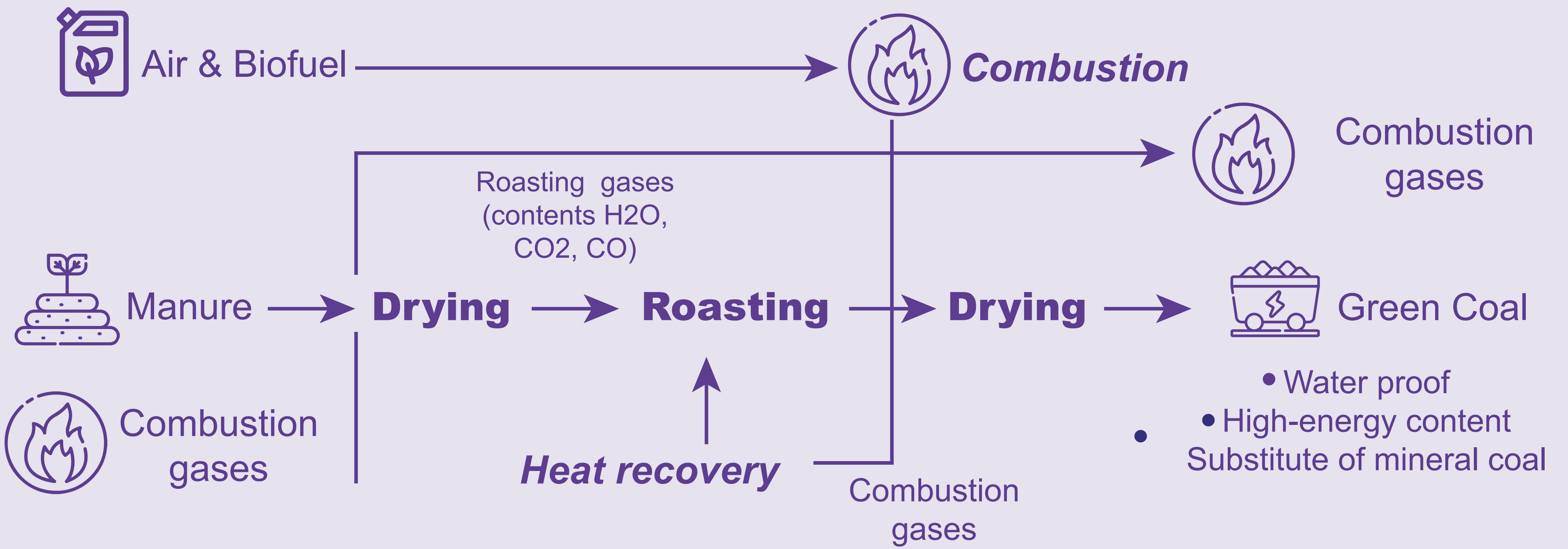




## ENERGY PRODUCTION

# ROASTING MANURE

Roasting is a mild thermochemical process in which the biomass is heated slowly (with a rate not exceeding 50°C / min) for 10 to 40 minutes, to temperatures which do not exceed 300°C, in an inert or oxygen-free atmosphere.

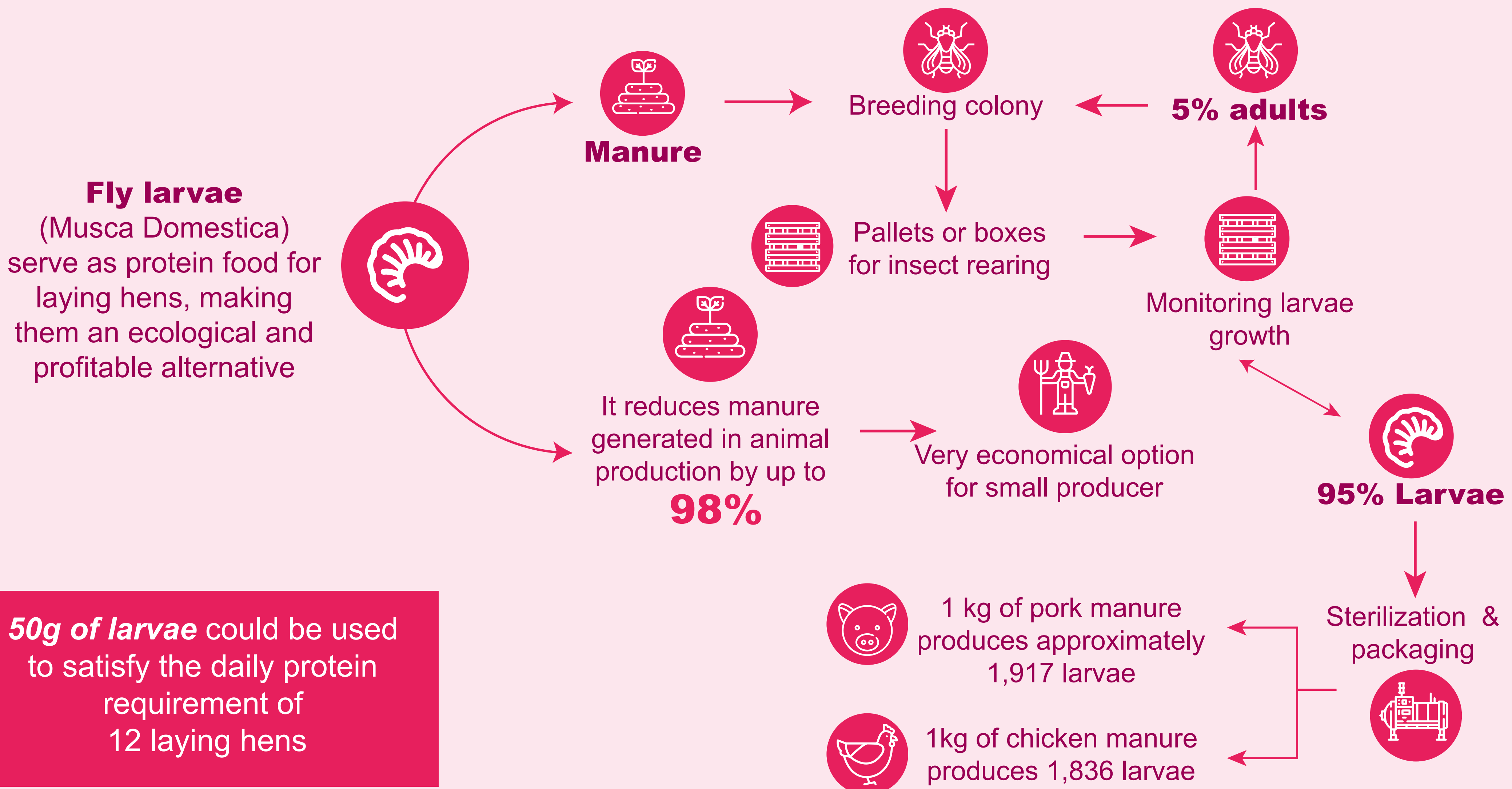


This process could be more useful for pig and poultry farmers located in more remote areas

Source: Roasting process. Agronomo Global, 2012.

## ANIMAL FEED

# INSECT REARING AS PROTEIN SOURCE



50g of larvae could be used to satisfy the daily protein requirement of 12 laying hens

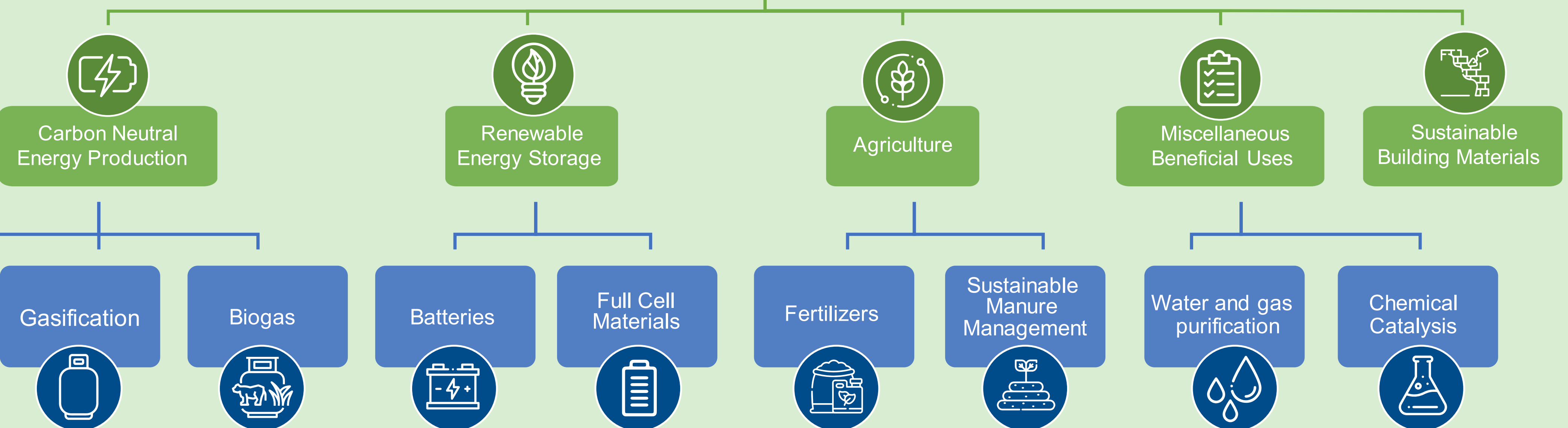
\*Manure processing for cattle feed through drying processes or biodigesters is forbidden by law in the EU  
Source: Gallinaza produce más larvas de mosca para alimentar ponedoras. Universidad Nacional de Colombia, 2019

