COMPASSION in world farming

Briefing on the economic implications of moving to farming systems with higher standards of animal welfare

Contents

Introduction

Overall production costs (including running costs as well as depreciation and interest in respect of capital outlay) are sometimes higher in systems with better animal welfare while in other cases – such as using group housing of sows rather than sow stalls - they are lower.

In some cases there is a 'win-win' with improved welfare producing economic benefits. For example, animals with higher welfare may be healthier resulting in lower veterinary costs and reduced disease and mortality as well as in some instances better growth rates and feed conversion.

Gentler handling of animals at markets and during transport and slaughter may involve few costs other than training but may bring substantial economic benefits in the form of reduced bruising and carcass downgrades.

1. Moving from sow stalls (also known as 'gestation crates') to group housing

Capital and operating costs for sow housing vary greatly between regions, and depend on whether the project is a new building or a retrofit of an existing building.

The costs of moving from sow stalls to group housing vary considerably depending on which form of group housing is selected. Although group housing provides much better welfare than sow stalls, it is important that group housed sows are protected from competition and aggression while feeding. Several systems for achieving this are in use including electronic sow feeders (ESF), free-access stalls and shoulder stalls.

A report by Humane Society International (HSI) compares the costs of installing sow stalls compared with two group housing systems: shoulder stalls and the Gestal 3G system developed by Jyga Technologies.[1] The Gestal 3G allows a sow to enter a stall while feeding to protect her from other sows and to be given an individualised diet tailored to her nutritional needs. Shoulder stalls extend to the sow's shoulder and provide her with some protection from other sows while feeding; feed is often provided in a trickle. Trickle feeding involves dispensing small amounts of feed at intervals which allow slow-eating sows to feed, and keep faster-eating sows in place waiting for the next portion of feed.

Table 1 shows that the HSI report found the cost of installing group housing with shoulder stalls or the Gestal 3G system is lower than the cost of installing sow stalls.

Table 1: Comparison of the cost of installing group housing rather than sow stalls: Cost estimates for a new build from three different equipment providers

Category	Sow stalls	Shoulder stalls	Gestal 3G
Total sow spaces	4,610	5,528	5,454
Total sow spaces	100%	120%	118%
Gating: steel or iron needed	100%	118%	24%
Electronic sow feeders	-	-	100%
Feed system	100%	60%	13%
Plumbing	100%	98%	40%
Install labour	100%	73%	99%
Total	100%	98%	77%
Cost/sow space	100%	81%	65%
Square foot/sow space	18.8	20.4	19.67
Costs/square foot	100%	75%	62%
Costs/sow space (USD)	490.30	399.12	318.66

Source: Humane Society International

Productivity can be higher in group housing than in sow stalls
In the U.S. most sows are housed in sow stalls throughout their pregnancy, whereas in the Netherlands the law only permits sows to be kept in stalls for the first four days of the pregnancy after which they must be kept in groups. Table 2 shows that productivity is much higher and mortality much lower in the Netherlands pig sector than in the U.S. This shows that group housing can deliver productivity benefits comparable to, and even better than, sow stalls. The figures in Table 2 are from the UK Agriculture and Horticulture Development Board.[2]

Table 2: Comparison of sow productivity in the Netherlands and U.S.

	Netherlands			**U.S.**		
Year	2019	2020	2021	2019	2020	2021
Pigs weaned/sow/year	30.10	30.82	32.11	27.91	27.29	27.35
Carcase meat production/sow/year (kg)	2,737	2,860	2,986	2,387	2,323	2,359
Rearing mortality (%)	2.4	2.3	2.5	4.0	4.6	4.1

Source: Agriculture and Horticulture Development Board

2. Provision of straw for pigs

When straw is provided, labour costs rise and the cost of the straw must be taken into account but – crucially – health care costs would fall as would mortality rates.

