Implementation Of A Breeding Programs

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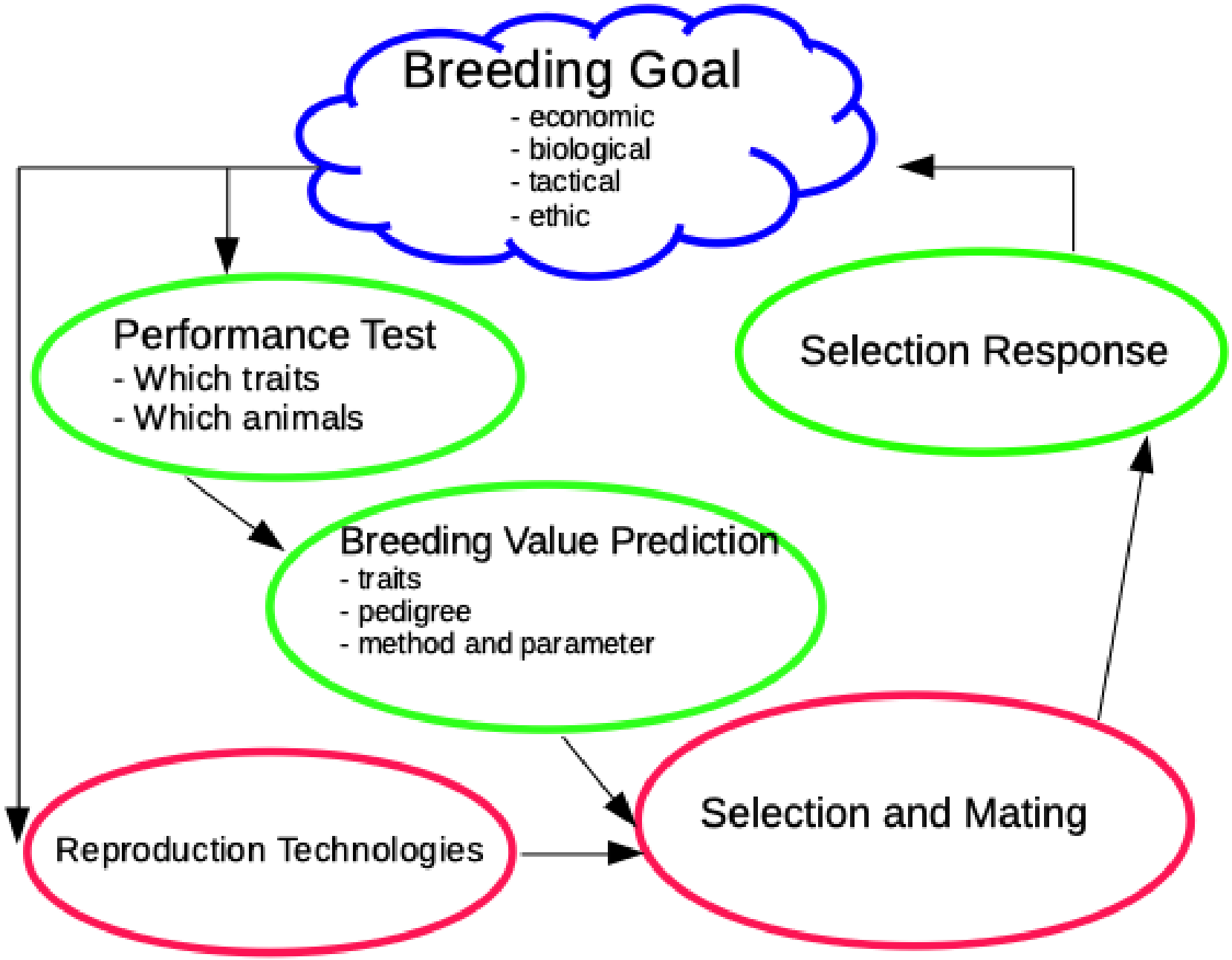
Recall

Types of breeding programs:

- focus on selection response (scientific)
- focus on customers and services (political)

