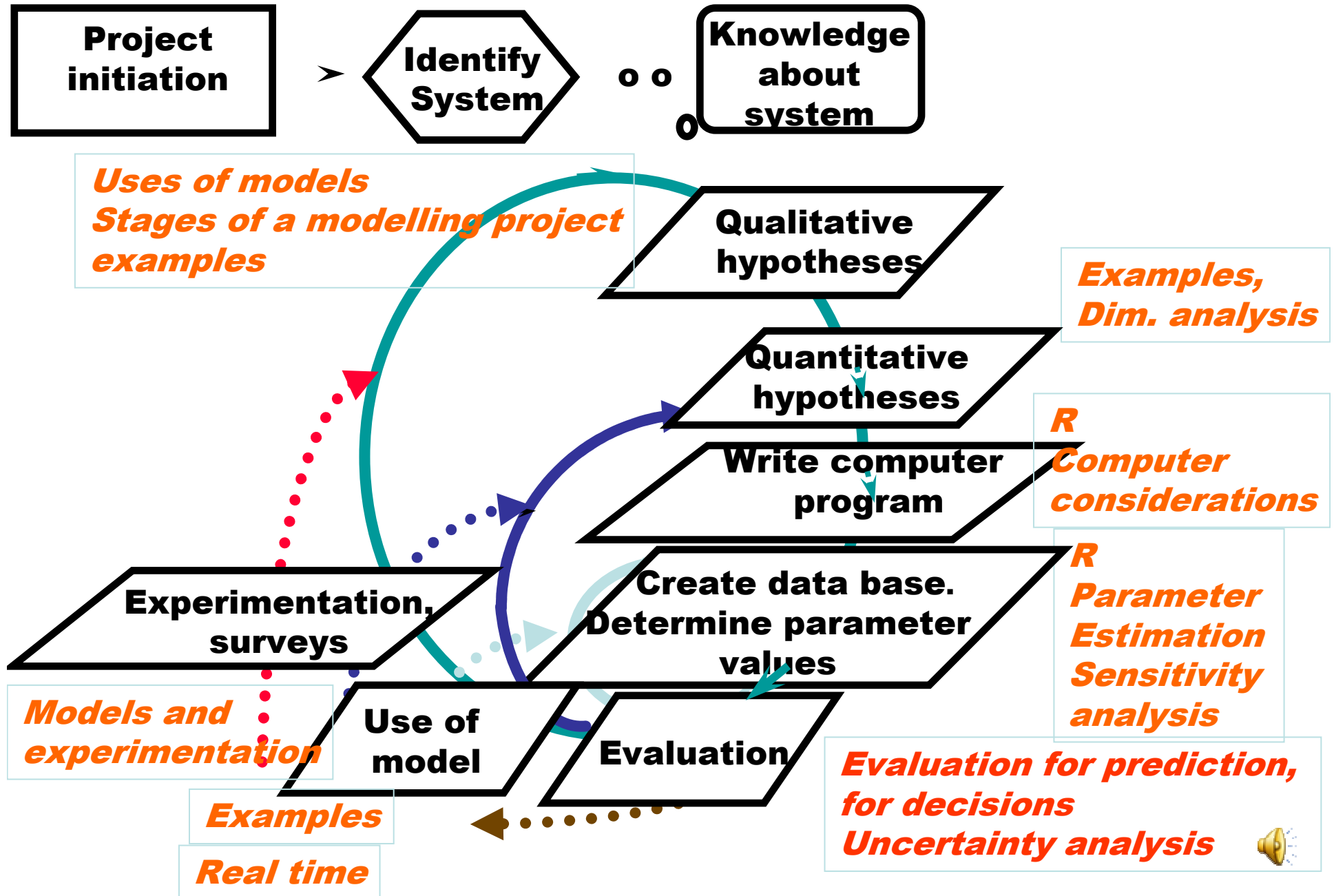# A modelling project

- In practical terms, what does a "modelling project" involve?
- What resources in time and expertise are required?