The potential for economic benefits is illustrated by studies which show that providing enrichment materials and/or more space for growing pigs can produce improved growth rates.[3] [4]

[5] [6] [7] [8] [9] A review of the literature concluded that alternative higher-welfare production systems for fattening pigs lead, in the majority of studies, to equal or faster growth.[10]

Research by Jensen *et al* (2020) provided fattening pigs with different amounts of straw i.e. 10 grams (g), 80g, 150g, 220g, 290g, 360g, 430g or 500g straw per pig per day.[11] Pigs were weighed at the start of the experimental period at approximately 30 kg and again at approximately 85 kg body weight. The average daily weight gain increased 8.1g for every extra 100g straw added daily resulting in 40g higher average daily weight gain with 500g compared to 10g straw per pig per day. Thus, between 10g and 500g, the more straw provided, the higher the daily weight gain.

The researchers conclude: "the present study is an example of simultaneous improvement of pig welfare and performance". The study points out that the provision of straw has been linked to reduced occurrence of gastric ulcers. The researchers state that as the nutritional value of straw is considered minimal, the rise in average daily weight gain occurring with increased provision of straw is likely due to improved gut health from the greater amounts of straw ingested and larger feed intake due to increased stimulation of exploratory behaviour with increasing amounts of straw available, or a combination of these.

A key factor determining the production and price of straw is the suitability of the weather for growing and harvesting crops. Poor weather will reduce the supply of straw leading to increased prices.

3. Moving from farrowing crates to free farrowing pens

Pro-Sau study

The Pro-SAU project conducted in Austria examined a variety of free farrowing pens.[12] [13] It compiled data from research farms and commercial piglet producing farms. The study examined four different confinement periods:

- In CP 3, sows were crated from the end of farrowing for 3 days after parturition
- In CP 4, sows were confined from the day before due date of farrowing for 3 days after parturition
- In CP 6 sows were confined from the day before due date of farrowing for 5 days after parturition
- In CP 0, which was the control, sows were not confined at all.

The reason for these various confinement periods is that many farmers argue that if they are to move away from confining sows in crates until the piglets are weaned at 3-4 weeks of age, they should still be allowed to use 'temporary crating' in which sows are crated during farrowing and for the first few days post farrowing as it is during these first few days that crushing of piglets by the sow is most likely to occur. However, temporary crating is highly damaging to sow welfare, though clearly better than confining sows in crates until her piglets are weaned.

Five pen types were used in the Pro-SAU project. Three provided 5.5m^2, one provided 6.0m^2, while another provided 7.3m^2.

Tables 3-6 are from slides produced by the lead author of the study, Birgit Heidinger, at the conference *Freedom in Farrowing and Lactation* in 2021.[14] The tables show the additional costs involved in using free farrowing pens compared with farrowing crates.

Table 3: Production parameters and additional costs

	Reference: $4m^2$ & permanent crating	Pens with $5.5m^2$ & CP 6 i.e. confined from the day before due date of farrowing for 5 days after parturition	
		Research farms	**Commercial farms**
Piglet mortality (%)	11.9	12.4	12.6
Weaned piglets/litter (n)	11.5	11.4	11.4
Sold piglets/sow & year (n)	26.4	26.2	26.1
Revenue/sow & year (€)	1 842.0	1 828.4	1 822.4
Additional costs/sow & year (€)	-	13.6	19.6

Source: Birgit Heidinger

Table 4: Additional building costs per sow per year for various free farrowing pens compared with permanent crating

Pen type	Additional building costs per sow per year (€)
Temporary crating with $5.5m^2$	23.33
SWAP pen with $6.0m^2$	24.34
Pro Dromi pen with $7.3m^2$	71.70

Source: Birgit Heidinger

Table 5: Additional work costs per sow per year for two free farrowing pens compared with permanent crating

Pen type	Additional work costs per sow per year (€)	Additional work time per sow per year (hours)
Temporary crating with $5.5m^2$	2.63	0.18
Pro Dromi pen with $7.3m^2$	54.95	3.74