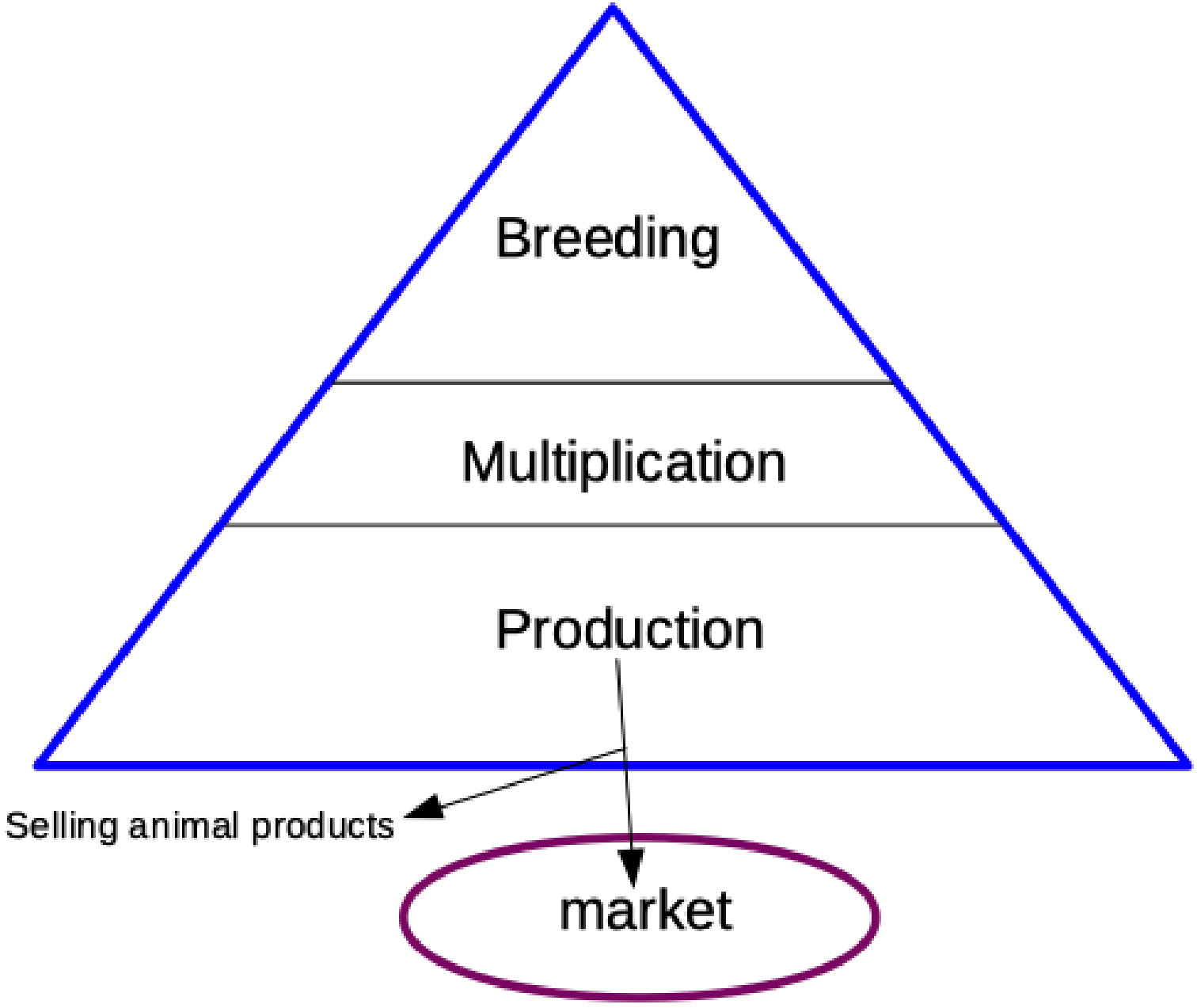
Components of a Breeding Program



Example of Implementation

- Assume: beef breeding organisation
- Improvement of animal at production level with respect to economic profitability
- Implementation of scientific breeding program
- Start to design and to develop economic breeding goal
- Combine economically important traits into an aggregate genotype (H)
- Use hierarchical structure