## SOIL AND CROP FERTILIZATION

## ENERGY PRODUCTION

# HYDROTHERMAL CARBONIZATION (HTC)

Through the process of hydrothermal carbonization (HTC), biomass and other residues are subjected to high temperature and pressure in the presence of water which results in different kind of products:

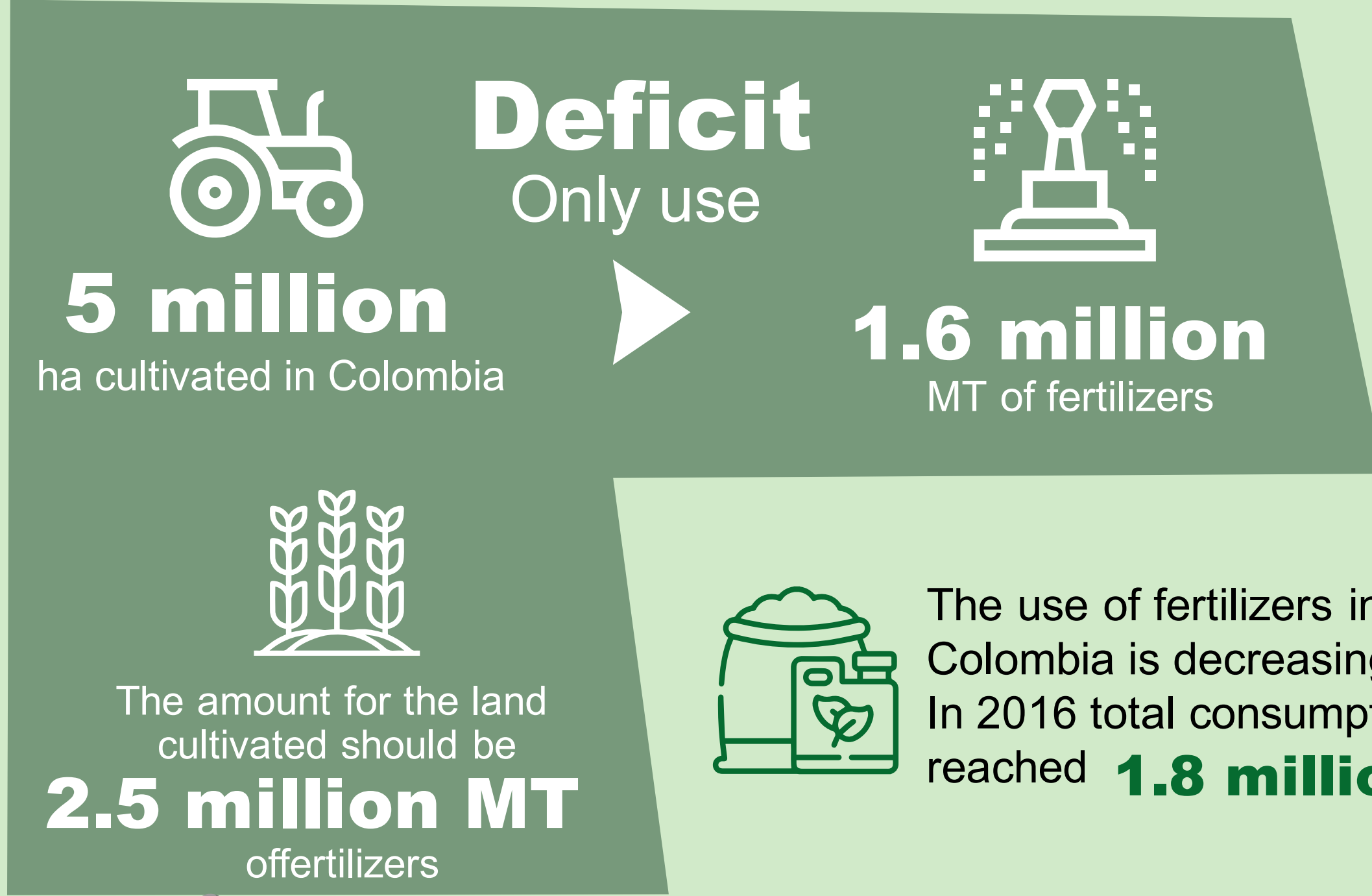




## Potential demand for technologies to transform manure in Colombia

### SOIL AND CROP FERTILIZATION

### ACTUAL FERTILIZER DEMAND IN COLOMBIA



According to experts

High undernourishment of the country's crops

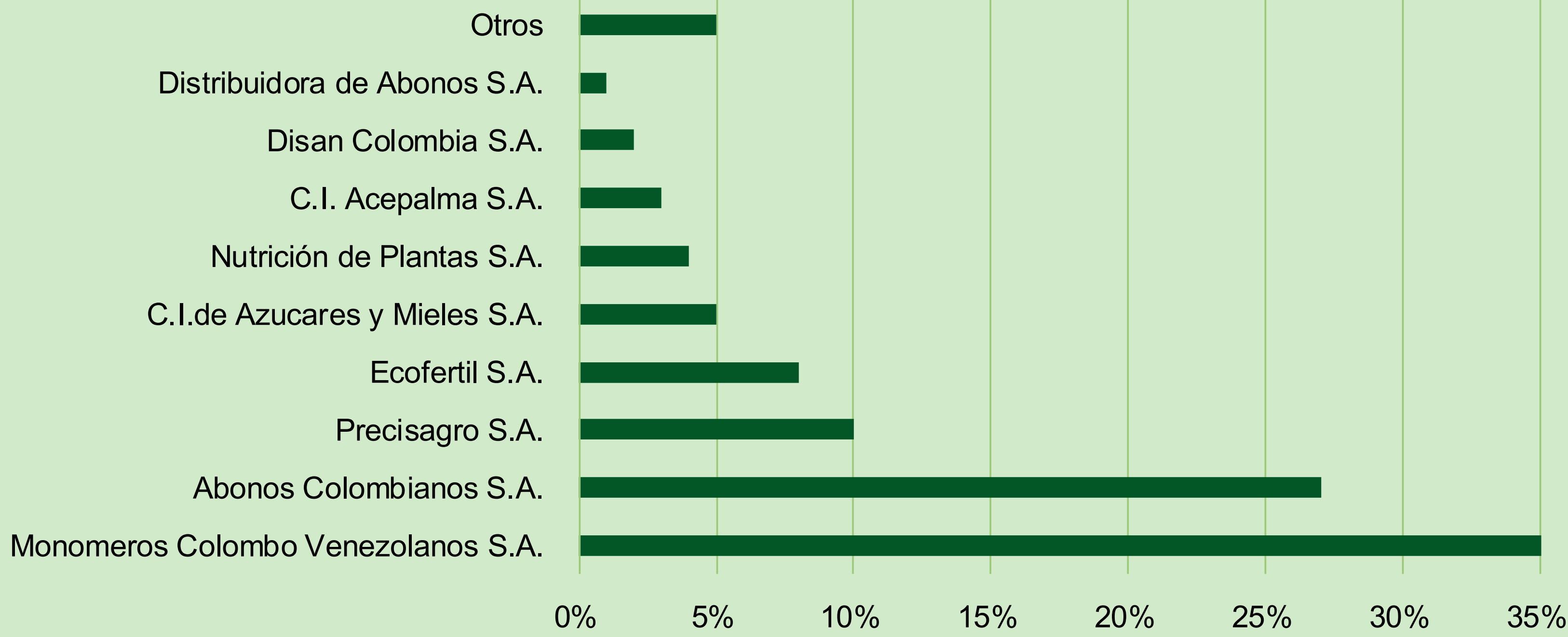
According to WUR research center, proper soil management requires organic matter and maintenance of the soil micro biome.