STEPS IN A MODELLING PROJECT

Project initiation

Identify System

o o

o

Knowledge about system

Uses of models
Stages of a modelling project
examples

Qualitative hypotheses

Examples, Dim. analysis

Quantitative hypotheses

R Computer considerations

Write computer program

R Parameter Estimation Sensitivity analysis

Create data base. Determine parameter values

Experimentation, surveys

Models and experimentation

Use of model

Evaluation

Evaluation for prediction, for decisions Uncertainty analysis

Examples

Real time

The emphasis on each stage depends on the project

- There is a very large diversity of models. Consider 3 fairly different situations.
- Examples (except first case) from survey of dynamic system models used by technical institutes, or by INRA in collaboration with technical institutes
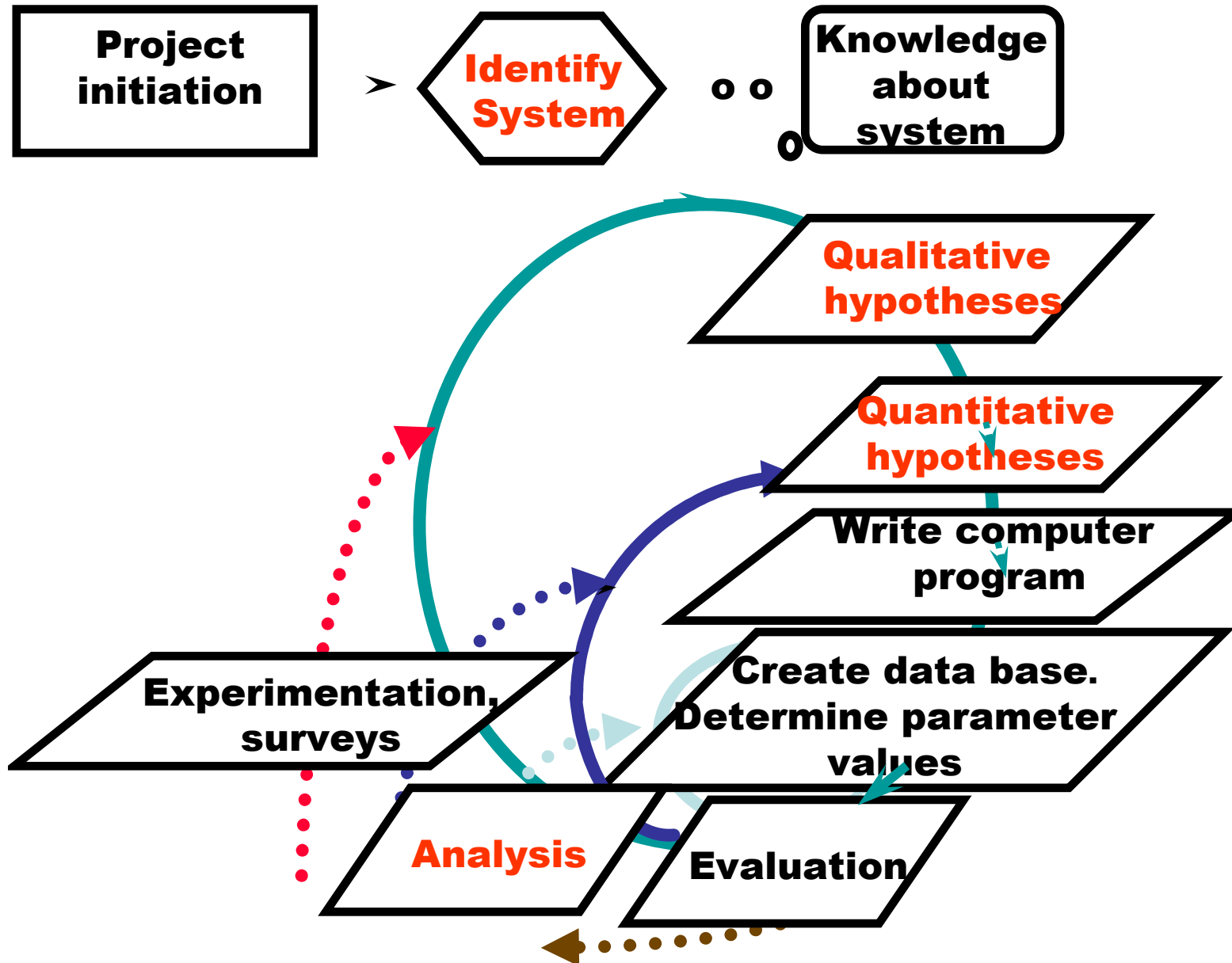
1. Simple exploratory model