Hierarchical Breeding Program

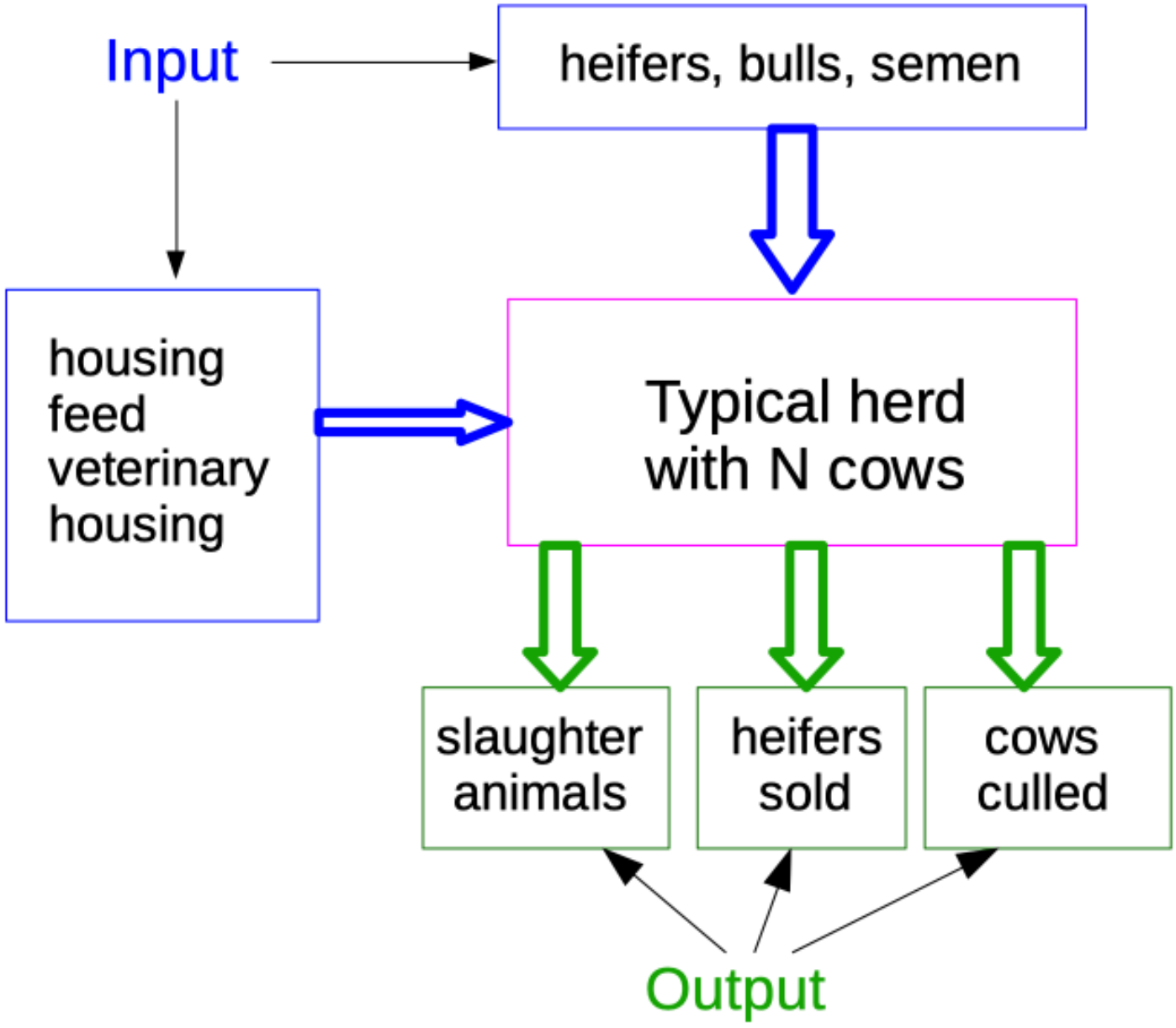


Three Steps To Design Economic Breeding Goal

The following steps are needed to implement a breeding program

1. description of production system
2. modelling profit of a typical herd
3. derive economic values

Production System



What is a Production System

- Simulation of production herd
- Collect input parameters (costs, biological parameters, labor, ...) from literature
- Use collected input parameters for simulation
- Run simulation
- Record output quantities (revenue, animals sold)

