

Primary production side flows – Danish pork as a case study

*Lisbeth Mogensen
Department of Agroecology,
Aarhus University*



Outline

- A new definition of food waste in primary production: the term 'side flow'
- Standard estimate of 'side flow' from primary production of livestock in the Nordic countries
- Method for estimating the standard 'side flow estimates' – Danish pork as a case

For 'food waste' in primary production we defined a new term 'side flow' I:

'Side flow' (SF) is defined as:

The flows of primary products that were meant to be eaten by humans, but never entered the next step in the food supply chain (e.g. slaughter, retail, processing), and instead were used for other purposes or sent to waste treatment.

Non-edible parts of wasted food e.g. peels and bones are not included as part of side flow.

For 'food waste' in primary production we defined a new term 'side flow' II:

Primary production is defined as agriculture, aquaculture and fisheries, **starting from when** plants are ready for harvest, farmed fish are hatched, **animals are born**, milk is drawn and eggs are laid.

The system **ends when the product is sent to processing** or wholesale/retail

For 'food waste' in primary production we defined a new term 'side flow' III:

Included in side flow (SF) is rearing of animals:

- * Animals that die due to illness
- * Animals that are rejected at the slaughterhouse due to health risk for humans

Other studies does **not** included rearing.

However 'harvesting' in animal production differ from crop production.

- Crops cannot be used before it is mature
- Animals can be slaughtered and the meat used as food at almost any age

Standard estimates of side flow and food waste in livestock production

Products	Side flow, %	Food waste, %	
		FUSION	FAO (Rearing) + transport + rejected
Meat			
Pork	0.2 (+2.8)	0.2	(2.5) + 0.11 + 0.12
Beef	0.7 (+8.3)	0.7	(2.25) + 0.013 + 0.6
Poultry	1.7 (+1.3)	1.7	(4) + 0.35 + 1.3
Milk			
Milk	0.3	0.3	(3.5) + 0.5

1) Östergren et al., 2014

2) Gustavsson et al., 2011

Method for standard estimates of side flow of pork

Products	Side flow, %	Food waste, %	
		FUSION ¹⁾	FAO ²⁾ Agriculture + postharvest
Meat			
Pork	0.2 (+2.8)	0.2	3.1 + 0.7
Beef	0.7 (+8.3)	0.7	
Poultry	1.7 (+1.3)	1.7	
Milk			
Milk	0.3	0.3	3.5 + 0.5

Method for standard estimates of side flow of pork

Products	Side flow, %	Reference
	Nordic project (+ rearing)	
Pork Meat		
Finland	3.5%	Hartikainen et al., 2014
Denmark	4.1% 3.7%	Mogensen et al., 2013 SEGES, 2015
Standard estimate	0.2 (+2.8)	

Method for standard estimates of side flow of pork in Denmark

Data from farms:

Existing statistic on production in private herds from 2011 from 664 sow herds (425.000 sows), 574 herds with weaners (9.4 million produced weaners of 31 kg) and 746 herds with finishers (4.9 million produced). Represent 41% of the pigs in Denmark in 2011.

Data from transport of pigs from farm to slaughterhouse:

Existing statistic

Data from slaughterhouse:

From the major slaughterhouse in Denmark which is responsible for 78% of pig slaughtered.

'Side flow' from dead piglets

	Per sow		Total numbers in Denmark, 2011		
	Per litter	Per year		Dead	Export
Sows	1	1	1,034,000		
Piglets born	16.6	37.5	38,775,000		
Dead piglets, % Still born/before weaning	23,0				
Dead piglets, N	3.9	8.8		8,918,250	
Weaned piglets at 7.1 kg LW, N	12.7	28.8	29,779,200		
Export, pighlet at 7,1 kg LW, N					406,942
Weaners for production in DK, N			29,372,258		

'Side flow' from dead weaners

	Per sow		Total numbers in Denmark		
	Per litter	Per year		Dead	Export
Weaners	12.7	28.8	29,372,258		
Dead before 30 kg, %	2.9				
Dead before 30 kg, N	0,37	0,83		851,795	
Weaners produced, N	12,33	27,9	28,520,463		
Export					7,632,169
Weaners for finisher production in DK			20,888,294		

'Side flow' from dead finishers

	Per sow		Total numbers in Denmark		
	Per litter	Per year		Dead	Export
Weaners for finisher production in DK	12.33	27.9	20,888,294		
Dead, %	3.5				
Dead, N	0.43	0.97		731,090	
Finishers produced, N	11.87	26.8	20,157,204		
Export					382,373
Finishers transported to slaughtering in DK			19,774,830		
Dead during transport (0.01%)				1977	
Finishers ready for slaughtering in DK			19,772,854		