Source: Birgit Heidinger

Table 6: Overall additional costs per sow per year for free farrowing pens with $5,5m^2$ and temporary crating compared with permanent crating

Type of additional costs	Additional costs per sow per year (€)
Additional production costs (this is the higher of the two figures in Table 3)	19.6
Additional building costs	23.33
Additional work costs	2.63
Total additional costs	45.56

Source: Author's calculation based on Birgit Heidinger data

This study shows that the use of a free farrowing pen leads to only marginal increases in piglet mortality and marginal decreases in weaned piglets per litter, piglets sold per sow per year, and revenue per sow per year. It leads to additional costs (building, production and work) of €45.56 per sow per year.

The study found that a sow in a free farrowing pen produces 26.1 piglets per year. After slaughter a pig produces around 75kg of meat. So, the 26.1 piglets produced in a year by a sow in a free farrowing pen produce 1,957.5 kg of meat. As the additional annual cost of keeping a sow in a free farrowing pen with temporary crating (rather than in a farrowing crate) is €45.56, the additional cost of producing a kg of pigmeat is just 2.32 eurocents.

Moustsen *et al* (2023)[15] estimated the cost of different kinds of farrowing accommodation as set out in Table 7:

Table 7: Cost of different kinds of farrowing accommodation

Type of accommodation	Cost
Farrowing crate	£3,246
Farrowing pen with temporary crating	£3,751 - £3,758
Free farrowing pen	£3,954

Source: Moustsen *et al*

AHDB Pork study

AHDB Pork completed an economic evaluation of alternative systems for the UK industry using established costings models developed by InterPig.[16] The AHDB figures are set out in Tables 8 and 9.

Table 8: Key costs and physical performance metrics

	2019 farrowing crate	Mortality not increasing in a 6m² pen	Mortality not increasing in a 8m² pen	14% mortality in a 6m² pen	14% mortality in a 8m² pen	18% mortality in a 6m² pen	18% mortality in a 8m² pen
Pre-weaning mortality	12.34%	12.34%	12.34%	14%	14%	18%	18%
Sow feed/sow/year	1370kg	1470kg	1470kg	1470kg	1470kg	1470kg	1470kg
Building cost/sow (incl dry, farrowing & lactation)	£2100	£2570	£3040	£2570	£3040	£2570	£3040
Straw & bedding/sow	£31.85	£32.34	£32.34	£32.34	£32.34	£32.34	£32.34
Disposal of dead animal costs/sow	£12.89	£12.89	£12.89	£13.33	£13.33	£14.41	£14.41
Extra piglet creep feed/sow	-	£1.37	£1.37	£1.35	£1.35	£1.28	£1.28

Source: Agricultural and Horticultural Development Board

Table 9: Cost of production: pence/kg deadweight

	2019 farrowing crate	Mortality not increasing in a 6m^2 pen	Mortality not increasing in a 8m^2 pen	14% mortality in a 6m^2 pen	14% mortality in a 8m^2 pen	18% mortality in a 6m^2 pen	18% mortality in a 8m^2 pen
Feed	89.76	90.64	90.64	90.94	90.94	91.70	91.70
Other variable costs	11.39	11.47	11.53	11.62	11.69	12.02	12.09
Labour	12.47	12.47	12.47	12.62	12.62	12.99	12.99
Building finance & misc	34.92	36.80	38.63	37.12	38.98	37.93	39.88
Total costs	**148.54**	**151.39**	**153.27**	**152.30**	**154.22**	**154.64**	**156.66**
Increase from base	**-**	**2.84**	**4.73**	**3.75**	**5.68**	**6.10**	**8.12**

Source: Agricultural and Horticultural Development Board

AHDP concluded that "Based on the evidence currently available, when taking account of likely changes to physical performance and costings, we expect the cost of production for GB indoor herds installing alternative farrowing systems to increase by 3-8p/kg deadweight depending on the chosen pen design's footprint and the mortality achieved. Even for those producers who might achieve comparable pre-weaning mortality levels, costs are likely to rise by 3-5p/kg".

