Description and validation of the Teagasc Pig Production Model

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Bio-economic models

- Describe the links between the components of economic and biological processes

  - Tools to predict systems behaviour by understanding such links

  - Estimate the impact of farm changes on performance and profitability

  - Allow realistic scenarios to be tested prior to implementation

- **Should be capable of simulating the conditions of a particular production system and market place**

A tailored made model with specific country based assumptions and practices is essential
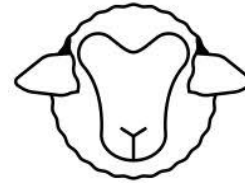
- A series of bio-economic models describing Irish production systems developed

MDSM[1] **GBSM[2]** **TLPM[3]**

- Continuously used in various aspects of production[4-7]

No similar bio-economic model that adjusts to the Irish pig production

[1]Shalloo et al. 2004. J. Dairy Sci. 87:1945–1959
[2]Crosson et al. 2006. Agric. Syst. 89:349-370
[3]Bohan et al. 2016. Agric. Syst. 148: 124-134

[4]McCarthy et al. 2007. J. Dairy Sci. 90: 1493-1505
[5]O'Brien et al. 2012. Animal. 6: 1512-1527
[6]Ryan et al. 2011. J. Dairy Sci. 94: 1032-1044
[7]Bohan et al. 2018. Livest. Sci. 210: 118-124

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Objectives

1. **To provide a detailed description of the development of a bio-economic pig farm model**

2. **To validate the model against real Irish farm data**

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Teagasc Pig Production Model (TPPM)

- Describes a farrow-to-finish Irish pig farm

- Farm simulated on a weekly basis for an entire year

- Built using real Irish data

- **7** animal categories

Category	Age, weeks
Piglet	0 - 4
Weaner 1	5 - 8
Weaner 2	9 – 12
Finisher	12 - 24
Maiden gilts	24 - 32
Gestating sows	≥ 33
Lactating sows	≥ 48
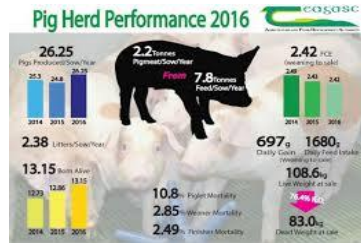
INPUTS

OUTPUTS

Biological
- Herd size
- Farrowing %
- No. born alive
- Litters/sow/yr
- Mortality

Reproduction
- AI
- Boar

Infrastructure
- Buildings
- Energy usage

Costs

Nutrition
- Growth curve
- Feed intake curve
- Diet composition

Health
- Herd health plan

Labour
- Hours worked
- No. employees

Income
- Finisher sales
- Culled sow sales

TPPM

Physical
- Feed usage
- No. pigs/stage
- No. pigs slaughter
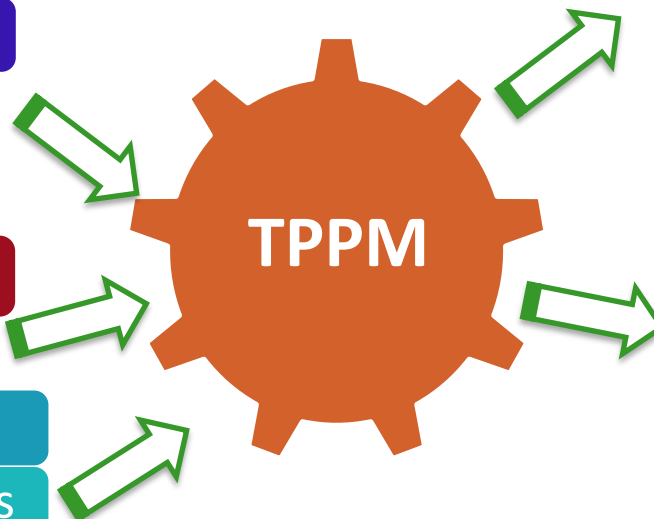- No. kg DW

Financial
- Annual cash flow
- Balance sheet
- Profit and loss

NET PROFIT

TPPM - Validation

1. **Delphi method**
   - Methodology
   - Values used

2. **TPPM outputs compared with real farm data**
   - TPPM parameterised to simulate the biological performance of 20 Irish pig farms
   - Simulated results compared to the average performance of such farms

Results from the validation show that the TPPM closely simulates the 20 Irish farms

Biological parameters of TPPM and values for validation farms

Performance variable	TPPM	Irish farms (n = 20; Mean ± SD)
Sow herd size	775	810 ± 495
Farrowing rate, %	86.0	85.4 ± 5.5
Litters/sow/year	2.4	2.3 ± 0.12
No. Born alive	13.2	13.3 ± 0.57
Pigs/sow/year	26.3	26.1 ± 1.79
Culling rate, %	50.1	50.6 ± 8.10
Sow mortality rate, %	4.9	4.8 ± 2.51
Piglet mortality rate, %	10.8	10.5 ± 2.79
Weaner mortality rate, %	2.9	2.7 ± 1.24
Finisher mortality rate, %	2.5	2.0 ± 0.98
Average BW on sale, kg	109.6	108.5 ± 4.10
Kill out %	76.4	77.1 ± 7.00

TPPM validation – Physical outputs

Performance variable	TPPM	Irish farms (n = 20; Mean ± SD)
Feed usage, ton		
Gestation	619.2	675.0 ± 444.54
Lactation	439.0	401.6 ± 241.6
Creep	66.1	61.7 ± 44.36
Link	155.8	160.5 ± 191.2
Weaner	1014.3	1046.8 ± 721.1
Finisher	3703.6	3707.0 ± 2386
Sales, thousands		
No. pigs sold	20.7	19.6 ± 11.55
No. kg/DW produced	1709.6	1648.4 ± 1023.93

TPPM validation – Financial outputs

	TPPM		Irish farms	
	Pig	kg/DW	Pig	kg/DW
Sales, €	**121.9**	**1.51**	**130.6**	**1.55**
Feed costs, €	70	0.87	77.8	0.93
Non-feed costs, €	10.4	0.13	8.71	0.10
Total variable costs, €	**80.4**	**1.00**	**86.6**	**1.03**
Fixed costs, €	13.1	0.16 ≅	14.2	0.17
Depreciation charges, €	3.02	0.04 ≅	3.5	0.04
Total farm costs, €	**96.5**	**1.20**	**104.3**	**1.24**
Farm net profit, €	**25.5**	**0.32**	**26.3**	**0.31**

-€8.7/pig
-€0.04/kg DW

-€6.2/pig
-€0.03/kg DW

-€7.8/pig
-€0.08/kg DW
+€0.85/pig
+€0.01/kg DW

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Discussion

- TPPM **closely simulates physical and financial outputs** of real Irish farms

⬆**No. pigs sold/kg DW produced**➔ No variation in from in No. of pigs sent to slaughter each week or BW at sale

⬇**Income** ➔Premiums/long term contracts with processing plants

Discussion

⬇️**Variable costs**

⬇️**Feed costs** ➔ other feed-associated costs in Irish farms

⬆️**Non-feed costs** ➔ Lack of/inaccurate records

What is next?

- **Risk Analysis**

- **Model applicability:**

  - Simulate expansion of finisher accommodations and increased BW at sale up to 120 kg

  - Simulate changes in feeding practices

  - Simulate respiratory disease (e.g. PRRSv) occurrence

  - Simulate welfare problem (e.g. tail biting)

- **Sensitivity Analysis**

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Thank you!!!