- Objective: better understanding of basic interactions (research).
- For example, basic predator prey model. Or relation between ecosystem complexity and stability. Or model of gene regulation.
- Only most important processes are taken into account
  - In predator-prey model: logistic growth, mortality of predator, predation.
- No detail for specific situation

STEPS IN A MODELLING PROJECT 1

Project initiation

Identify System

o o o

Knowledge about system

Qualitative hypotheses

Quantitative hypotheses

Write computer program

Experimentation, surveys

Create data base. Determine parameter values

Analysis

Evaluation

- This is usually part of a more general research project.
  - The model is a research tool, like experimentation
- Time: a few months? (For one article)
- Expertise:
  - in domain modeled essentially.

2. More applied research model

- Objective: Develop general rules for management.
- For example, model strategies for irrigation of corn,
  - Other examples: fertilization of wheat. Weed control taking into account multi-year dynamics. Managing fish stocks as a function of fishing intensity.
- Take into account major processes that affect outcome of interest.
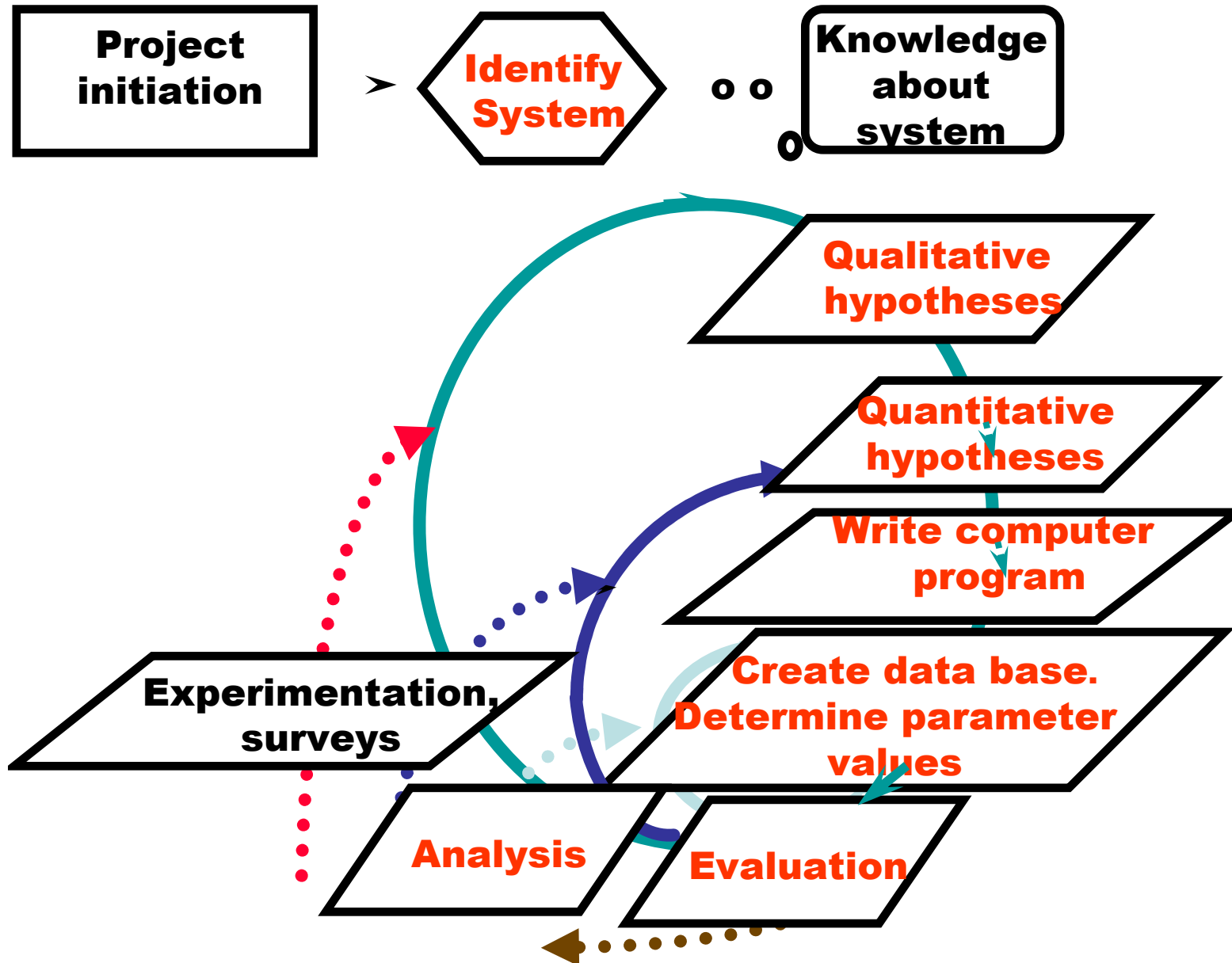- Must resemble real systems