In Colombia, coffee and potato crops use fertilizers the most

Source: Operación histórica de importación de fertilizantes. Ventura Group Colombia, 2019

### PRESENT USE OF SYNTHETIC FERTILIZER

#### The largest importers of fertilizers in Colombia, 2018

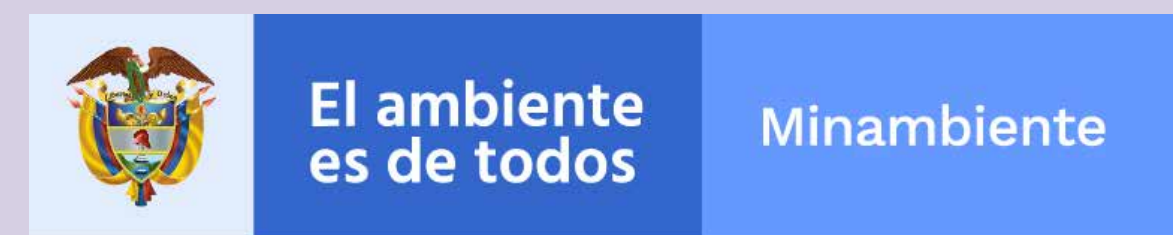


**8.6%** reduction of the volume of imported fertilizers in 2018 compared to 2017

**2.1 million tons** of fertilizers entered Colombia

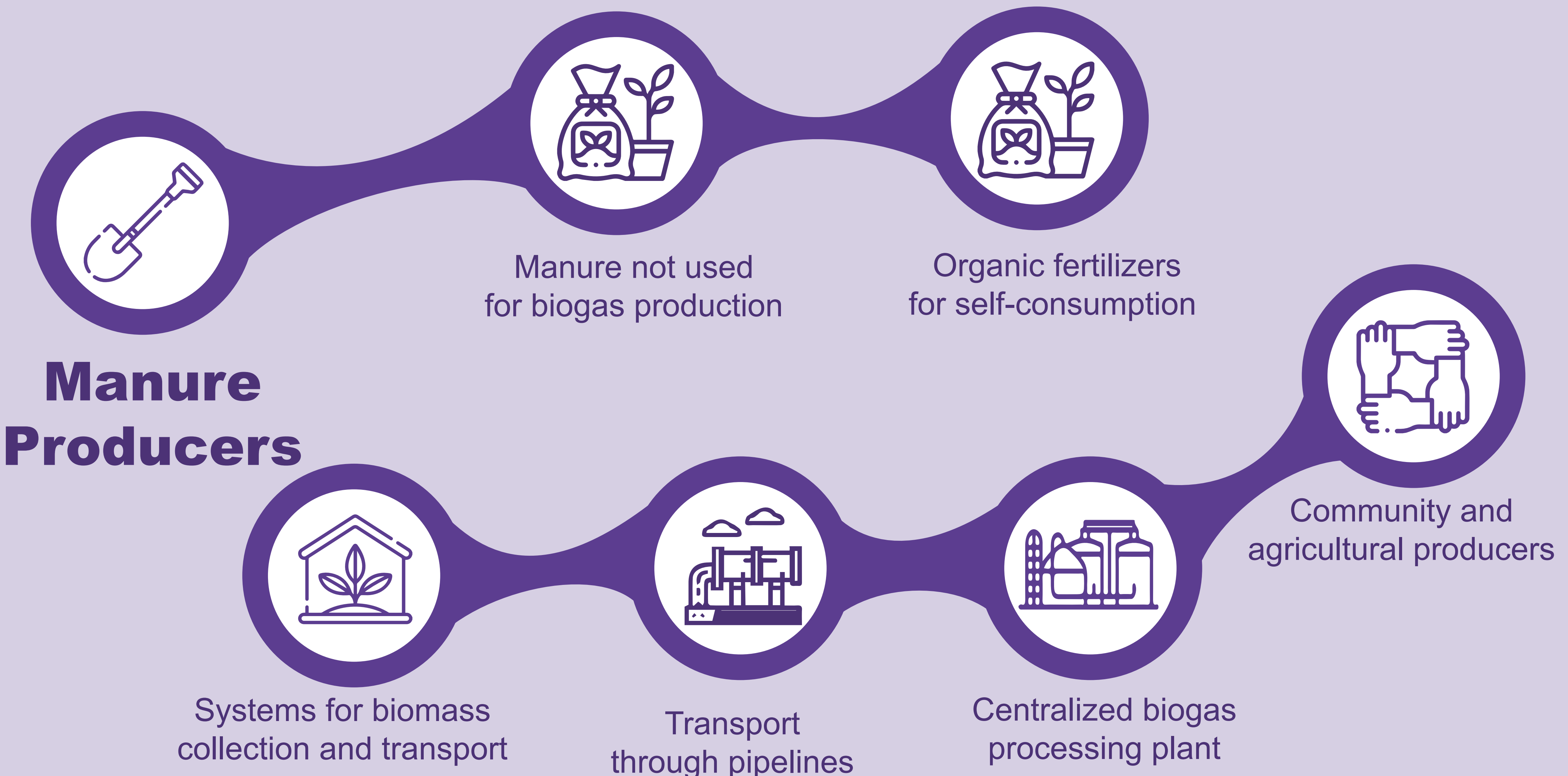
**Synthetic fertilizer is one of the highest imported products by volume into Colombia.**

### ENERGY PRODUCTION



### Biogas production and usage at community level

The Ministry of Environment and Sustainable Development aims to implement pilot projects regarding this structure:



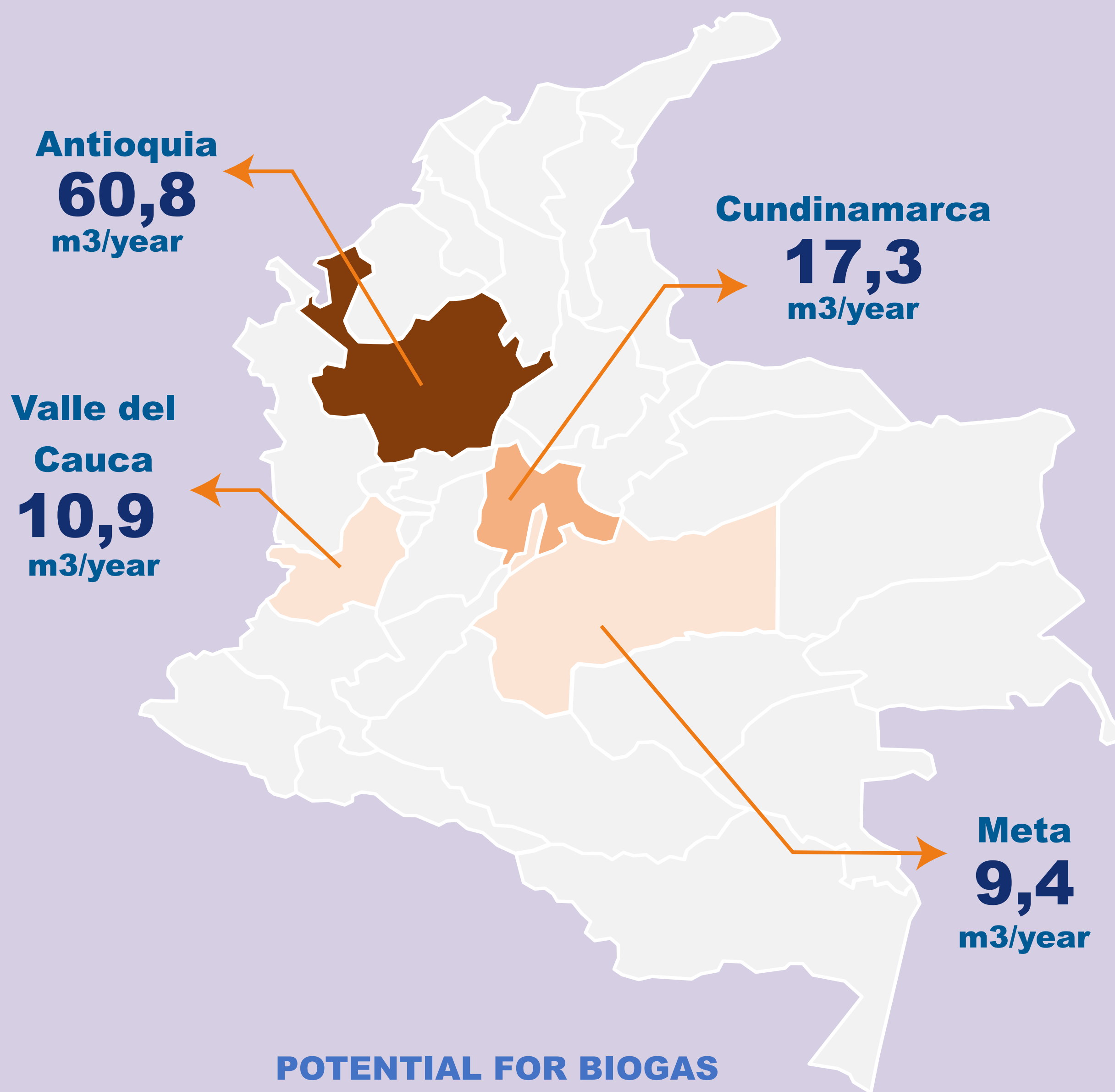
SOIL AND CROP FERTILIZATION

ENERGY PRODUCTION



## ENERGY PRODUCTION

## POTENTIAL FOR BIOGAS PRODUCTION



### POTENTIAL FOR BIOGAS GENERATION FROM PORK MANURE IN COLOMBIA, 2018

Department	Biogas m <sup>3</sup> /year in millions	Energy GJ/year
Antioquia	60,8	915,076
Cundinamarca	17,3	260,830
Valle del Cauca	10,9	165,399
Meta	9,4	142,842

