S A Edwards, J-Y Dourmad, H L Edge, E Fabrega, K de Greef, E Ilari, C Phatsara, L Rydhmer, M Bonneau

Project Objective:
To develop high quality pork products in sustainable production systems with low environmental impact

Module II:
Sustainability of farm level production systems

Challenges for Pigmeat Production Systems

1. Increasing social rejection of the current intensive systems due to environmental and animal welfare shortcomings
2. Lack of economic competitiveness on the world market
3. Loss of diversity due to pressures on small-scale systems adapted to local conditions.

Module II Objective
To survey the range of existing systems within Europe and evaluate these against sustainability benchmarks
Therefore – need to agree standardised tools for the assessment of sustainability of pigmeat production systems

Sustainability

- World Commission on Environment and Development (1987)
  - Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs
- Crossen (1992)
  - A sustainable agricultural system is one that can indefinitely meet the requirements for food and fibre at socially acceptable, economical and environmental costs.

The Sustainability Tripod

- Environmental
- Social
- Economic
Review of tools

<table>
<thead>
<tr>
<th>Theme</th>
<th>Lead partner</th>
<th>Person responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental impact</td>
<td>INRA</td>
<td>Jean-Yves Dourmad</td>
</tr>
<tr>
<td>Genetic resources</td>
<td>SLU</td>
<td>Lotta Rydhmer</td>
</tr>
<tr>
<td>Economic sustainability</td>
<td>IFIP</td>
<td>Estelle Iari</td>
</tr>
<tr>
<td>Human working conditions</td>
<td>Newcastle</td>
<td>Helen Edge</td>
</tr>
<tr>
<td>Animal welfare</td>
<td>Newcastle</td>
<td>Helen Edge</td>
</tr>
<tr>
<td>Animal health</td>
<td>Bonn</td>
<td>Chirawath Phatsara</td>
</tr>
<tr>
<td>Meat safety</td>
<td>Bonn</td>
<td>Chirawath Phatsara</td>
</tr>
<tr>
<td>Meat quality</td>
<td>IRTA</td>
<td>Emma Fabrega</td>
</tr>
<tr>
<td>Societal conformity</td>
<td>ASGV</td>
<td>Karel de Greef</td>
</tr>
</tbody>
</table>

Tool Review and Nomination

- Review of scientific literature and practice
- SWOT analyses
- Nomination of the best currently available tool for the pigmeat production context
- Production of Standard Operating Procedure
- Identification of benchmarks

ENVIRONMENTAL IMPACT

- **Scope of tool**
  
  Many potential aspects
  - eutrophication
  - acidification
  - climate change
  - use of non-renewable energy

  Needs to consider the whole production chain
  - Processes occurring on farm
  - Production and delivery of inputs

ENVIRONMENTAL IMPACT

- **Tools reviewed**

<table>
<thead>
<tr>
<th>Target group</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy makers</td>
<td>Means based</td>
</tr>
<tr>
<td>Farmers</td>
<td>Effect based</td>
</tr>
<tr>
<td>Meat industry</td>
<td>System-state related</td>
</tr>
<tr>
<td>Environmental issue</td>
<td>System considered</td>
</tr>
<tr>
<td>Global</td>
<td>Farm</td>
</tr>
<tr>
<td>Local</td>
<td>Product</td>
</tr>
</tbody>
</table>

ENVIRONMENTAL IMPACT

- **Tool nominated**

  Life Cycle Assessment:
  an holistic analysis taking into account local and global impacts

  Inputs – pigs, feed, energy, chemicals
  Outputs – pigs, manure
  Emissions – estimated from systems description

GENETIC RESOURCES

- **Scope of tool**

  Assessment of the sustainability of the pig breeding programme
  - Preservation of genetic diversity
  - Contribution to other sustainability themes
GENETIC RESOURCES

Tools reviewed
- Tools for inbreeding estimation
  - inbreeding rate from effective population size
  - programmes for estimation of inbreeding
  - frequency of heterozygotes at DNA level
  - breed characterisation, DAD-IS

Sustainability checklists for breeding
- Assessment of breeding goals
- Code EFABAR

Tool nominated
- Wolliam’s checklist for breeding schemes: (e.g.)
  - how is the market defined?
  - how is the breeding goal defined?
  - how is sensitivity to external factors addressed?
  - how is a sufficiently large effective population size secured?
  - which traits are recorded?
  - how is genetic progress monitored and evaluated?
  - characteristics of the breed

ECONOMIC SUSTAINABILITY

Scope of tool
- Holistic analysis of economic health and profitability of whole farm
- Ability to provide a correct and regular income to support a family and to be able to pass on a viable farm

Tools reviewed
- IDEA and IDERICA (indicators of durability)
- Sustainability diagnosis
- Territorial observatory project
- Sustainable farm tree (farmers opinions)
- Australian sustainability indicator
- RISE (response-inducing sustainability evaluation)

Tool nominated
- Indicateurs de Durabilité des Exploitations Agricoles IDEA:
  - Economic viability
    - Available income per worker
    - Economic specialisation rate
  - Independence
    - Financial autonomy
    - Reliance on subsidies
  - Transferability (operating capital)
  - Efficiency (operating expenses: production value)