Models in survey (1)

- Models to evaluate cropping or grazing systems
  - Integrated pathogen management
  - Fertilization practices for field crops
  - Irrigation practices for field crops
  - Choice of variety for sunflower
  - Mixed cropping-animal systems
  - Milk cow systems
  - Herbivores on heterogeneous pasture
  - Rapeseed production and oil content
  - Water stress effect on vineyards

STEPS IN A MODELLING PROJECT 2

Project initiation

Identify System

o o
o

Knowledge about system

Qualitative hypotheses

Quantitative hypotheses

Write computer program

Experimentation, surveys

Create data base. Determine parameter values

Analysis

Evaluation

- Time: Often a thesis, 3 years (building on existing models)
- Expertise:
  - Modelled domain
  - practical problem
  - Modelling
  - programming (often a major task)
  - statistics (for parameter estimation, also a major task)

3. Model for end-users

- Objective: Decision aid for farmers or farm consultants

- For example, model of risk of disease septoriose on wheat. Recommendation to treat if risk is great.

- Model must give good results (good recommendations) for each specific situation.

Models in survey (2)

- Models of disease or insect development (for warnings)
  - Grape vines (various cryptogamic diseases)
  - Thrips on leeks
  - Rust on leeks
  - Mildew on lettuce
  - Alternariose on carrots
  - Bacteriose on walnuts
  - Oidium on strawberries
  - Thrips on peaches
  - Carpocapse on apples
  - Septoriose on wheat

Models in survey (3)