\*1 ton of crude oil = 41,868 GJ \*\*GJ: Gigajoules

### POTENTIAL

- Departments not prioritized
- 0.0 - 250,000 GJ/year
- 250,000 - 500,000 GJ/year
- 500,000 - 500,000 GJ/year
- 750,000 - 750,000 GJ/year

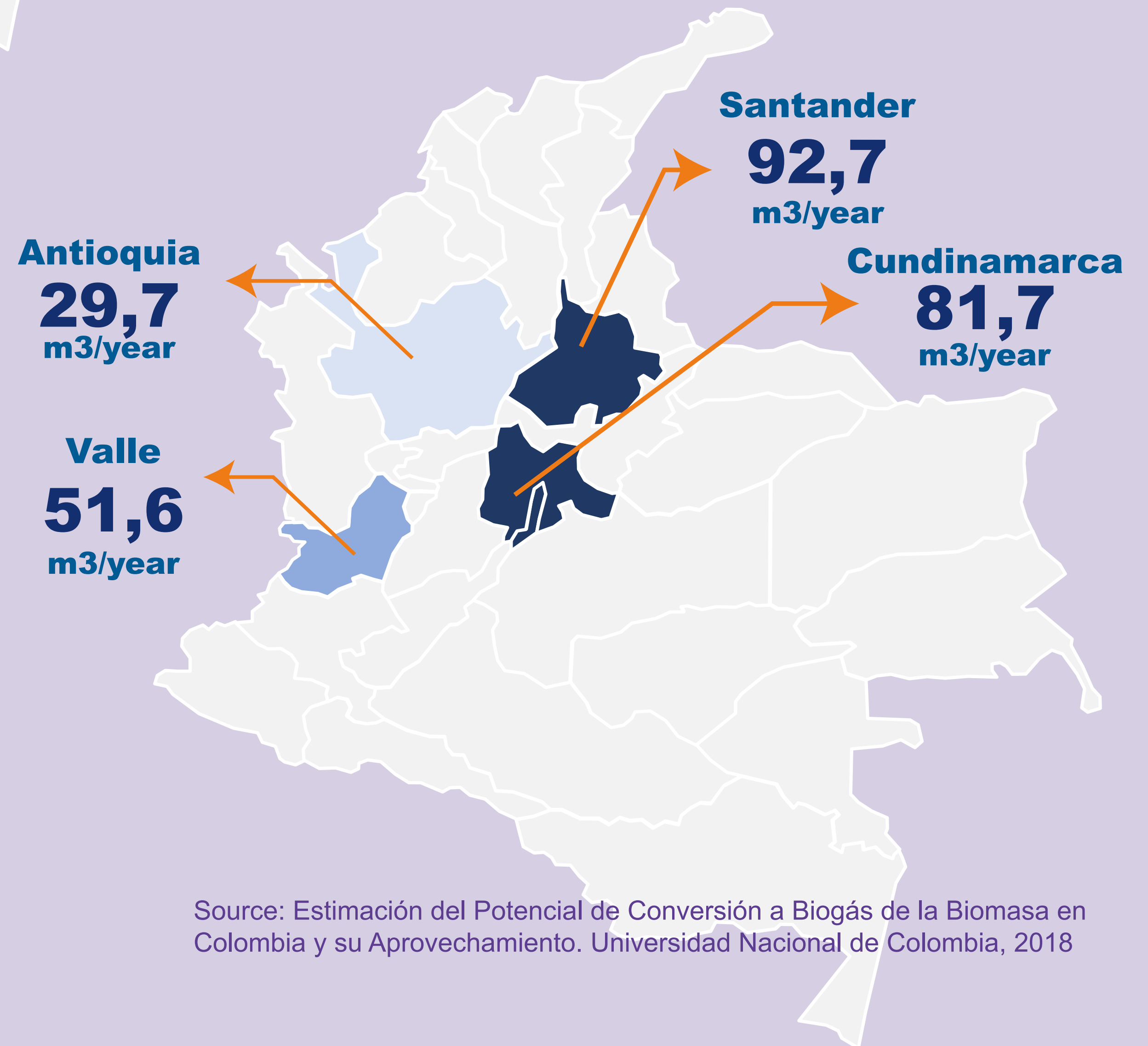
### POTENTIAL FOR BIOGAS GENERATION FROM POULTRY MANURE IN COLOMBIA, 2018

Department	Biogas m <sup>3</sup> /year in millions	Energy GJ/year
Santander	92,7	1,394,911
Cundinamarca	81,7	1,229,850
Valle	51,6	776,430
Antioquia	29,7	447,172

\*1 ton of crude oil = 41,868 GJ \*\*GJ: Gigajoules

### POTENTIAL

- Departments not prioritized
- 400,000 - 600,000 GJ/year
- 600,000 - 1,000,000 GJ/year
- 800,000 - 1,000,000 GJ/year
- 1,000,000 - 1,200,000 GJ/year
- 1,200,000 - 1,400,000 GJ/year



Source: Estimación del Potencial de Conversión a Biogás de la Biomasa en Colombia y su Aprovechamiento. Universidad Nacional de Colombia, 2018

## POTENTIAL FOR BIOGAS PRODUCTION

In Colombia, the Law 1715 of 2014 promotes the development of renewable energy.

The Corporate Social Responsibility of some sectors has promoted the signing of sectoral agreements with environmental authorities to promote biogas production

There is high potential in Colombia to produce the biogas necessary for cooking food and generating energy for farmers and producers in rural areas to reduce:



Sanitation & health problems

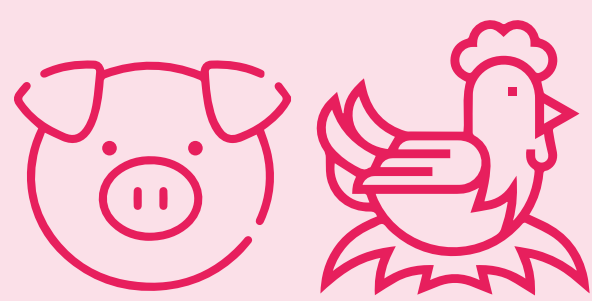
Manure would be used for biogas production so that farmers' environment is not polluted

Deforestation in the countryside

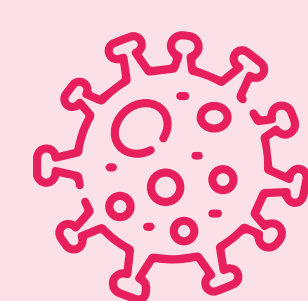
Biogas replaces wood for cooking and other farmers' daily activities, which decreases logging in the countryside

## ANIMAL FEED

### INCREASING DEMAND FOR ALTERNATIVE ANIMAL FEED FOR PORK AND POULTRY SECTORS, IN ORDER TO SUBSTITUTE IMPORTS



Pig and poultry companies in Colombia import around the **85%** of the feed for their animals



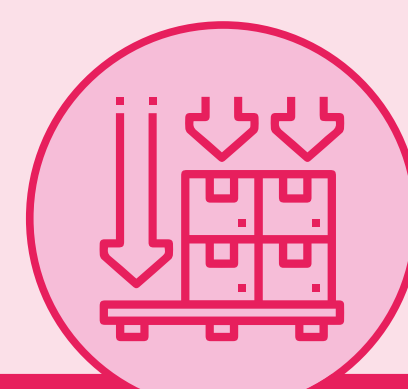
Due to COVID-19 and devaluation of the Colombian peso, animal feed imports have become more expensive



Other ways for insect rearing: Urban waste, residues from food industry, and manure