HUMAN WORKING CONDITIONS

Scope of tool
- Health and Safety at Work
  - personal injury risk
  - aerial environment
- Demands of the Job
  - number of animals under care
  - degree of automation
- Job Satisfaction
### HUMAN WORKING CONDITIONS

- **Tools reviewed**
  - Aerial environment
    - measurement of gases and airborne particles
  - Workload
    - reports on man hours/pig
  - Job satisfaction
    - questionnaires in other industries

- **Tool nominated**
  - No current tool exists, so combined tool devised:
    - a questionnaire on employee health and frequency of work-based injuries (indirect measure of workplace safety)
    - a check list for workload and degree of automation within the pig unit
    - a job satisfaction questionnaire developed specifically for the project

### ANIMAL WELFARE

- **Scope of tool**
  - Assessment of the adequacy to meet pig needs:
    - health
    - physiology
    - behaviour
  - Must operate in diverse systems
    - outcome measures more appropriate

- **Tools reviewed**
  - Animal needs index
  - Decision support tool
  - Behaviour observation tool
  - Qualitative assessment
  - Farm assurance schemes
  - Bristol Welfare Assurance programme
  - Welfare Quality programme

- **Tool Nominated**
  - Welfare Quality:
    - integrates both animal-based measures of pig health and behaviour, including qualitative assessment, with key resource measures of environmental provision

- **Condensed tool** (if time or farm access limited):
  - a short “needs-based” questionnaire

### ANIMAL HEALTH

- **Scope of tool**
  - Assessment of the health status of animals
  - Early detection and elimination of disease risk factors
  - Early detection and treatment of disease
**ANIMAL HEALTH**

- **Tools Reviewed**
  
  **Laboratory analytical tools**
  - Diagnostic tools (cultures, ELISA, PCR)
  - APP (Hapt, SAA, PigMAP)

  **Combined health assessment tools**
  - Monitoring and surveillance systems (MOSS)
  - Herd health plans
  - Information technology tools

- **Tool nominated**
  
  **Health questionnaire (basic tool):**
  - Health management checklist
  - Vaccination programme record
  - Medication records
  - Disease and mortality report
  - General health report

  **Acute phase proteins (advanced tool):**
  - Haptoglobin
  - Pig MAP

---

**MEAT SAFETY**

- **Scope of tool**

  Hygienic status of meat throughout production chain
  Presence of zoonotic diseases

- **Tools reviewed**

  **General tools**
  - Laboratory analytical tools (mATP, PCR, APP)
  - Monitoring tools (abattoir vet, Salmonella index)
  - Statistical risk tools
  - Hygiene tools (cleaning and disinfection)

  **Combined quality assurance tools**
  - Health management (HACCP, HAZOP, GMP)
  - Quality management systems (TQM, GIQS)

- **Tool nominated**

  **Hazard Analysis and Critical Control Point**
  - A preventive system to ensure food safety
  - Aims at identification and control of potential hazards at all stages in food production

  HACCP checklists developed

  Records from national Salmonella monitoring

---

**MEAT QUALITY**

- **Scope of tool**

  **Carcass quality**
  - grading criteria

  **Meat quality**
  - suitability for process
  - consumer satisfaction
MEAT QUALITY

- **Tools reviewed**
  
  **At farm**
  - Prediction of fat and muscle depths by ultrasound

  **At slaughter plant (on line)**
  - Carcass grading parameters (weight, fat/muscle depth)
  - Muscle properties (pH, conductivity, colour, marbling)

  **In laboratory**
  - Muscle chemistry (WHC, intramuscular fat)

- **Tool nominated**
  
  **Assessment at abattoir:**
  - Lean percentage estimation
  - Ultimate pH
  - Drip loss (Rasmussen method)
  - Colour assessment (Japanese colour scale)

SOCIETAL CONFORMITY

- **Scope of tool**
  
  Assessment of the degree to which a production system meets the demands and expectations of the society

- **Tools reviewed**
  
  **Societal expression of conformity**
  - Media and politics inventories
  - Focus group discussions
  - Social inventories – quantitative and qualitative surveys
  - Social experiments

  **Production systems conformation actions**
  - Conformation to laws and regulations
  - Participation in quality schemes
  - Development of alternative systems
  - Communication and transparency

- **Tool nominated**
  
  **A questionnaire for informed professionals:**
  - Society (NGOs, journalists, government)
  - Industry (producers, advisers, scientists)

  Designed to assess degree of:
  - Awareness
  - Interest
  - Information
  - Approval

Applications of Tools

- All tools will be applied in a study of different production systems in each of 5 EU countries
- Data will be collected for 3 contrasting systems per country (2008-09)
  - 1 conventional, 2 alternative
- Alternative systems will be differentiated on one or more sustainability claims
  - Welfare
  - Environment
  - Traditional breeds
Acknowledgements

The authors gratefully acknowledge from the European Community financial participation under the Sixth Framework Programme for Research, Technological Development and Demonstration Activities, for the Integrated Project Q-PORKCHAINS FOOD-CT-2007-036245.

We thank all the participants in the different theme working groups.