- Models to test alternative strategies
  - Energy consumption for animal housing
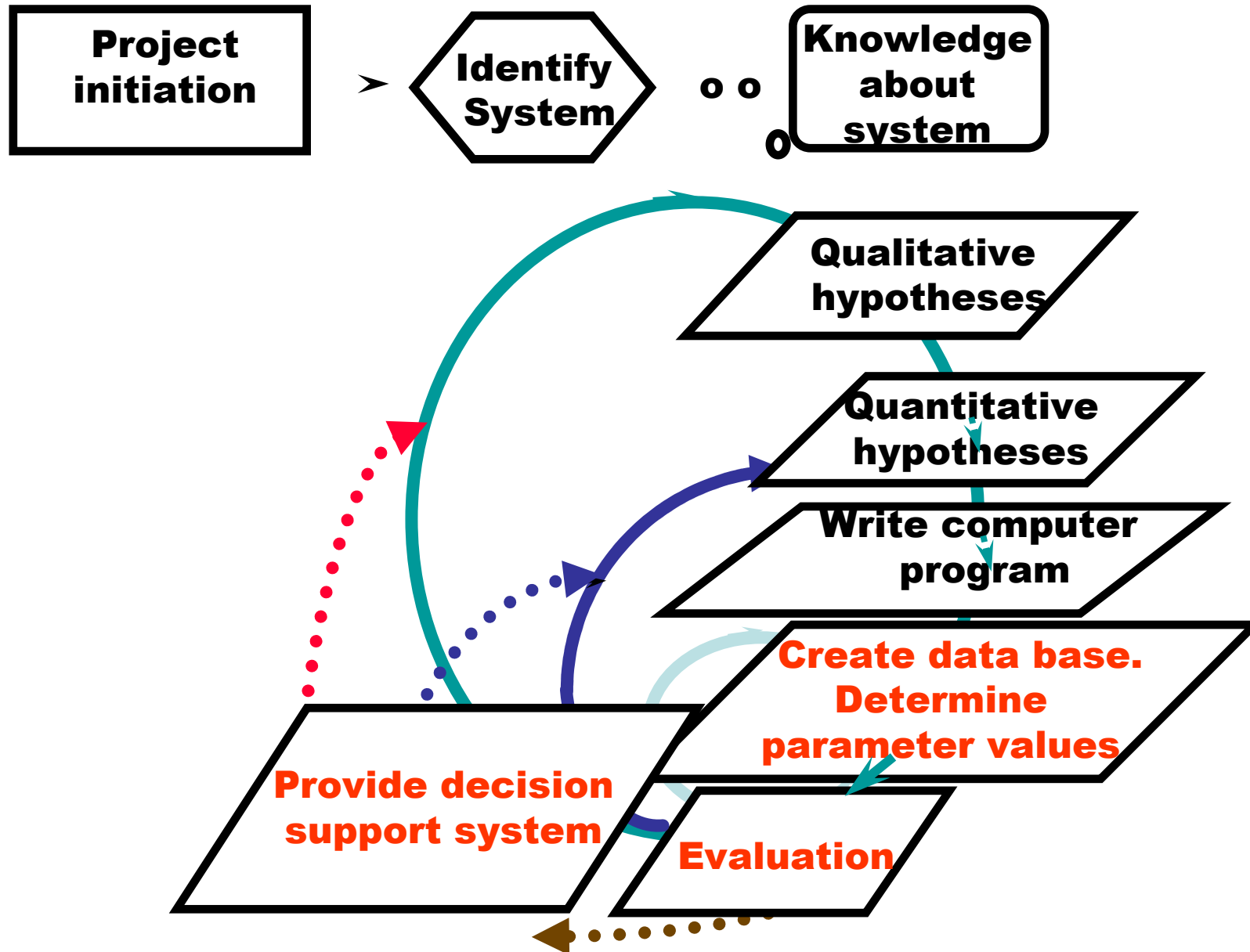 - Evaluation of methane production in animal systems

Models in survey (4)

- Models to help technical institute engineers (better analysis of data)
    - Simulation of goat system production
    - Simulation of bovine grazing system

STEPS IN A MODELLING PROJECT 3

- The model is a product, provided (sold) to end-users.
- Time: Often several years, mostly for testing. (Model is often quite simple).
- Expertise:
  - Modelled domain
  - practical problem
  - Modelling
  - programming for end-users (often use a pre-existing platform)
  - statistics (for parameter estimation)

Conclusions

- Modelling projects are often long and complex
- Where to invest time and resources depends on the type of project
- So be clear about what type of project you have.

THE END