In Colombia, approximately 37,700 tons / day of poultry and pig manure are produced



Possibility for reducing imports of animal feed through

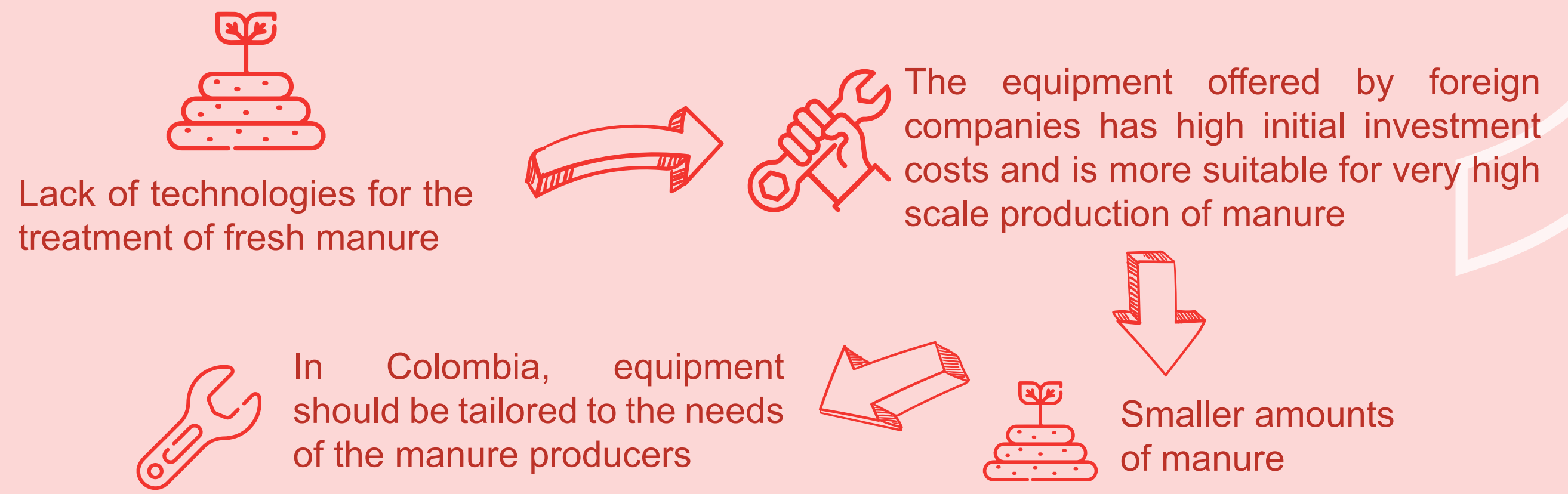


Insect rearing as protein source

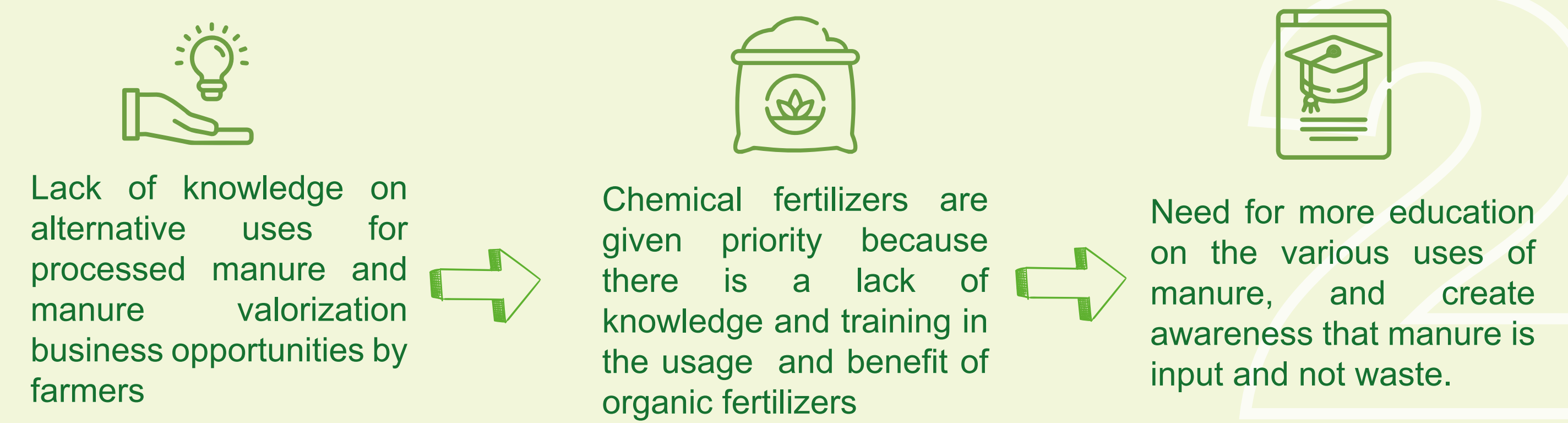


## Challenges in Colombia for manure processing

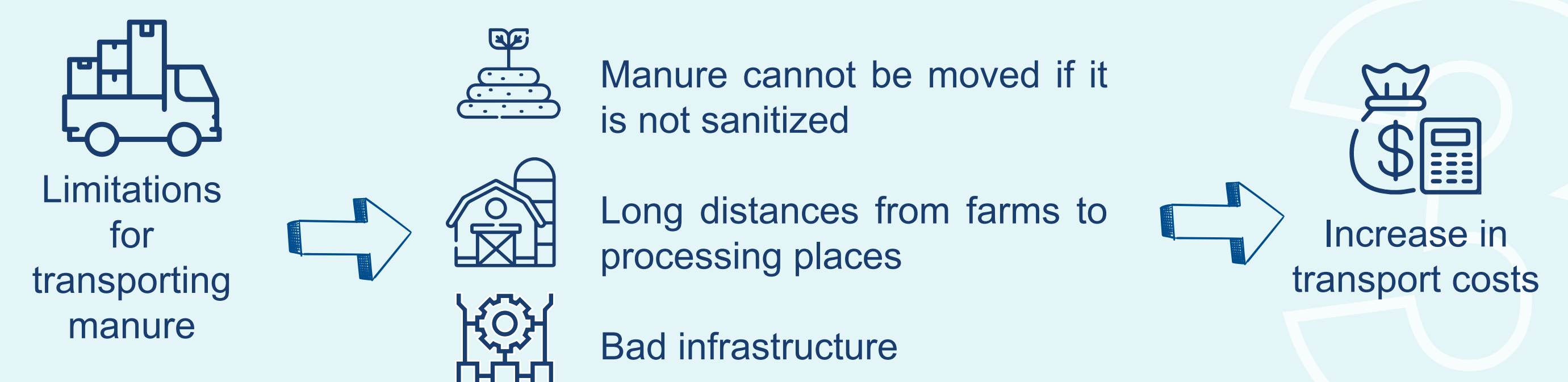
### Existing technologies for manure treatment are very basic



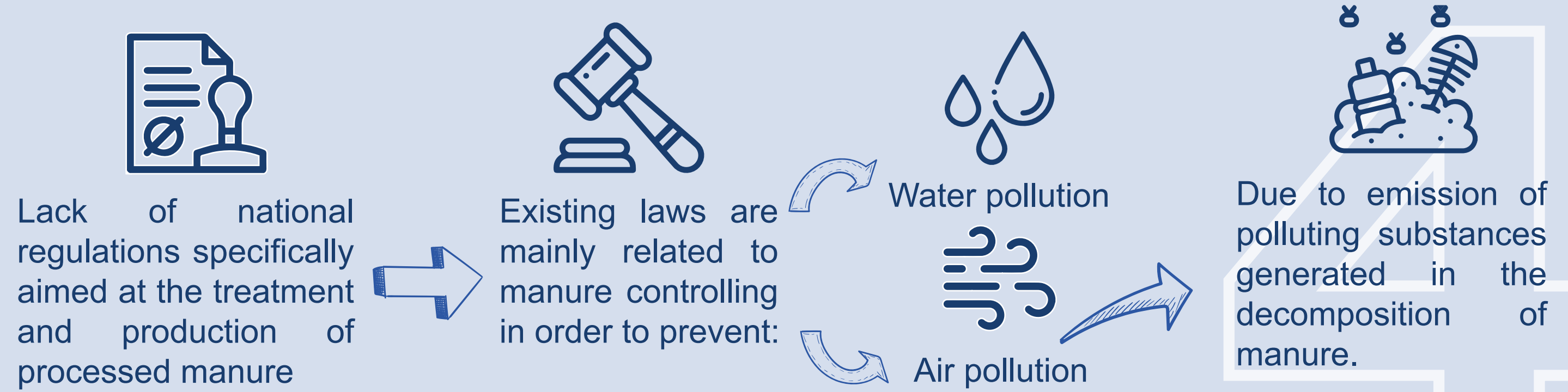
### Lack of knowledge by agricultural producers