'Side flow' from dead finishers

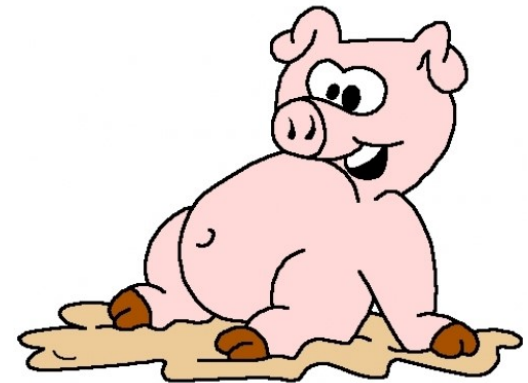
	Per sow		Total numbers in Denmark		
	Per litter	Per year		Dead/ Rejected	Export
Finishers ready for slaughtering in DK			19,772,854		
Finishers rejected at sl. house, 0.2%				35,196	
Finishers for meat production			19,737,658		

'Side flow' from dead sows

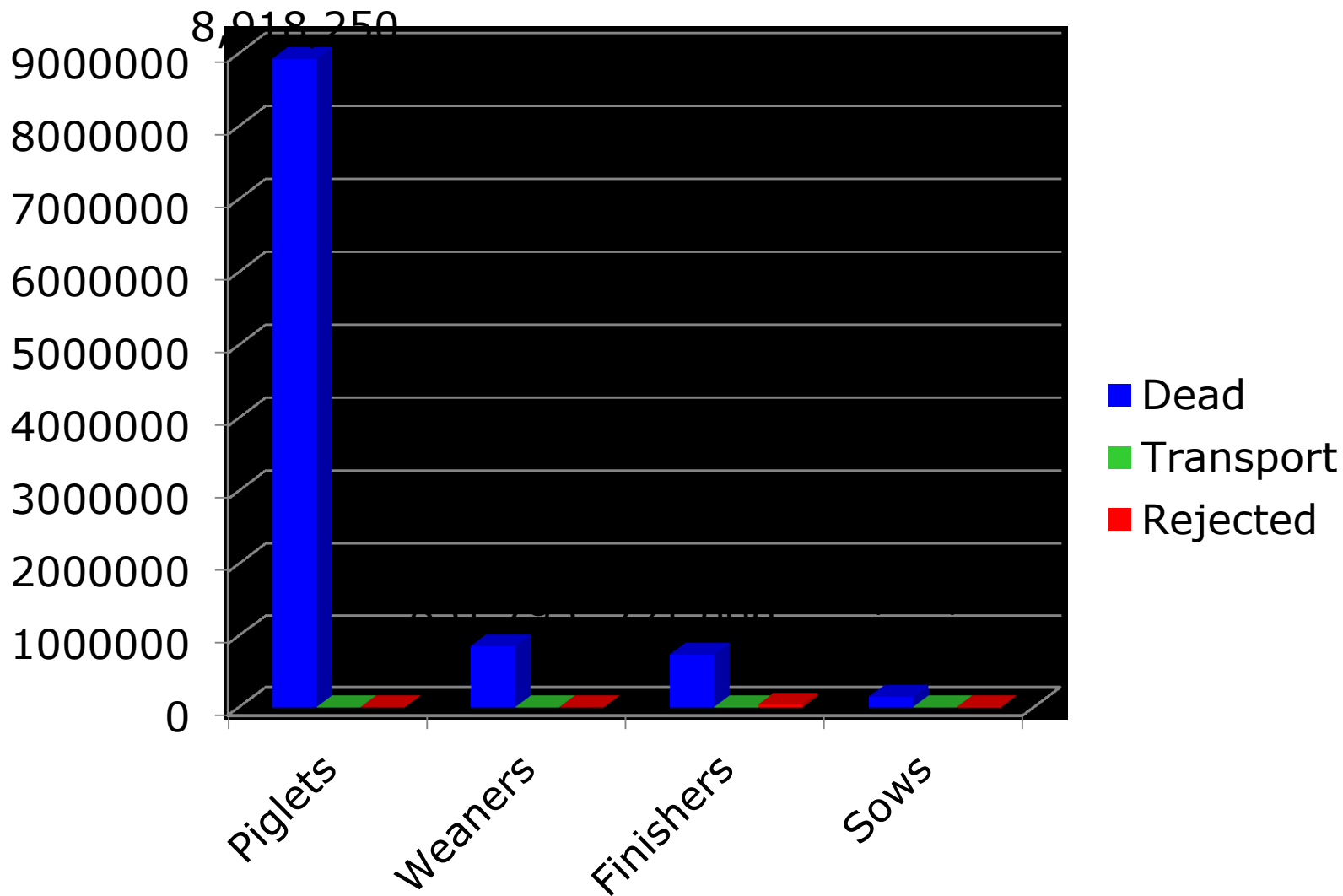
	Total in Denmark		
		Dead/ Rejected	Export
Number of sows	1,034,000		
Replacement (54% per year)	558,360		
- Dead sows (13.7%)		141,658	
- For slaughter (40.3%)	416,847		
- Hereof exported			118,022
- Hereof sent to slaughter in DK	298,825		
Dead during transport (0.07%)		209	
N slaughtered	298,616		
Sows rejected at sl. house (1.2%)		3604	
Sows for meat production	295,012		