The suggestion that production costs could rise by 8 pence per kg deadweight is based on assuming an18% mortality rate in free farrowing pens. This is most unlikely to occur. Scientific research shows that in well-designed, well-managed free farrowing pens, piglet mortality can be kept as low as, or lower than, in farrowing crates.[17] [18] [19]

A UK National Pig Association (NPA) briefing states that pork produced using the PigSAFE free-farrowing pen would need to command a premium of 1.6% (2.3 p/kg) to allow producers to break even, if piglet mortality remains at the same level.[20]

However, piglets raised in free farrowing systems can have increased weaning weights (which can result in pigs reaching slaughter weight more quickly). This arises because sows in such systems are less stressed and so produce more milk.[21,22] An increase in piglet weaning weight of 0.3 kg would reduce the premium required in PigSAFE pens to just 1.3 p/kg carcass weight (0.9% extra).[23] Also, the sows in free farrowing systems tend to have better body condition scores which can benefit the health and survival of the next litter.

Finally, we should note that the additional production costs arising from using free farrowing systems likely to decrease as producers become more efficient in operating these systems.

4. The relative costs of surgical castration of pigs and immunocastration

Mancini *et al* (2017) state that "the literature tends to agree that, on average, the costs of immunocastration are balanced by the benefits" such as higher feed efficiency and thinner carcases.[24] De Roest (2009) concluded that the "benefits from the improvement in feed efficiency compensate for the extra costs of immunocastration" and that "the improvement in feed efficiency may compensate almost entirely for the cost of vaccination".[25]

Two vaccinations are needed for immunocastration. One dose of Improvac costs farmers between €1.40 and €1.50, so two vaccinations will cost between €2.80 and €3.00 (these are 2019 figures).

However, immunocastrated pigs are more efficient than physically castrated pigs at converting feed into lean body weight. Previous research has estimated that the better feed conversion is worth €6.10 per pig for immunocastrated pigs.[26]

This means that not only are the feed costs lower for immunocastrates but Zoetis, who produce Improvac which is used for immunocastration, state that the pigs have a lower environmental impact (e.g., less manure, less phosphorous, less energy) in reaching the same weight. They also produce a carcass with a higher proportion of lean meat.[27]

5. Egg production: Moving from cages to barn/aviary systems

In some countries most hens are still kept in battery cages. These are often referred to as 'barren' or 'conventional' cages to distinguish them from 'enriched' cages. In the EU the use of battery cages is prohibited by law; if cages are used, they must be enriched cages.

In barn and aviary systems hens are housed indoors but not in cages. In barns, hens are kept on a litter floor; aviaries are similar except that hens are kept on multiple levels so allowing more efficient use of space. Eggs produced in both barn and aviary systems are usually marketed as 'barn eggs'.

The European Commission said in 2021 that it would propose a legislative ban on enriched cages. It has not yet done this but is coming under strong pressure to do so. In the U.S. many of the largest retailers have pledged to go entirely cage-free by January 2026.