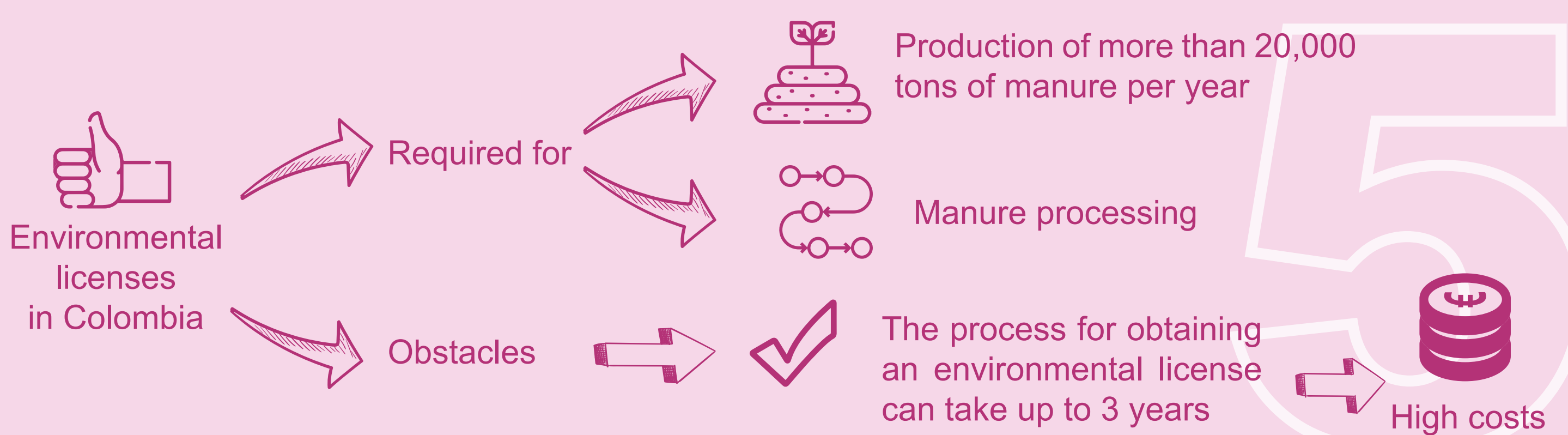
### Fresh manure transportation



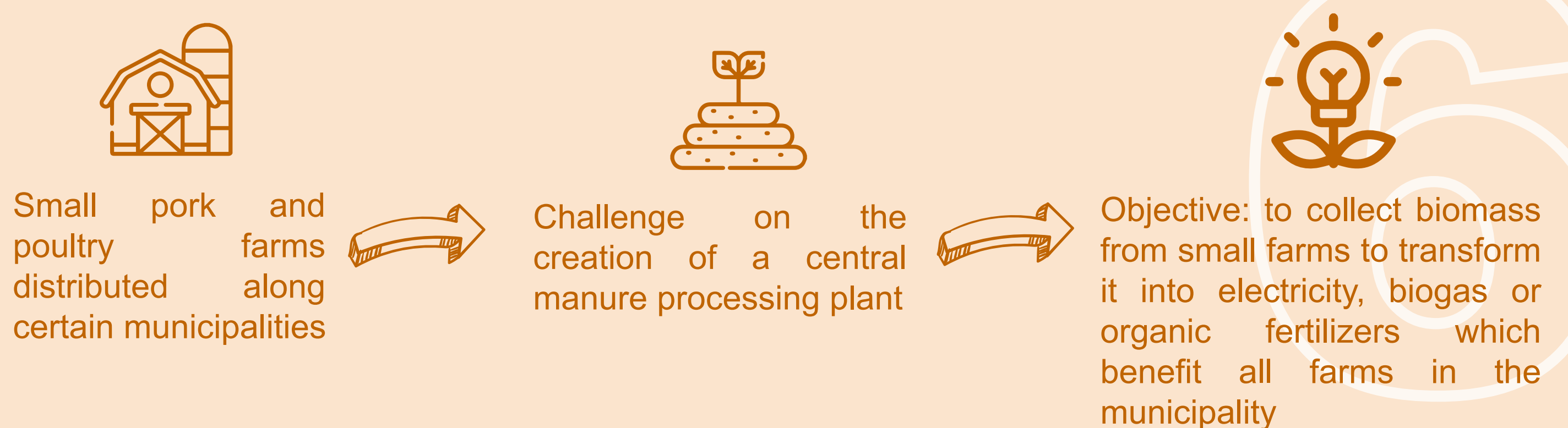
### Lack of national regulations for manure processing



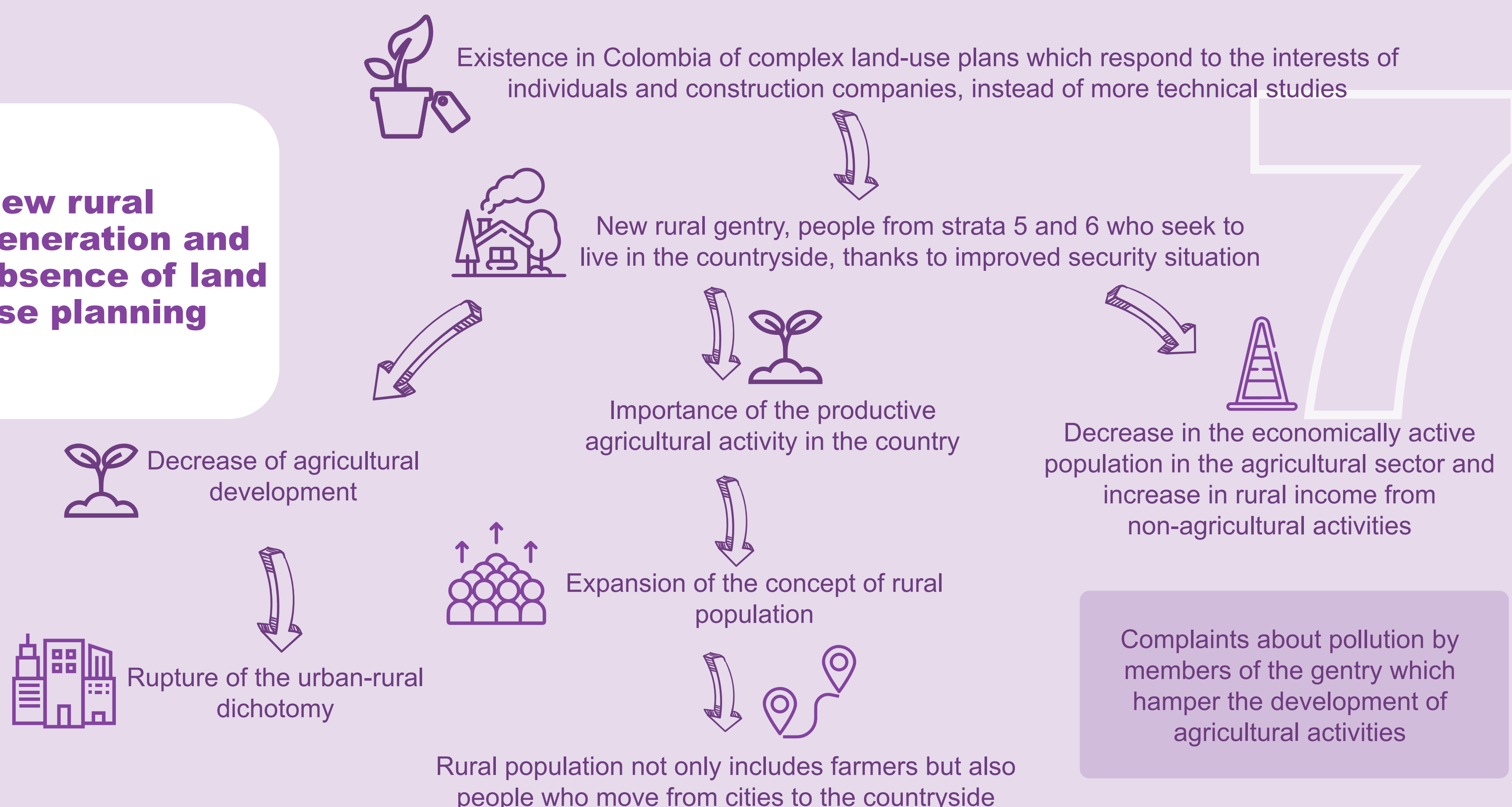
### Environmental licenses



### Segregation of pork & poultry farms

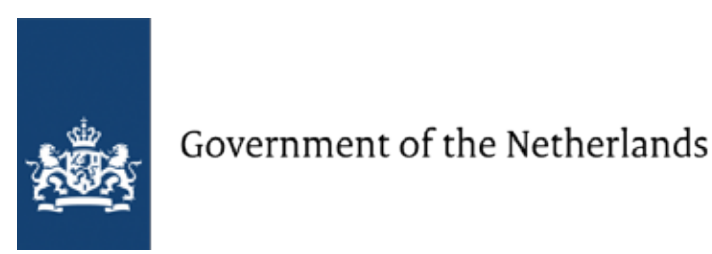


### New rural generation and absence of land use planning





Research Conducted by:



More than Manure:  
Opportunities for Dutch know-how and technology in manure valorization in the **Colombian pig and poultry Sector**

## Key Actors

Colombian

### National government



### Companies in the sector



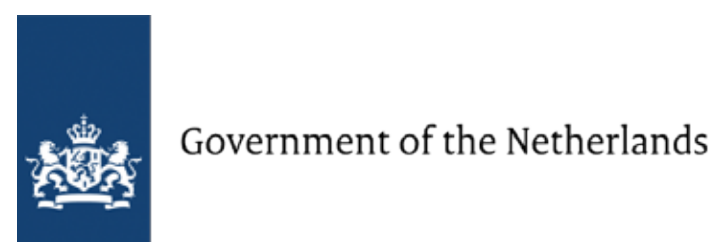
### Private associations



### Knowledge centers

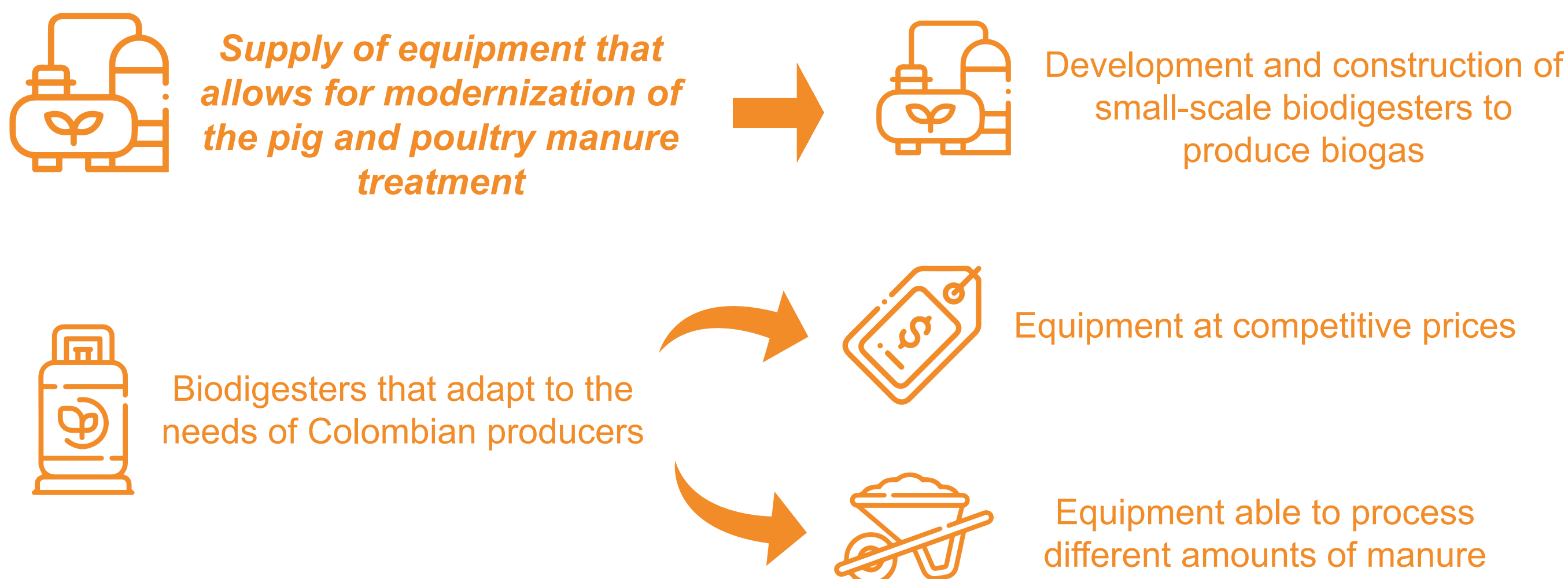


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## Opportunities



**Technological & infrastructural solutions for biogas production**

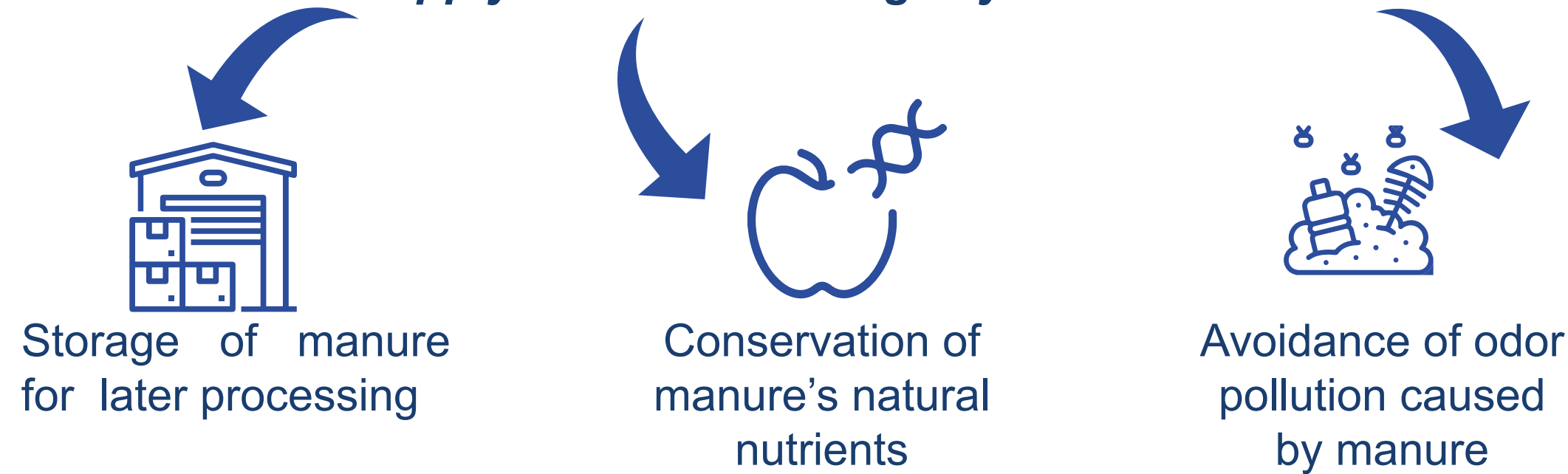


**Technologies & equipment supplies for manure processing**

Supply of processing manure equipment and technologies to get



Supply of manure storage systems which allow:



**Silos or manure storage systems**



**Manure processing plant at community level**

Centralized processing manure plant that allows



Provide knowledge to farmers and workers in the poultry and pork sector, on the uses and benefits of processing manure