'Side flow' in numbers

- 10.7 million dead/rejected pigs per year
- 27 % of total number of pigs
(Total production: 1.03 mio sows + 38.78 mio piglets born)

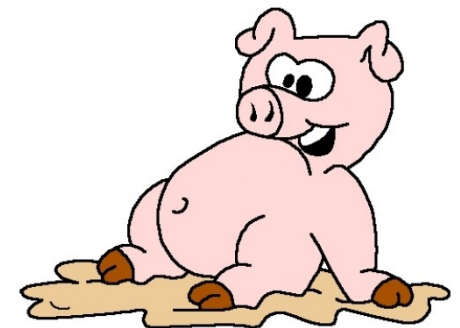


'Side flow' in numbers

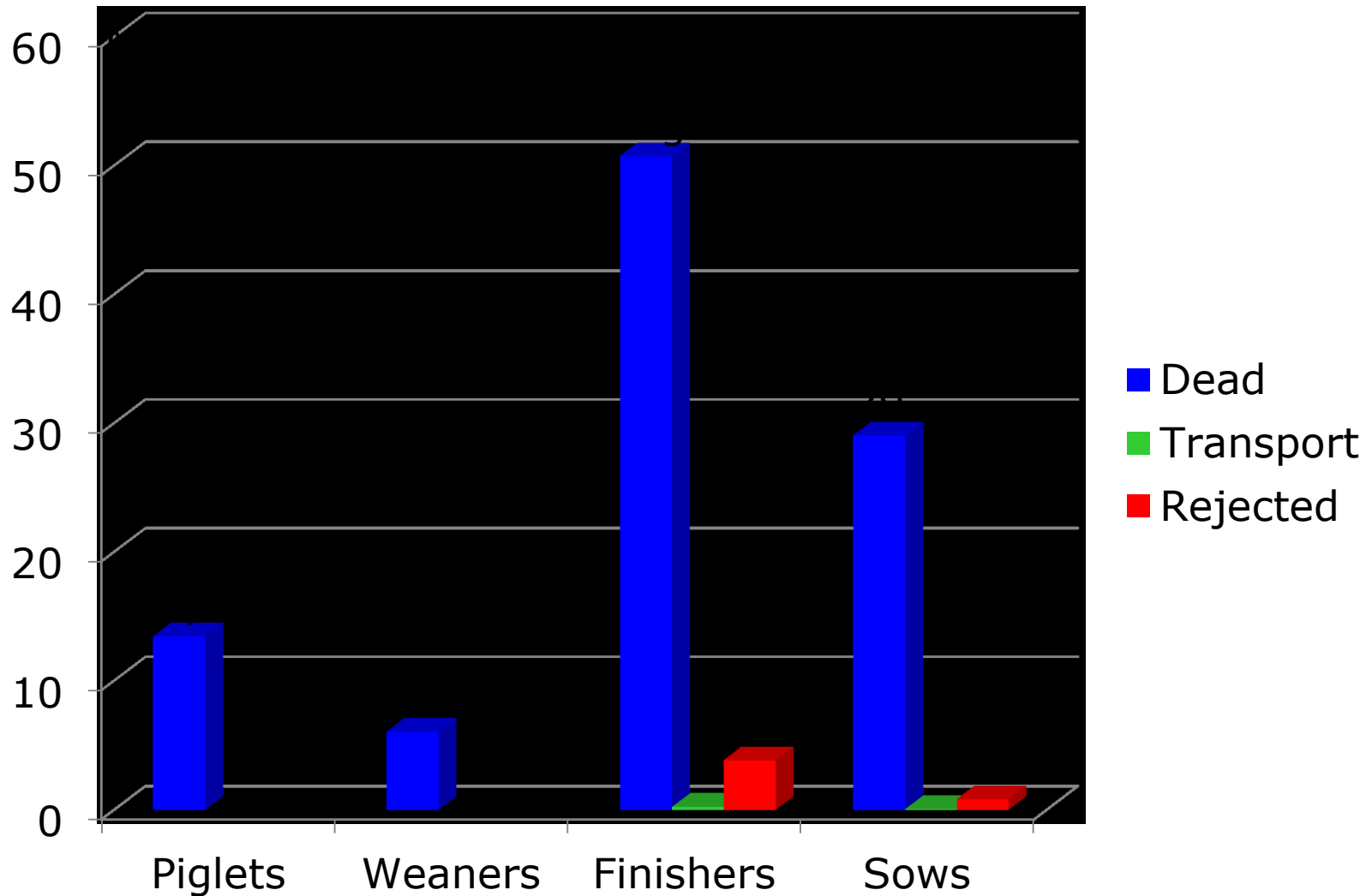


'Side flow' in live weight (kg)

- 104 million kg LW dead/rejected pigs per year in Denmark
- 4.1 % of production/sow/year
(4.8 % when export is taken into account)
(Total production: 2,172 mio kg LW produced)



'Side flow' in live weight (mio kg)



Reasons for the 23% dead piglets

- 22.6 % stillborn
- 24.0 % due to crushing by the sow or trauma
- 24.0% due to malnutrition (hunger)
- 13.0% due to blood poisoning, arthritis,
diarrhea
- 3.0 % due to injury at castration
- 13.4 % others or not found

Reasons for the 2.9% dead weaners

- 25.5% due to gastro-intestinal disorders
- 22.7% due to general infection by bacteria
- 17.6% due to pneumonia (lung)
- 14.3% due to arthritis
- 8.9% due to otitis media
- 11.0 % due to others or not found

Reasons for the 3.5% dead finishers

- 23.5% due to pneumonia (lung)
- 20.2% due to arthritis (leg)
- 19.3% due to general infection by bacteria
- 19.3% due to several different diseases
- 10.9% due to otitis media
- 6.8 % due to others or not found

Reasons for the 13.7% dead sows

52.8% euthanized:

- 37% due to locomotors disorders
- 6% due to infection
- 5% due to reproductive disorders
- 4% others or not found

47.2% sudden death:

- 11% due to organ torsion
- 11% related to reproduction
- 8% due to gastro-intestinal disorders
- 5% related to heart
- 12% others or not found

Reasons for dead during transport

Due to strict regulation on transport and short duration hereof (< 3 hours for 95% of the pigs) these numbers are among the lowest in the world

Reasons for rejected at slaughterhouse