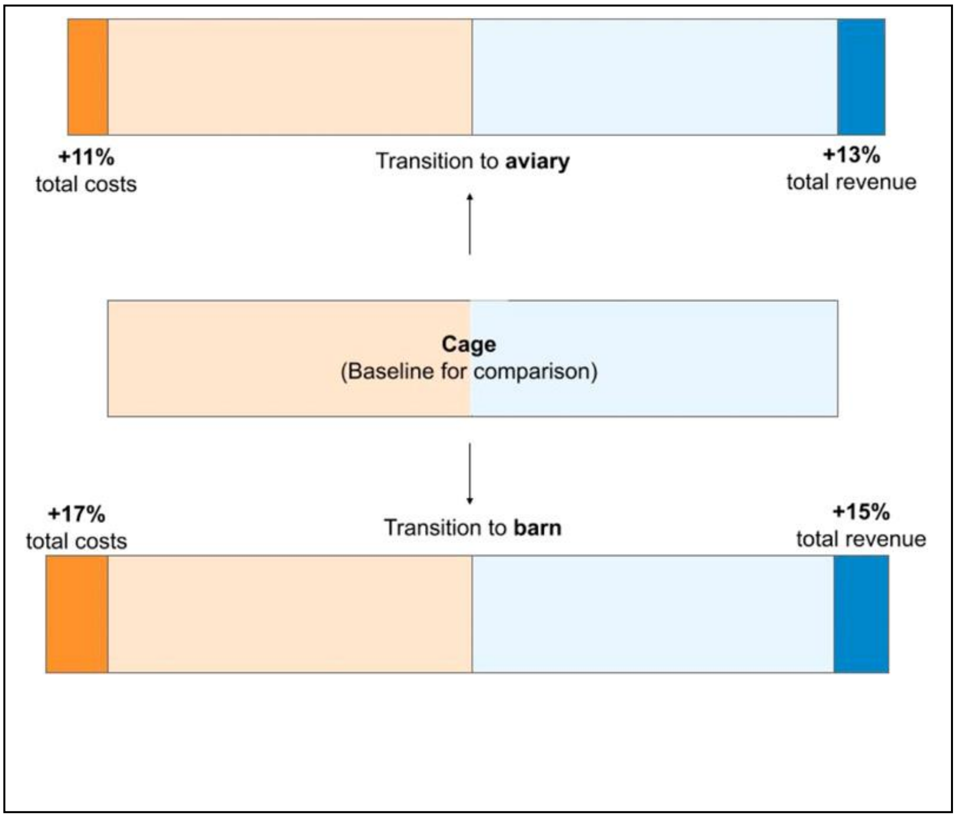
Van Horne and Bondt (2023) point out that egg production costs can be divided into six components:

- hen (cost of young hen at 20 weeks, less the revenue obtained when the hen is sold for meat at the end of her productive life)
- feed (feed costs during the laying period)
- other (all other variable costs e.g. electricity, litter and animal health)
- labour (cost of the labour of the farmer or a farm worker)
- housing (depreciation, interest and maintenance cost on building and equipment)
- general costs (book-keeping, clothing, insurance and, if applicable, manure disposal costs).[28]

Southeast Asia

Ryba (2024)[29] states: "In Southeast Asia, the emerging trend towards cage-free egg production is largely driven by retailer commitments. For example, Tesco has committed to sell only cage-free eggs in Thailand and Malaysia by 2028 (HSI, 2019)[30]." The publication *Poultry* World states that global companies such as Subway, Burger King, Sodexo, Compass Group, Accor Hotels, Metro AG and Marriott International have made global cage-free pledges that cover Asia.[31]

Ryba (2024) reviewed a large number of studies from Southeast Asia and other parts of the world. She reports that studies from around the world have found that cost increases associated with cage-free egg production are matched by revenue increases. This can be seen in Figure 1 which is reproduced from Ryba (2024).



Source: Ryba, 2024

Figure 1 shows that, across the studies reviewed by Ryba (2024), aviaries involved a median cost increase compared with cages of 11%, while the median cost increase from cages to barns was 17%. This is roughly offset by higher revenues; the median revenue increase is 13% from cages to aviaries and 15% from cages to barns. However, the author points out that, while medians provide a useful indication, they are not precise values. She points out: "The minor differences between these revenue and cost values (+2% and -2%), respectively) will be naturally swamped by normal fluctuations in input costs and output prices in any real-world context (e.g. feed prices)".

A survey of 224 Asian egg producers by de Luna *et al* (2022) found that the majority of producers (65%) responded "yes" or "maybe" when asked if they consider cage-free systems to be feasible in their country.[32] The most common reasons to consider adopting cage-free systems included improved animal welfare, increased market access, and increased product quality. Most producers (72%) said more support is needed to establish cage-free farms, mostly pertaining to technical advice and training in cage-free system management and best practice.