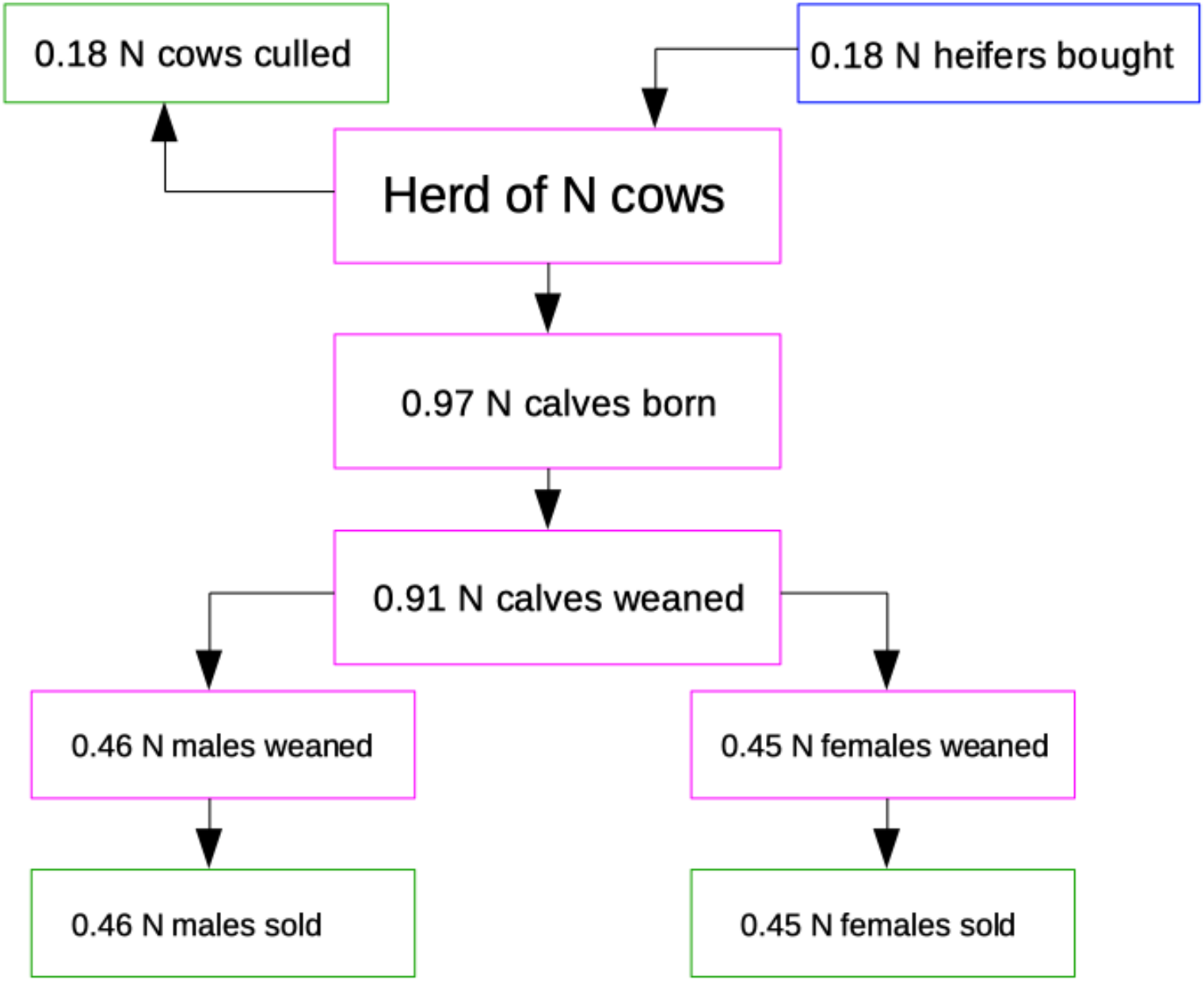
Why Production System

- Profit is computed based on revenue and costs
- Characteristics and traits of animals with impact on profitability are found
- Impact of traits on profitability detected by changing input parameters
- Progeny must meet needs of production farms
- Breeders must select parents such that optimal progeny produced for production farms

Structure of Production System

- Assume a hierarchical structure of the breeding program
- Alternatively: mixed farms in monolithic structure
- Breeding (and possibly multiplier) farms are selling their progeny to production farms

Example Of Typical Production Farm



Traits Of Interest

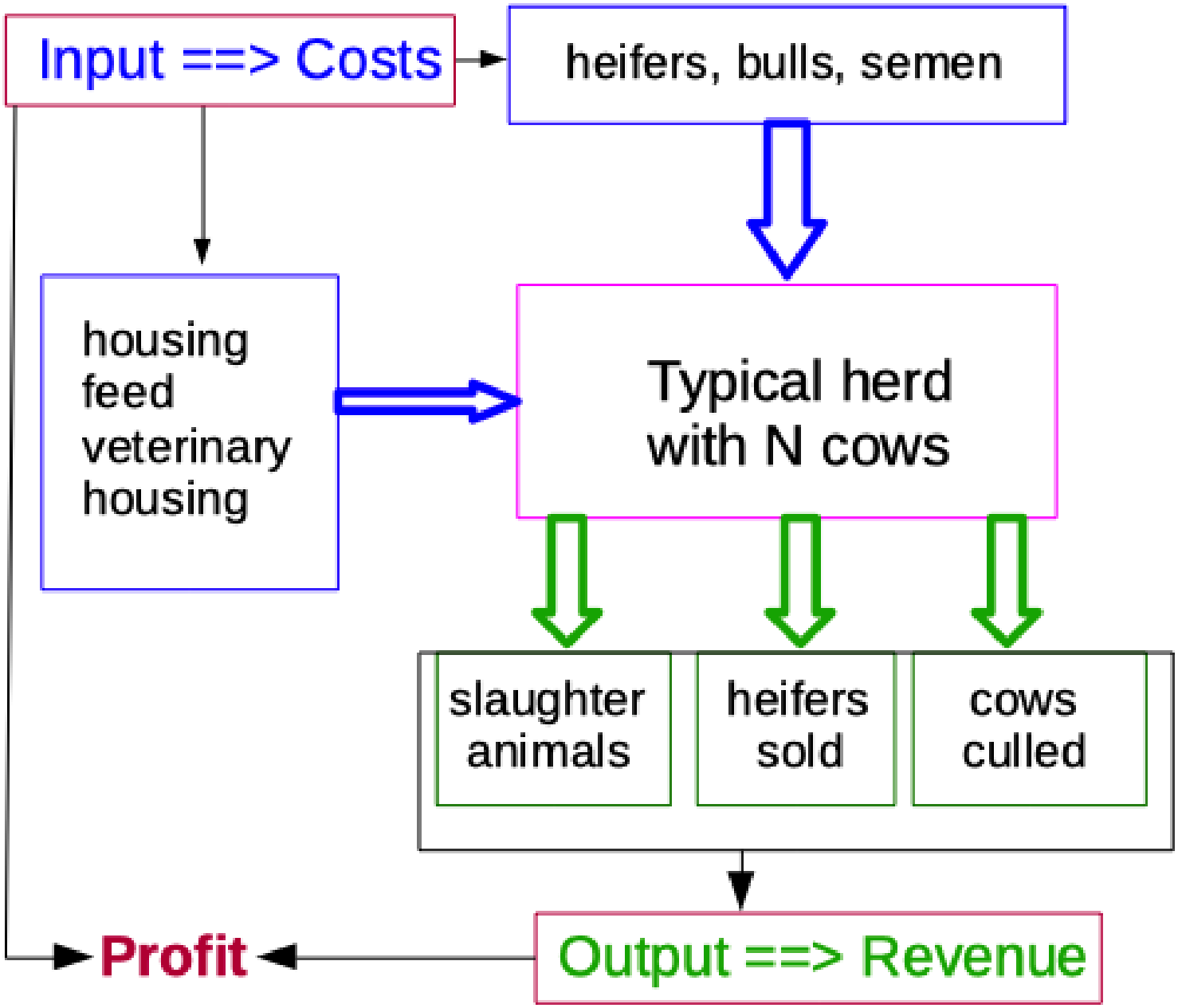
- Profit (P) of production farm determined by revenues (R) and costs (C)

$$P = R - C$$

- Traits of economic interest influence P
- Restrict ourselves to output
  - age corrected carcass weight (CW)
  - carcass confirmation (CC)
  - carcass fat (CF)
- Above traits will be included in aggregate genotype (H)

$$H = a^T \cdot u$$

Economic Evaluation



Economic Values

- . . . also known as economic weights
- Change of profit (P) due to small change of trait mean (μ_x)
- For trait x with mean μ_x, the economic value a_x is defined as

$$a_x = \frac{\partial P}{\partial \mu_x}$$

Genetic Evaluation

- Statistical modelling
- Stochastic relationship between genetic background and phenotypic expression
- Contrast: deterministic modelling in physics, e.g. law of gravity

Statistical Modelling

- In most cases, two steps plus preparation
- Given: dataset on breeding animals containing traits of interest as response variables and predictor variables
- Preparation: do model selection to eliminate unimportant predictor variables
- Steps:
  1. variance components estimation
  2. prediction of breeding values