The major part is pigs that by the veterinary control are detected to have some kind of illness, and only healthy animals can be used as human food.

A minor part is made up of pigs that are killed immediately after they arrive due to injury from the transport.

Aim to reduce pig mortality by 20% before 2020

- Breeding for stronger and more surviving piglets
(increased % live born piglets and increased chances for surviving the first critical day)
- Improving maternal traits and increasing milk production by the sow, to reach 14 weaned piglets/litter
- Improved environment in farrowing pens and other stables
- Management strategies for handling large litter sizes
- Barriers for transmission of diseases between groups
- Using handbooks to secure correct work routines in stable
- Breeding for improved longevity and improved leg condition among sows.

Productivity - sows

	1981	1995	2009	2011	2015
Prod.weaners / sow / year	18,5	22,3	27,5	28,8	31,4
Live born / litter	10,7	12,3	14,2	14,8	15,9
Dead born/litter			1,9	1,8	1,7
Weaned / litter	-	9,9	12,2	12,7	13,8
Litter/sow/year			2,25	2,26	2,27
Mortality pre weaning*, %	-	19,5	24,2	23,0	21,6
Sow mortality, pct.	-	7	15	13,7	10,5

* Sum of born dead and dead untill weaning

Productivity - finishers

	1981	1995	2007	2011	2015
Daily gain, g	600	752	898	898	947
Feed efficiency, SFU/kg gain	3,3	2,9	2,84	2,87	2,80
Mortality and rejected at slaughter pct.	2,1	3,2	4,1	3,7	3,7



Conclusion I

“Side flow” in primary production of pork in Denmark:

- 27% of the number of pigs in Denmark
- 4.1 % of the weight of pork prod. (kg LW)



Conclusion II

From a waste point of view, a total 'side flow' in Danish primary production of pork of 4% of the total production of pork is relatively low, but from welfare and an economic point of view it is important to reduce mortality.

The aim of the Danish pig sector is to reduce mortality by 20% before 2020.