U.S.

Caputo *et al* (2023) carried out surveys of U.S. egg producers.[33] The survey responses suggest that expenses in cage-free systems would be 8 to 19% higher than in cage systems. The authors point out that, compared to cage housing, cage-free annual costs are 18% higher for labour, 11% higher for feed, 17% higher for fixed/non-operating capital, 16% higher for variable/operating capital, 9% higher for electrical/utilities, 8% higher for repairs/maintenance, 11% higher for mortality, and 8% higher for morbidity. Set against the anticipated 8-19% higher costs in cage-free systems, survey responses suggest that revenue will be 8% higher in cage-free systems than in cage systems.

The largest cost element in egg production is feed; this is a much bigger component than housing. Fluctuations in feed prices, which can vary considerably from year to year, can have a much larger impact on egg production costs than whether cage or non-cage housing systems are used.

It should also be noted that when egg producers transition to non-cage systems the additional production costs are likely to decrease as producers and their personnel become more efficient in operating these systems.

EU

Van Horne and Bondt (2023) have calculated the production cost differences between egg production in battery cages and in barn/aviaries in North West Europe using a base year of 2021.[34] Table 10 shows these differences.

Table 10: Comparison of egg production costs in barren cages and barn/aviaries in North West Europe, 2021

	Conventional (barren) cage: stocked at 550cm² per hen	**Barn/aviary Stocked at 9 hens per m²**
Cost in euro per hen housed:		
Pullet (at 17 weeks)	4.29	4.73
Feed	16.01	17.11
Other variable costs	1.24	1.35
Housing	2.46	3.84
Labour	1.32	2.47
General costs	0.39	0.66
Revenue from spent hens	-0.29	-0.38
Total cost	25.42	29.76
Total cost per egg: eurocent	**5.80**	**6.95**
Total cost per kg: euro	**0.95**	**1.15**
Increase from barren cage at 550cm²		**21%**

Source: van Horne & Bondt

Table 11 sets out assumptions regarding labour and housing made by van Horne and Bondt in comparing egg production costs in barren cages and barn/aviaries

Table 11: Assumptions made by van Horne and Bondt in comparing egg production costs in barren cages and barn/aviaries

	Conventional (barren) cage: stocked at 550cm² per hen	**Barn/aviary stocked at 9 hens per m²**
Labour:		
Number of hens per worker	75,000	40,000
Buildings:		
Density (hens per m²)	35	18
Surface area per house (gross m²)	2,336	2,302
Investment:		
Housing (euro per hen housed)	7.32	13.53

Inventory (euro per hen housed)	11.95	17.50

Source: van Horne & Bondt

Table 12 sets out the main assumptions made by van Horne and Bondt regarding production barren cages and barn/aviaries.

Table 12: main assumptions made by van Horne and Bondt regarding production in barren cages and barn/aviaries

	Conventional (barren) cage: stocked at 550cm^2 per hen	**Barn/aviary stocked at 9 hens per m^2**
Laying period (days)	490	490
Eggs per hen housed (number)	438	428
Feed consumption/hen/day (grams)	110	118
Egg production per hen housed (kg)	26.7	25.9

Source: van Horne & Bondt

6. Broiler chicken production costs

Aviagen, a global market leader in poultry genetics, points out that feed is the major component of broiler input cost and can account for up to 70% of the total production cost.[35] In the EU feed accounts for around 60% of overall broiler production costs at farm level.[36] Hence, an increase of, say, 10% in non-feed costs, such increasing space allowance or the provision of enrichment materials, will add much less than 10% to overall production costs.

A study by Wageningen University has compared the costs involved in producing broilers in the Netherlands under:

- conventional (intensive) standards. Birds are fast growing and stocked at a maximum density of 42kg/m^2
- the *New Dutch Retail Standard* (NDRS) which is the standard applied by Dutch retailers. This requires the use of slower-growing birds and a maximum stocking density of 38kg/m^2
- what the authors refer to as a *Global Welfare Standard*. This requires the use of slower-growing birds and a maximum stocking density of 30kg/m^2.[37]

Details of the three systems are set out in Table 13.

Table 13: Characteristics of three broiler systems examined by Wageningen

Production system	**Broiler type**	**Stocking density (kg/m^2)**	**Natural light**	**Enrichment (grains, straw bales, perches)**	**Light intensity (lux)**
Conventional intensive	Fast growing	42	No	No	20
New Dutch Retail Standard	Slower-growing	38	No	2g/broiler 1 bale/1000 broilers	20
Global Welfare Standard	Slower-growing	30	Yes	2 bales/1000 broilers 2m perch/1000 broilers	20

Table 14 sets out the costs involved in each of these systems.

Table 14: Costs involved in three broiler production systems (eurocents per kg live weight)

System	Variable costs							Fixed costs				Total costs
	Feed	Chicks	Health	Litter	Grain & straw	Catch ing	Other	General	Lab our	Hous ing	Equip ment	
Conv - NL	52.7	13.7	2.0	0.4	0	2.1	4.3	0.8	2.7	3.6	2.1	**84.3**
NDRS	61.5	14.0	1.5	0.6	0.6	2.0	5.0	0.8	3.5	5.1	3.1	**97.7**
GWS	61.5	14.0	1.5	0.6	1.4	2.0	5.7	0.8	6.0	6.4	4.3	**104.1**

Average annual per capita consumption of broiler meat in the EU is 20.8kg, which amounts to an average of 400 grams per capita per week.[38] Broilers raised to the *New Dutch Retail Standard* (NDRS) cost 13.4 eurocents per kg more to produce than conventional intensively reared broilers. Switching from intensively produced broilers to ones raised to the NDRS standard would add just 5.36 eurocents to an average consumer's weekly food bill, provided that retailers charge no more extra for NDRS chicken than is needed to cover the additional cost of producing it.

Broilers produced to the GWS cost 19.8 eurocents per kg more to produce than conventional intensively reared broilers. Switching from intensively produced broilers to ones raised to the GWS standard would add just 7.92 eurocents to an average consumer's weekly food bill.

There is some evidence that the additional costs involved in providing better welfare can be offset by the production advantages arising from the improved health of the birds.[39] A 2020 RSPCA report compared three conventional fast-growing broiler breeds with a slower growing breed. The report is based on a trial described in Dixon (2020).[40]

The RSPCA report found that, compared with the slower growing breed, the three conventional breeds had significantly higher mortality (including culls), poorer leg, hock and plumage health, and more birds affected by breast muscle disease (wooden breast and white striping). Some of the key differences are set out in Table 15.

Table 15: Key health and meat quality results from the RSPCA commissioned trial to assess the production and welfare characteristics of the leading meat chicken breed from each of the three globally dominant meat chicken breeding companies (conventional breeds) and a commercially viable slower growing breed

	Slower growing breed	Conventional fast growing breeds			Compared to the slower growing breed, the conventional breeds …
		Breed A	Breed B	Breed C	
Mortality (including culls) (%)	5	11	11	7	had 1.4–2.2 times higher mortality (an increase of 40–120%)
Lame birds (gait scores 3,4 & 5) (%)	11	38	28	26	had 2.4–3.5 times more lame birds (an increase of 136–245%).
Hock burn (%)	19	77	70	59	had 3.1–4.1 times more birds with hock burn (an increase of 211–305%)

White striping of breast muscle (%)	10	78	78	63	had 6.3–7.8 times more birds with white striping of the breast muscle (an increase of 560–713%)
Wooden breast muscle (%)	1	23	3	14	had 3–23 times more birds with wooden breast

The slower growing breed consumed more feed than the fast growing birds to achieve the same slaughter weight. Further, due to the slower growing birds' longer lifetime, fewer flocks can be reared per year. However, the RSPCA concludes that these factors "are likely to be significantly, if not entirely, offset if other factors affecting the conventional breeds are taken into account. For example, the mortality of two of the conventional breeds was more than double that of the slower growing breed." In addition, the much higher incidence of lameness, hock burn and breast muscle disease in fast growing breeds will have economic implications. The RSPCA states "there are significant inefficiencies associated with producing meat from the conventional breeds that, if taken into account, would have a considerable impact on the cost of production and could result in higher production costs compared to the rearing of higher welfare breeds."