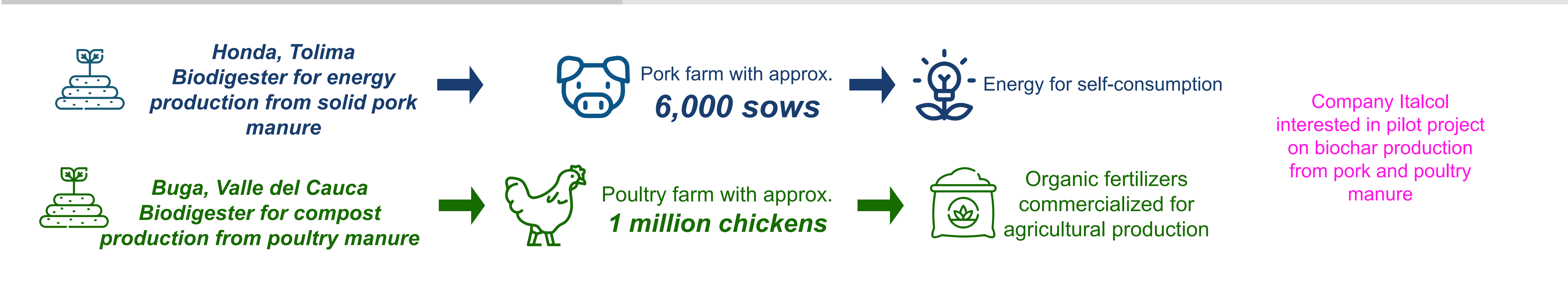


**Knowledge transfer & research centers in Colombia**





# Current projects on manure valorization in Colombia



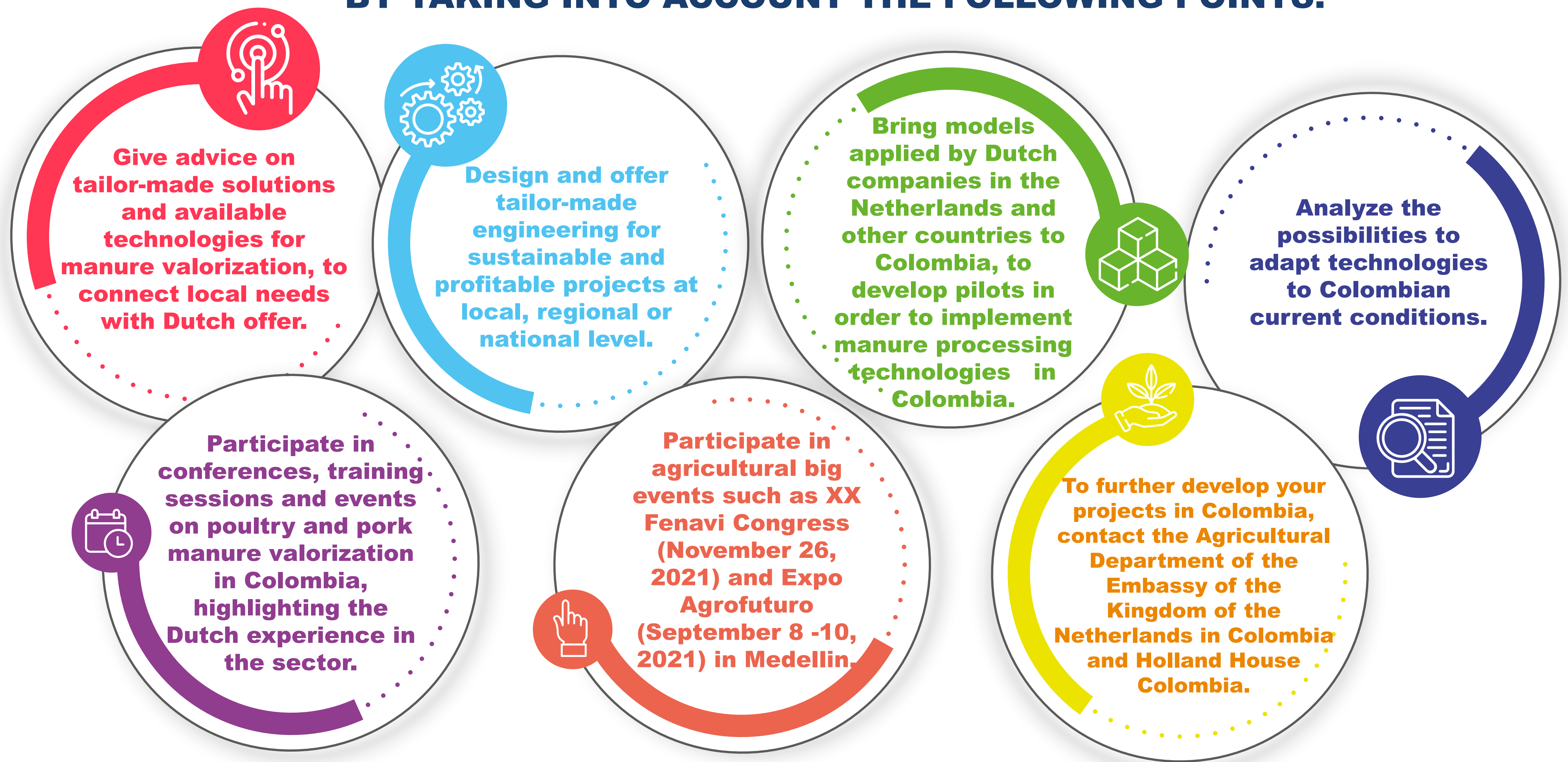
Research Conducted by:

Government of the Netherlands | **HOLLAND HOUSE COLOMBIA** (CAMARA DE COMERCIO COLOMBIO-HOLANDESA)

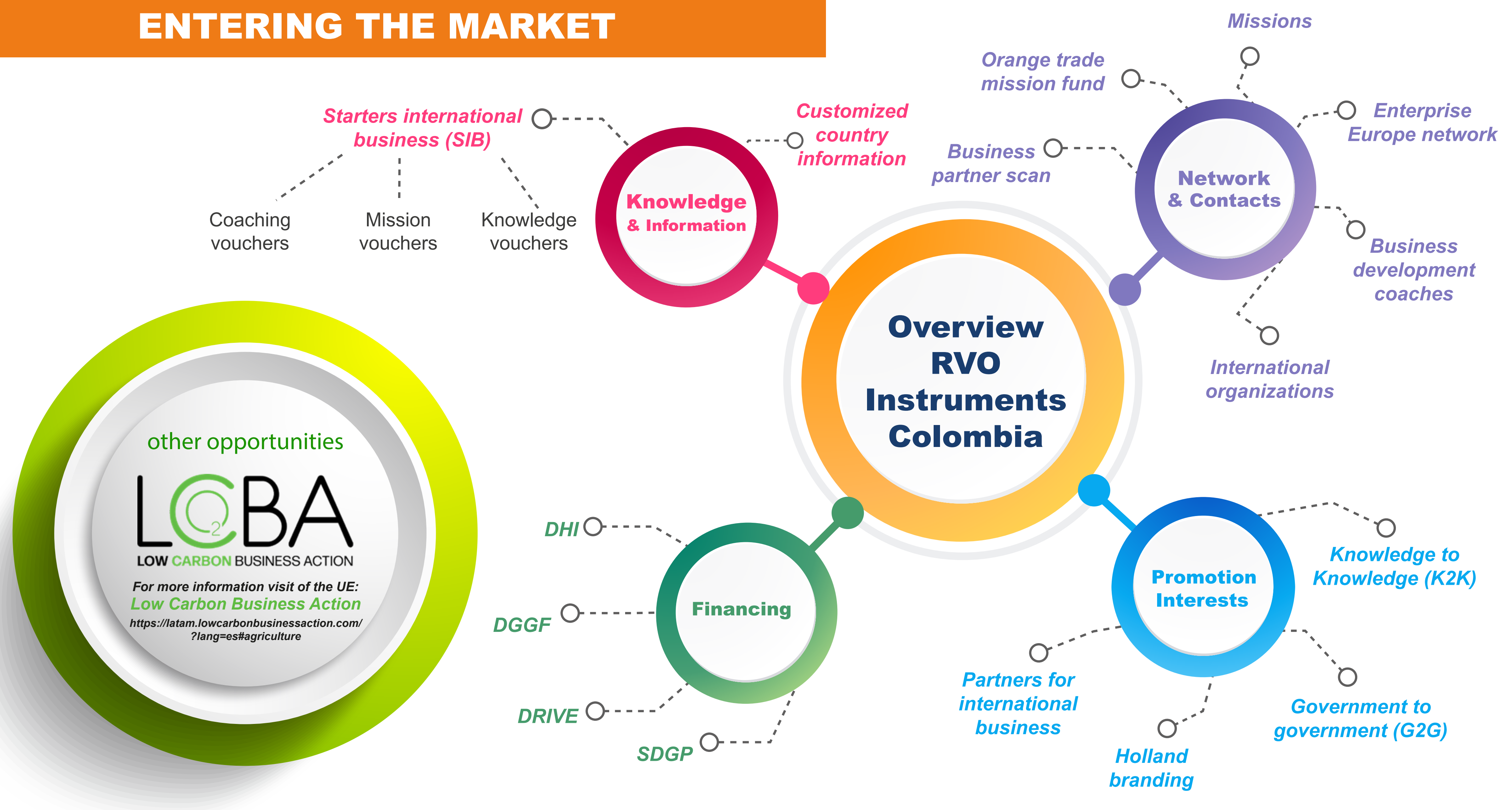
**More than Manure: Opportunities for Dutch know-how and technology in manure valorization in the Colombian pig and poultry Sector**

## How to enter the Colombian market

**TO BECOME SUCCESSFUL AS A DUTCH COMPANY, IT WOULD BE ADVISABLE TO START WITH SMALL BUT SCALABLE PILOTS BY TAKING INTO ACCOUNT THE FOLLOWING POINTS:**



## DUTCH INSTRUMENTS TO FACILITATE ENTERING THE MARKET



## FOR MORE INFORMATION, PLEASE CONTACT: