# Introduction to CO2 calculations

# $CO_2$ calculation for HKScan meat production- background

**Starting point**

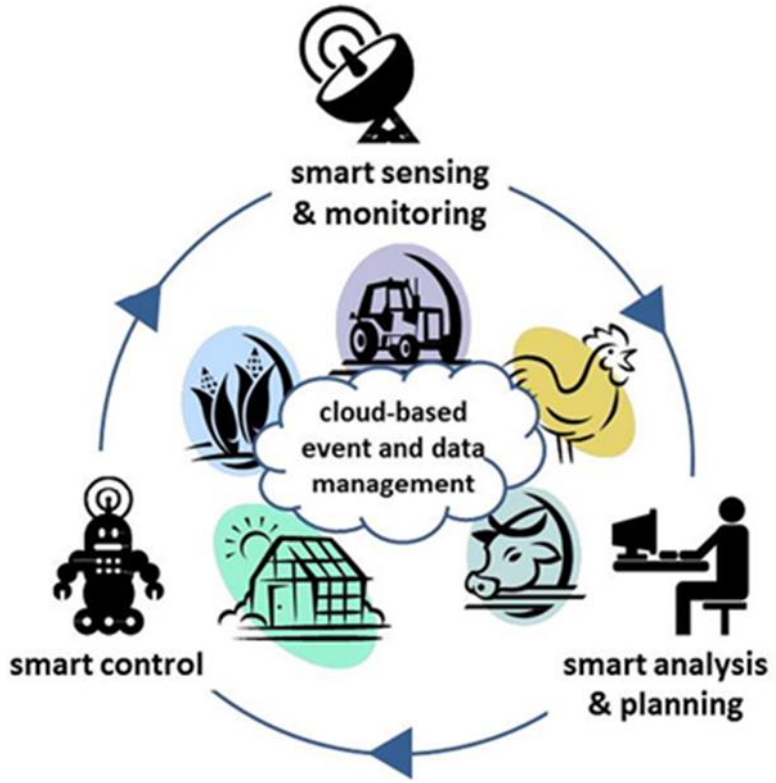
- Pilot farms: 13 rapeseed pork farms, 10 broiler farms, 4 beef farms
- Collection of the relevant basic data, covering all the inputs and outputs of production in one year.
  - Subcontract with ProAgria, whose advisors visited every pilot farm (Oct – Dec 2019, 2-3 hrs / farm)

**Calculation and user interface:**

- Calculation: VTT Technical Research Center
  - IPCC, ISO and national standards

**Some remarks**

- Harmonization of calculation methods is missing
- Actions to improve carbon footprint are running in pilot farms



# Calculation process

**Starting point:**

- Calculation will cover meat production ”from farm to the gate of slaughter house”

- Data per year, results both
  - farm level, and
  - average value for HKScan (kg CO2 / live weight)

- GWP (climate change) as indicator
  - All green house gas (GHG) emissions, covering whole LCA ($CO_2$ , $CH_4$, $N_2O$; converted to carbon equivalents, see table)

- All calculatios must be based on scientific data, and alla formulas must have references.

| | IPCC:n muuntokerroin |
|---|---|
| Hiilidioksidi, $CO_2$ | 1 |
| Metaani, $CH_4$ | 28 |
| Dityppimonoksidi, ilokaasu, $N_2O$ | 265 |

# Calculation references

- ISO 14040 – 44: LCA-standardit (2006)
- ISO 14067: Carbon footprint standardi (2018)
- PEFCR Feed for food producing animals (2015)
  https://www.mr.gov.pl/media/23552/pasza_metodyka.pdf
- Product Environmental Footprint Category Rules Guidance, Version 6.3 – May 2018
  https://eplca.jrc.ec.europa.eu/permalink/PEFCR_guidance_v6.3-2.pdf
- IPCC Guidelines for National Greenhouse Gas Inventories (2006)
  - Chapter 10 – Emissions from livestock and manure management
    http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_10_Ch10_Livestock.pdf
  - Chapter 11 - N2O emissions from managed soils, and CO2 emissions from lime and urea application
    http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_11_Ch11_N2O&CO2.pdf
- IPCC Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf
- MTT Suositus elintarvikkeiden ilmastovaikutusten arvioimiseksi elinkaariarvioinnilla (2012)
  https://portal.mtt.fi/portal/page/portal/mtt/hankkeet/foodprint/laskentasuositus/Suositus_071112_Final.pdf
- MTT – Liite 2 Elintarvikkeiden ilmastovaikutusten arvioimista yhtenäistävä maatalouden päästöjen kaavakokoelma Suomen oloihin (2012)
  https://portal.mtt.fi/portal/page/portal/mtt/hankkeet/foodprint/laskentasuositus/Foodprint%20kaavakokoelma_2012_11_07_vanhentunut.pdf
- Luke Finnish normative Manure System (2017)
  http://jukuri.luke.fi/bitstream/handle/10024/540238/luke-luobio_48_2017.pdf?sequence=1&isAllowed=y

# $CO_2$ calculation - values

## Feed production

- ProAgria databases were used as a model for typical agricultural production in Finland

- More accurate data from each farm was used as a model for production

- Industrial feed compositions were asked from feed companies
  ⇒ Modelling the carbon footprint / kg feed
  ⇒ Calculation for average carbon footprint for other industrial feed

- Ecoinvent database was used for evaluation of other components not available (like soya in industrial feed)

## Production of feed in farm

- Calculated when the farms used their own fields to cereal (=feed) production

- Soil types
  - Organic / Mineral (different N2O emissions)
- Cereal production
  - Average yield (kg/ha), field area (ha), seeds (kg), fertilizers (N,P kg/ha), calcium (kg/ha), energy consumption in fields (fuel/ha) energy used for drying of wheat (kWh/kg)
- All values are calculated as yearly basis

# $CO_2$ calculation - values

**Results of these calculations are available in separate files !**