7. Improved welfare can lead to economic benefits including reduction in certain production costs and losses

In better welfare systems, animals will tend to be healthier.[41] [42] [43] [44] [45] This can lead to savings in terms of reduced expenditure on veterinary medicines, including antimicrobials, and lower mortality rates. Healthier animals also can produce economic benefits in the form of better feed conversion ratios, higher growth rates, fewer injuries as well as better immune response and ability to resist disease. In some cases the economic benefits will outweigh the costs incurred in achieving them while in other cases the costs will overshadow the financial gains.

An Australian study found that providing shade infrastructure for cattle reduced the intensity of the heat load experienced by the animals and led to an increase in profits that outweighed the cost of installing shade.[46]

Training can improve the skills of stock keepers leading to improved economic returns. Research shows that good stockkeeping (such as gentleness in handling) leads not only to improved welfare but also to enhanced productivity, for example improved growth rates and fertility in pigs, improved feed conversion and growth rates in calves and broiler chickens, and increased milk yield in dairy cows.[47] One study evaluated the effect of a training course undertaken by stockpersons and found an increase in the number of pigs weaned per year of between 3.8% and 12.4%.[48]

Aggressive handling of cattle can result in bruising and damage which lowers carcass value. Low-stress handling can bring economic benefits including increased efficiency, increased weight gain without additional inputs and reduced carcass downgrades.[49]

There are considerable economic benefits - in the form of reduced bruising and improved meat quality - in handling animals gently, transporting them with care, and slaughtering them in a quiet, efficient and compassionate manner.[50] [51] Stress before and during slaughter has serious adverse effects on meat quality.[52]

Two linked studies looked at pig carcase condemnation rates at slaughterhouses in the Republic of Ireland (ROI) and Northern Ireland (NI).[53] In the first study economic analysis of data from three NI slaughterhouses shows an average loss of €0.37 per pig slaughtered in the study population of 14,794 pigs as a result of carcase condemnations. The second study focussed on one ROI slaughterhouse; it found that the high condemnation rate at this slaughterhouse equated to an average loss of €0.79 per pig slaughtered.

The researchers conclude that the ability to reduce many of the financial losses associated with condemnations is within the control of the producer. Abscessation and other infectious conditions are the main causes; control of these can be achieved by addressing welfare issues on farm such as: re-mixing, overcrowding, poor hygiene, damaged/inappropriate flooring and absence of manipulable substrates. If these issues can be resolved the pigs' welfare (and consequently health status) should concurrently improve and the financial losses associated with carcase condemnations could be reduced.

8. The impact of welfare improvements on retail prices

McInerney points out that the impact on retail food prices of welfare improvements is often "greatly over-stated".[54] He explains that most husbandry changes required for higher welfare methods affect only a subset of the overall costs entailed in livestock production (such as space allowance, housing, feed, health management, transportation standards) leaving all the other costs unchanged. He states "so while some components of production costs may as much as double (unlikely) the resulting impact emerges as perhaps just, say, a 10% increase in overall production cost".

Moreover, any increase in on-farm production costs arising from the use of a higher welfare system will have a proportionately smaller impact on the retail price. For example, a 10% rise in on-farm production costs will lead to a significantly lower than 10% increase in the retail price. This is because on-farm production costs are only one of a range of factors which determine the retail price. Distribution and marketing are also significant components of the final price. For example, a rise in the price of fuel may well have more impact on the retail price of pork than improving the way in which the pigs are housed.

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