River Court, Mill Lane, Godalming, Surrey, GU7 1EZ
T: +44 (0)1483 521 950  F: +44 (0)1483 861 639

## Economic implications of moving to improved standards of animal welfare

The economic implications of introducing higher standards of animal welfare are complex and may vary between countries depending on factors such as differing costs of land, building materials, feed and labour.  This article can serve only as an introduction to this area.

The picture that emerges from this article shows that:

- replacing existing buildings and equipment with higher welfare systems often involves very large capital outlay costs.  However, these costs will be much reduced if the change is delayed until the existing facility has reached the end of its working life;
- where a producer is constructing a new building (rather than replacing an existing one) the capital costs entailed in selecting a higher welfare system will in some cases be greater - but sometimes will be less than - those of a lower welfare system;
- overall production costs (including running costs as well as depreciation and interest in respect of capital outlay) are generally higher in better welfare systems although in some cases they are lower;
- the additional costs associated with higher welfare systems may be relatively small in some cases.  However, for such systems to be economically viable, producers must receive a price premium that covers the extra costs   In the EU and US a reasonable proportion of consumers are willing to pay higher prices for higher welfare products. However, consumers in  the non-EU countries covered by this report may not be able or willing to do so;
- 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;
- Improved welfare may in some cases entail very few additional costs.  For example, gentler handling of cattle may involve few costs other than training but may bring substantial economic benefits in reduced bruising and carcase downgrades.

Certain improvements will involve major capital investments.  The capital costs of introducing a higher welfare system will vary depending on whether the producer has to convert an existing building and replace existing equipment or whether he or she is constructing a new building either because they are expanding their business or are entering livestock production for the first time.  Converting a building and replacing equipment is generally more burdensome economically than providing a new building and equipment as in the latter case the difference in cost between providing a lower or higher welfare system may be relatively small.

Similarly, the costs involved in changing an existing system will be much less if the producer is able to wait until the present infrastructure and equipment (e.g. battery cages) have come to the end of their working life and have to be replaced. At that point it may cost little more to install a higher welfare system than a lower welfare system; for example, the capital costs of installing group housing for sows are no greater (and may well be lower) than providing sow stalls.

Indeed the reason why EU legislation often gives producers a lengthy phase out period when a particular production system is banned is to ensure that a proportion of producers will, before the ban comes into force, reach the point where their infrastructure and equipment come to the end of their working life and would in any event need to be replaced. It is indeed important to give producers an extended phase out period which is tailored to the level of development of the subsector and country in question. The EU gave egg producers 12.5 years to phase out barren battery cages and pig producers 11.5 years to phase out sow stalls.

There is a widespread assumption that moving to higher welfare systems and outcomes for farm animals invariably entails a substantial increase in production costs (including running costs and depreciation and interest in respect of capital investment). However, analysis of industry data shows that in certain cases, such as changing from sow stalls to group housing, higher welfare farming adds relatively little to the costs of production.

As indicated above, improvements to welfare may involve major investments of capital; however, in other cases small inexpensive changes to the design of handling facilities or equipment or changes in the behaviour of animal handlers may be sufficient to deliver important welfare improvements.

For example, the author has seen a new cattle slaughterhouse in the Middle East in which the passageway from unloading to the place of slaughter went through a right angled bend. This layout has built welfare problems into the system as cattle will not move through a right angle; almost inevitably the slaughter personnel will end up beating the animals. It would not have been more expensive to build a curved passageway through which cattle will readily move. The issue was not one of cost but of the designer not understanding how cattle move.

**Egg production costs**

2013 data show that production costs in enriched cages are 7% higher than in conventional (barren) battery cages stocked at 550 $cm^2$ per hen (the minimum space allowance in the EU from 2003 until the ban on barren cages came into force in 2012).[1] In the aviary system the increase is 22%. If a comparison is made with battery cages stocked at 450 $cm^2$ per hen, production costs in enriched cages are 11% higher and those in avaries 26% higher.[2]

A study prepared for the European Parliament compares egg production costs in the EU and selected third countries (Argentina, Brazil, India and the US).[3] The study shows that the main factor influencing the disparity between production costs in the EU and the third countries are differences in feed costs.

---

[1] Van Horne P, 2013. Production costs of eggs: analysis and trends. International Egg Commission conference, Sepember 2013.

[2] *Id*

[3] European Parliament Directorate General for Internal Policies, 2010. The poultry and egg sectors: evaluation of the current market situation and future prospects. http://www.europarl.europa.eu/RegData/etudes/etudes/join/2010/438590/IPOL-AGRI_ET(2010)438590_EN.pdf

In 2005 the RSPCA published data that showed the production costs in different systems. In some cases the data distinguishes between whether an existing building is used or a new one is constructed.[4] The data also distinguishes between small enterprises (12 000 hens), medium scale (100 000 hens) and large enterprises (400 000 hens). The data includes both capital and running costs.

The data derives from a series of case studies carried out with individual egg producers. In addition a number of equipment manufacturers were consulted to obtain quotes for the different systems which could, under EU law, be installed to replace barren battery cages.

The RSPCA data is shown in Table 1.

**Table 1: Total costs (capital and running) of egg production in different systems**

**Costs are stated in UK pence per dozen (12) eggs**

| System of production | Small case study | Medium case study | Large case study |
|---|---|---|---|
| Existing cage (barren) | 54.46 | 43.81 | 41.89 |
| Enriched cage | 55.97 | 45.32 | 43.40 |
| Existing barn multi-tier | 54.86 | 49.66 | 44.86 |
| New barn multi-tier | 57.25 | 52.05 | 47.25 |
| Existing barn single tier | - | 54.71 | 52.21 |
| New barn single tier | - | 61.57 | 59.07 |
| New free range multi-tier 2500 hens/ha | 76.79 | 69.19 | 67.45 |
| New free range single tier 2500 hens/ha | 78.39 | 71.31 | 69.58 |
| New free range multi-tier 1000 hens/ha | 79.55 | 71.95 | 70.22 |
| New free range single tier 1000 hens/ha | 81.15 | 74.07 | 72.34 |

Source: The case against cages: evidence in favour of alternative systems for laying hens, RSPCA

It can be seen from Table 1 that producing eggs in a new multi-tier barn rather than in barren battery cages adds on average 11.7% to egg production costs. This figure is based on an average of the cost differential between these two systems for small, medium and large producers.

For a producer with an existing multi-tier barn the cost differential between production in barren battery cages and a multi-tier barn is 6.6%. Again, this figure is based on an average of the cost differential between these two systems for small, medium and large producers.

[4] The case against cages: evidence in favour of alternative systems for laying hens, RSPCA http://www.rspca.org.uk/ImageLocator/LocateAsset?asset=document&assetId=1232712906556&mode=prd

Data in a socio-economic report prepared for the European Commission show that a free-range egg costs just 2.6 eurocents more to produce than a battery egg, and a barn egg costs just 1.3 eurocents more to produce than a battery egg.[5] The European Commission accepted these figure in a 2008 report[6]; it was on the basis of this report that the Commission decided not to propose any postponement of the EU ban on barren battery cages.

Figures published for December 2010 by the National Farmers Union (England and Wales) show that a dozen free range eggs cost 94.31 pence [€1.10][7] to produce while the cost of producing a dozen cage eggs is 69.34 pence [€0.81].[8] Turning to the cost of producing one egg, one free range egg costs 7.86 pence [9 eurocents] to produce and one cage egg 5.78 pence [7 eurocents]. This means that a free-range egg costs just 2.08 pence [2 eurocents] more to produce than a cage egg.

If producers had to bear the increased production costs themselves those costs would be extremely burdensome. For the introduction of a higher welfare system to be economically feasible for producers, it is vital that the additional costs involved are borne by those who buy the eggs (wholesalers, retailers or consumers); for individual consumers the extra price of eggs should amount to just a few eurocents each per week.

It appears that consumers in the EU and US are generally willing to pay a higher price for barn and free range eggs and that this is sufficient to cover the additional costs of producing such eggs rather than cage eggs. In 2012, the US Department of Agriculture stated that conventional eggs were selling in grocery stores for $1.18 [€0.89][9] per dozen, whereas non-organic cage-free eggs were selling for $3.59 [€2.71] per dozen.[10] Retail egg prices noted in supermarkets in selected EU Member States in the period 23-28 August 2013 indicate that in general the higher prices being charged for barn and free range eggs are more than sufficient to cover the extra costs of producing such eggs; details of these prices are set out in Table 2.

**Table 2: Retail egg prices in supermarkets in selected EU Member States in the period 23-28 August 2013**

| Member State | Price of 6 enriched cage eggs | Price of 6 barn eggs | Price of 6 free range eggs |
|---|---|---|---|
| Italy | €0.90 | €1.68 | €1.86 |
| UK | None on sale at supermarkets visited | £1.05 [€1.23] | £1.49-£1.90 [€1.74-€2.22] |
| Poland | 2.93-2.99 Zloty [€0.68-€0.70] | 6.99-7.99 Zloty [€1.63-€1.86] | 7.99-8.69 Zloty [€1.86-€2.03] |
| France | €1.24-€2.00 | €1.63 | €1.70-€3.30 |
| Greece | €1.39-€1.43 | €1.70-€2.71 | €2.21-€3.44 |

Source: figures collected by the author and colleagues

[5] Study on the socio-economic implications of the various systems to keep laying hens. Final report for the European Commission by Agra CEAS Consulting Ltd. December 2004.
[6] European Commission Communication on the various systems of rearing laying hens in particular those covered by Directive1999/74/EC. 08.01.2008 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0865:FIN:EN:PDF
[7] GB Pounds have been converted to Euros at the exchange rate of £1=€1.17 (rate on 29 August 2013)
[8] Business Brief – NFU Poultry. Edition 33: February – March 2011.
[9] US Dollars have been converted to Euros at the exchange rate of $1=€0.75 (rate on 29 August 2013)
[10] Bret Thorne, "Burger King to go cage-free, supply costs may rise". http://nrn.com/archive/burger-king-go-cage-free-supply-costs-may-rise Accessed 29 August 2013

Note: the range of prices for a particular class of eggs in the same Member State arise from differences in size and quality distinctions such as feed being GMO free, freshness and, in France, the eggs carrying the *Label Rouge* mark.

In some cases producers are not only able to recover the additional costs of producing barn or free range eggs rather than cage eggs from the purchaser but are able to achieve a higher net margin. The Commission's socio-economic report referred to earlier[11] and a University of Manchester study[12] show that margins for free-range eggs can be around twice as high as those for conventional battery eggs. However, circumstances can change and producers of higher welfare eggs may find higher net margins being eroded over time.

However, while a substantial proportion of consumers in the EU are willing to pay the higher prices needed to cover the additional costs of producing non-cage eggs, consumers in the non-EU countries covered by this report have lower average incomes and may be less willing and less able to pay more for higher welfare eggs.

**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.[13] In the EU feed accounts for around 60% of overall broiler production costs at farm level.[14]

For non-EU producers who wish to comply with the EU Directive on broiler welfare, one of the main aspects that will impact on costs is the maximum stocking density set by the Directive. The Directive sets a maximum density of 33 kg/m$^2$ but, by way of derogation, permits Member States to allow the keeping of broilers up to a maximum of 39 kg/m$^2$ provided that a number of welfare conditions are met. By way of further derogation, Member States may allow broilers to be kept up to a maximum of 42 kg/m$^2$ if certain further criteria are fulfilled. Most Member States permit broilers to be kept at the higher densities of 39 kg/m$^2$ or more commonly 42 kg/m$^2$. Accordingly, non-EU producers who wish to observe the EU Directive are usually going to have a maximum density of 39 kg/m$^2$ or 42 kg/m$^2$ in mind.

A non-EU producer who wishes to build housing for a flock of 100 000 broilers stocked at 42 kg/m$^2$ will need to construct housing of 4762 m$^2$; this figure is based on the assumption that broilers are grown to a slaughter weight of 2 kg. However, a producer who wishes to comply with the maximum stocking density of 39 kg/m$^2$ will need to provide housing of 5128 m$^2$, i.e. the producer will need to build an additional 366 m$^2$ of housing. The cost per m$^2$ of building housing will of course vary as between different countries.

The capital cost of providing a small amount of extra space has only a moderate impact on overall broiler production costs. A detailed UK study estimates that the cost of providing a

---

[11] Study on the socio-economic implications of the various systems to keep laying hens. Final report for the European Commission by Agra CEAS Consulting Ltd. December 2004.

[12] Russell N., Zhuang Y. Farrar J. and Clare M., 2005. The economics of egg production: 2003. Special studies in agricultural economics: report no. 62. Economic Studies, School of Social Sciences, University of Manchester. February 2005.

[13] http://www.thepoultrysite.com/articles/894/economic-approach-to-broiler-production
Accessed 2 August 2013

[14] European Parliament Directorate General for Internal Policies, 2010. The poultry and egg sectors: evaluation of the current market situation and future prospects.
http://www.europarl.europa.eu/RegData/etudes/etudes/join/2010/438590/IPOL-AGRI_ET(2010)438590_EN.pdf

broiler space ranges from £6 - £9 [€7 - €10.50] depending on the amount of space provided.[15] The study estimates that seven broiler flocks will be produced each year. If one assumes a fifteen year life for a broiler house (in practice it may be longer), 105 broilers will be produced from each broiler space during the life of the house.

A study prepared for the European Parliament found that reducing stocking density from 42kg/m$^2$ to 38kg/m$^2$ would add 2% to production costs, while reducing density from 38kg/m$^2$ to 34kg/m$^2$ would add 2.5% to production costs.[16] These figures indicate that the cost of providing additional space has only a moderate impact on overall costs. This is in part due to the fact that the cost of chicks and feed are by far the largest aspect of broiler production costs.[17] In the EU the cost of housing comprises just 5%-9% of overall broiler production costs at farm level (the range is due to the percentage varying between different Member States).[18]

Some other welfare improvements also involve relatively modest costs. The *Freedom Food* standards require the provision of enrichment such as straw bales and perches. These can improve bird health and welfare by encouraging birds to be more active, thereby promoting improved leg health. Such enrichments can be provided at a cost of around 1 eurocent per bird.

There is some evidence that the additional costs involved in providing better welfare can be offset by the production advantages from the resulting improved health and welfare of the birds.

A comparison of production results in standard intensively-reared birds (housed at 38 kg/m$^2$) and birds reared to RSPCA *Freedom Food* standards in extensive indoor systems (housed at 30kg/m$^2$, using moderately slower growing birds and providing environmental enrichment) indicates lower mortality, fewer transport losses, fewer slaughterhouse rejects and a greater proportion of grade A carcasses in the *Freedom Food* birds.[19]

An analysis of data relating to chickens reared to *Freedom Food* and UK *Red Tractor* (standard intensive housed at 38 kg/m$^2$) standards shows that measurably better welfare outcomes were achieved by the *Freedom Food* birds.[20] The average level of hock burn for the *Freedom Food* chickens was 3.5% compared with 19.0% for the *Red Tractor* birds. The *Freedom Food* chickens had an average level of foot pad burn of 3.5% compared with 6.5% for the *Red Tractor* birds. The average mortality rate for the *Freedom Food* broilers was 1.8%, while that of the *Red Tractor* birds was 5.1%.

---

[15] Sheppard A & Edge S, 2005. Economic and Operational Impacts of the Proposed EU Directive laying down Minimum Standards for the Protection of Chickens kept for Meat Production. University of Exeter http://socialsciences.exeter.ac.uk/media/universityofexeter/research/microsites/centreforruralpolicyresearch/pdfs/researchreports/BRreport05.pdf

[16] European Parliament Directorate General for Internal Policies, 2010. The poultry and egg sectors: evaluation of the current market situation and future prospects. http://www.europarl.europa.eu/RegData/etudes/etudes/join/2010/438590/IPOL-AGRI_ET(2010)438590_EN.pdf

[17] *Id*

[18] European Parliament Directorate General for Internal Policies, 2010. The poultry and egg sectors: evaluation of the current market situation and future prospects. http://www.europarl.europa.eu/RegData/etudes/etudes/join/2010/438590/IPOL-AGRI_ET(2010)438590_EN.pdf

[19] RSPCA (2006) Everyone's a Winner: How rearing chickens to higher welfare standards can benefit the chicken, producer, retailer and consumer. Royal Society for the prevention of Cruelty to Animals, Horsham, UK. Available online at: http://www.rspca.org.uk/servlet/Satellite?blobcol=urlblob&blobheader=application%2Fpdf&blobkey=id&blobtable=RSPCABlob&blobwhere=1158755016591&ssbinary=true&Content-Type=application/pdf

[20] Agra CEAS Consulting, 2006. Broiler analysis (Report for RSPCA).

The average level of *Freedom Food* broilers that were dead on arrival at the slaughterhouse was 0.05% compared with 0.17% for *Red Tractor* birds. The average level of slaughterhouse rejects was 1.6% for the *Freedom Food* birds in contrast to 1.9% for the *Red Tractor* birds. The average level of *Freedom Food* birds graded ‘A’ was 83.4% while the figure for *Red Tractor* birds was 66.2%.

The RSPCA has compared the financial implications of rearing broilers to these two different standards. The RSPCA considered the situation where the shed size was the same with the result that the number of birds reared to *Freedom Food* standards was lower than the number reared to *Red Tractor* standards. The results are presented in Table 3.

**Table 3: Differences between rearing broilers to *Freedom Food* and *Red Tractor* standards in the same size shed**

| Parameter | *Freedom Food* | *Red Tractor* | *Freedom Food* compared to *Red Tractor* |
|---|---|---|---|
| Shed size ($m^2$) | 1315.8 | 1315.8 | No difference |
| Weight birds reared to (kg) | 2 | 2 | No difference |
| Stocking density (kg/ $m^2$) | 30 | 38 | -8 |
| Number of broilers per $m^2$ | 15 | 19 | -4 |
| Number of chicks placed in shed | 19,737 | 25,000 | 5,263 |
| Age at slaughter (days) | 50 | 39 | +11 |
| Number of birds with hock burn | 691 (3.5%) | 4,750 (19%) | -4,059 |
| Number of birds with foot pad burn | 691 (3.5%) | 1,625 (6.5%) | -934 |
| Total amount of feed provided (kg) | 79,466 (4.1kg/bird) | 90,155 (3.8kg/bird) | -10,689 |
| On-farm mortality (number of birds) | 355 (1.8%) | 1,275 (5.1%) | -920 |
| Number of birds dead on arrival at slaughterhouse | 10 (0.05%) | 40 (17%) | -30 |
| Number of birds rejected at | 310 (1.6%) | 450 (1.9%) | -140 |

| | | | |
|---|---|---|---|
| slaughterhouse | | | |
| Total losses | 675 | 1,765 | -1,090 |
| Remaining number of birds | 19,062 | 23,235 | -4,173 |
| Number of birds graded A | 15,898 (83.4%) | 15, 382 (66.2%) | +516 |
| Number of birds graded lower than A | 3,164 | 7,853 | -4,689 |

Source: RSPCA *Everyone's A Winner*

The RSPCA assumed that the chicks are bought at the same price (20p each), grade A birds are sold for the same price (£1.30 each) and feed is bought at £130 per tonne. This would result in a *Red Tractor* producer potentially losing £3,112.97 [€3,642.17] compared to a *Freedom Food* producer.

The RSPCA also produced calculations based on the *Freedom Food* producer increasing the size of the shed to accommodate the same number of birds as the *Red Tractor* producer. Here too the *Red Tractor* producer had a poorer economic performance, potentially losing £4,816.50 [€5,635.31] compared to a *Freedom Food* producer.

Clearly the higher welfare of the *Freedom Food* birds translates into improved carcass quality and economic performance. In addition, birds reared to higher welfare standards may attract a price premium from the retailer.

A note of caution must be sounded about this study. As noted earlier in the report, *Freedom Food* chicken has only 3% of the market in the UK. However, those producers who are in the *Freedom Food* scheme may be achieving better financial results than *Red Tractor* producers.

Another study contrasted standard (Cobb 500) and slow growing broilers (Hubbard JA 957).[21] It found that the slow growing birds had much lower levels of breast blisters, thigh scratching, hock burn and foot pad lesions than the standard birds.

Turning to broiler breeders, a study contrasted conventional breeds with slow growing birds (Hubbard JA 987 & 957).[22] It reported that the cost of producing chicks was lower with the slow growing birds than the conventional breeds. This was mainly due to lower feed consumption (and hence lower feed costs), better hatchability and a higher number of chicks per female in the slow growing birds. Details of this are set out in Table 4.

[21] Toudic C., 2008. PowerPoint presentation. French broiler market & French and UK quality products: Hubbard.
[22] *Id*

**Table 4: Comparison of cost of producing chicks in conventional and slow growing breeds**

| | Conventional breed | JA 987 | JA 957 |
|---|---|---|---|
| Hatchability | 80% | 84% | 85% |
| Number of chicks per female placed | 134.4 | 180.6 | 191.3 |
| Total feed/chick (grams) | 468 | 301 | 276 |
| Chick cost per unit | €0.306 | €0.226 | €0.215 |

Source: Hubbard

**Pig production costs**

Sow stalls versus group housing

In a 2001 report, the European Commission pointed out that, as regards investment, some forms of group housing are cheaper than sow stalls (referred to as gestation crates in the U.S.).[23] The Commission added that overall pig production costs (including both building and running costs) are also lower in some group housing systems than with sow stalls.

Figures from France (Institut Technique du Porc),[24] the Netherlands (Rosmalen Institute)[25] and the UK (Meat and Livestock Commission and CEAS)[26] [27]show that, looking at both capital and running costs, even in the better group housing systems – ones giving reasonable space and ample straw — a kg of pig meat costs only around 2 eurocents more to produce than in sow stalls. Indeed recent research that looks at the Netherlands, France, Italy, Denmark, Belgium, Germany and Spain indicates that the increase in production costs due to group housing of sows is on average just 1.06 eurocents per kg of pig meat.[28]

Lammers *et al*. (2008) compared construction and operating costs for two sow housing systems – individual indoor gestation stalls with slatted floors and group pens in deep-bedded naturally ventilated hoop barns.[29] The operating costs, calculated in terms of the cost of producing a

---

[23] European Commission, 2001. Communication from the Commission to the Council and the European Parliament on the welfare of intensively kept pigs in particularly taking into account the welfare of sows reared in varying degrees of confinement and in groups. Brussels 16th January 2001.
[24] ITP, 1998. Rousseau P. and Salaün Y. Bien-être en élevage intensif: incidence des recommandations des experts sur l'investissement et le coût de production du porc charcutier, Institut Technique du Porc, May 1998.
[25] Rosmalen, 1997. Backus G.B.C. et al. Comparison of four housing systems for non-lactating sows. Research Institute for Pig Husbandry, Rosmalen. Report 5.1.February 1997.
[26] Meat and Livestock Commission, 1999. Baldwin C.P., 1999. Pig cost competitiveness in selected European countries.
[27] CEAS, 2000. Study by Centre for European Agricultural Studies for RSPCA. Profit with Principle: animal welfare and UK pig farming. RSPCA, 2000.
[28] De Roest K., Rossi P. And Ferrari., 2009. Presentation at European Commission workshop on pig welfare. Brussels. 17 November 2009.
[29] Lammers, PJ; Honeyman, MS; Kliebenstein, JB; Harmon, JD (2008). Impact of gestation housing system on weaned pig production cost. *Applied Engineering in Agriculture* 24(2): 245-249.

weaned pig, were found to be up to 10% lower in group housing. This calculation took into account the higher prolificacy rates (the number of healthy young produced) found in group housing, backed up by a number of studies.[30] [31] However, even when prolificacy was assumed to be equal for the two systems, total cost per weaned pig was still 3% lower in the hoop barn system.

Feed and bedding costs were higher in the hoop barns (there was no bedding in the confinement system) but these higher costs were outweighed by lower construction costs (which were 30% lower) and lower fixed costs (16% lower) in the hoop barns system.

The principal factor leading to lower construction costs is that hoop barns do not require ventilation as they are open and freely circulate air. A detailed comparison of construction costs in (i) a confinement system with individual gestation stalls and (ii) group pens in hoop barns appears in Table 5.

**Table 5: Estimated construction costs per sow space for (i) confinement system with individual gestation stalls and (ii) group pens in hoop barns**

| Item | Confinement facility ($) | Hoop barns ($) | Hoop: Confinement (%) |
|---|---|---|---|
| Land costs | 4.41 | 17.65 | 400 |
| Building structure | 265.00 | 249.94 | 94.3 |
| Ventilation system | 150.00 | 0 | 0 |
| Flooring & manure storage | 135.61 | 78.13 | 57.6 |
| Food and water system | 71.20 | 58.77 | 82.5 |
| Other expenses | 193.78 | 165.51 | 85.4 |
| Total construction cost | 820.00 | 570.00 | 69.5 |

Source: Lammers *et al*, 2008

To sum up, the data indicate that as regards investment, some forms of group housing are cheaper than sow stalls and that, looking at both capital and running costs, group housing is sometimes cheaper than sow stalls and in other cases it is only slightly more expensive.

It is also important to note that a number of studies indicate that reproductive performance can be as good or even better in group housing systems that are well-designed and well-managed compared with confinement of sows in individual stalls.[32] [33] [34]

[30] Bates, RO; Edwards, DB; Korthals, RL (2003) Sow performance when housed either in groups with electronic sow feeders or stalls. *Livestock Production Science*, 79: 29-35.
[31] Lammers, PJ; Honeyman, MS; Mabry, JW; Harmon, JD (2007) Performance of gestating sows in bedded hoop barns and confinement stalls. *Journal of Animal Science*, 85: 1311-1317.
[32] Bates, RO; Edwards, DB; Korthals, RL (2003) Sow performance when housed either in groups with electronic sow feeders or stalls. *Livestock Production Science*, 79: 29-35.

Study comparing four pig production systems

A 2011 U.S. study compared four pig production systems: sow stalls (gestation crates); group housing of sows; a high welfare indoor system in which sows are group housed and farrow in pens not crates, bedding is provided for both sows and growing pigs and antibiotics are not used; and a free range system.[35] Table 6 shows the farm level cost of producing one pound of pig meat in each of the four systems investigated by the study.

**Table 6: Production costs of four pig production systems: Seibert & Norwood, 2011**

| Production system | $ per pound of finished pig |
|---|---|
| Sow stalls | $0.45 |
| Group housing of sows | $0.486 - $0.489* |
| High welfare indoor system | $0.53 - $0.65** |
| Free range | $0.53 |

*The lower figure applies when the facility is built from scratch, the higher figure when it is converted from a sow stall system

** Range results from varying welfare benefits on different farms

The study found that the cost of changing U.S. pork production from sow stalls to group housing "would be modest – increasing costs at the farm level by 9% and the retail level by 2% - if all costs were passed on to the consumer". The authors point out that this means that the retail price of pork would increase by a maximum of 6.5 cents [5 eurocents] per pound. They add that consumer surveys have shown that the average American is willing to pay 34 cents [26 eurocents] per pound more for pork produced in sow group housing systems than in a sow stall system. The authors conclude that "banning gestation crates creates an average value of $0.34 [26 eurocents] per pound but only costs an extra $0.065 [5 eurocents] per pound".

The study also reports that the cost of changing U.S. pork production from sow stalls to free range would increase pig production costs by 18% at the farm level and 5% at the retail level if costs were passed on to consumers in full.

Farrowing crates versus loose farrowing systems

Pressure is building on producers in a number of European countries to move from farrowing crates, which are extremely narrow and are highly restrictive of sows' movements to farrowing pens which provide sows with ample space.

A leading UK producer reports the following economic benefits of changing to farrowing pens:

[33] van Wettere, WHEJ; Pain, SJ; Stott, PG; Hughes, PE (2008). Mixing gilts in early pregnancy does not affect embryo survival. *Animal Reproduction Science*, 104: 382-388.
[34] Cassar, G; Kirkwood, RN, Seguin, MJ; Widowski, TM; Farzan, A; Zanella, AJ; Friendship, M (2008) Influence of stage of gestation at grouping and presence of boars on farrowing rate and litter size of group-housed sows. *Journal of Swine Health and Production*, 16: 81-85.
[35] Seibert L. and Norwood B. F., 2011. Production costs and animal welfare for four stylised hog production systems. Journal of Applied Animal Welfare Science: 14: 1-17.

- the sows eat 10% more feed, which at first sight is disadvantageous economically. However, as a result of eating more, the sows produce more milk which leads to piglets being up to 25% heavier at weaning, leading to a gain of £8 [€9.36] per pig
- sows' condition score is 1.5 higher in free systems than in crates; this is likely to benefit the next litter
- gilts (a female pig that has not yet had her first litter) are less agitated in a free farrowing system and get up and down 30% less; as a result piglet mortality is reduced compared with farrowing crates
- the producer has designed his own free farrowing system which is being sold at the same price as traditional farrowing crates.

In addition, producers who use free farrowing systems may receive a price premium when selling their pigs.

A recent study compared capital and running costs between five farrowing systems:

- The PigSAFE system (Piglet and Sow Alternative Farrowing Environment); this comprises a loose pen including a straw-bedded nest with embedded design features which promote piglet survival

- the Midland Pig Producers 360 Degree Farrower (360° Farrower); this is a free-farrowing system

- a Danish free-farrowing system (Danish)

- farrowing crates

- outdoor farrowing (40% of the UK sow herd is kept outdoors).[36]

The study provides capital and repair costs for each of the above systems. These are set out in Table 7.

**Table 7: Specification and building costs of different farrowing systems**

| | **Farrowing system** | | | | |
|---|---|---|---|---|---|
| | **Crate** | **PigSAFE** | **360° Farrower** | **Danish free farrowing** | **Outdoors** |
| **Area per sow & litter ($m^2$)** | 4,3 | 8,9 | 4,3 | 6,0 | 526,3 |
| **Capital costs (£ per place)** | 3170 | 4388 | 3670 | 3804 | 1196 |
| **Sow place cost per year including** | 368 | 509 | 425 | 441 | 195 |

[36] Guy JH, Cain PJ, Seddon YM, Baxter EM and Edwards SA, 2012. Economic evaluation of high welfare indoor farrowing systems for pigs. Animal Welfare 2012, 21(S): 19-24

| | | | | | |
|---|---|---|---|---|---|
| **repairs (£)** | | | | | |

Source: Guy *et al*, 2012

Table 8 shows the cost of producing weaners using different farrowing systems at three different levels of liveborn mortality.

**Table 8: Cost of production using different farrowing systems at three different levels of liveborn mortality**

| | **Farrowing system** | | | | |
|---|---|---|---|---|---|
| | **Crate** | **PigSAFE** | **360° Farrower** | **Danish free farrowing** | **Outdoors** |
| **£ per sow**[1] | 776.29 | 803.65 | 788.44 | 789.33 | 670.59 |
| **£ per weaner (12% mortality)** | 34.03 | 35.23 | 34.57 | 34.60 | 31.12 |
| **£ per weaner (15% mortality)** | 35.23 | 36.48 | 35.79 | 35.83 | 32.22 |
| **£ per weaner (9% mortality)** | 32.91 | 34.07 | 33.43 | 33.46 | 30.10 |

Source: Guy *et al*, 2012

1. Total cost per sow includes all the costs in the farrowing stage and also costs in the gestation stage (average costs from two of the most common gestation sow housing systems, assumed to be the same housing system across all indoor systems, and an outdoor paddock system for the Outdoor option)

As regards indoor systems, the Danish and 360° Farrower involved production costs just 1.7% higher than the farrowing crate while the PigSAFE systems' production costs were 3.5% higher than the farrowing crate. The study reports that an increase in weaning weight of 0.3 kg in PigSAFE systems compared with farrowing crates, as was achieved in the study, would bring the production cost difference between PigSAFE and farrowing crates down to 0.9%.

The study stresses that "If pig performance in alternative indoor systems could be improved from the crate baseline (e.g. through reduced piglet mortality, improved weaning weight or sow re-breeding), then the differential cost of production could be reduced. Indeed, with further innovation by pig producers, management of alternative farrowing systems may evolve to a point where there can be improvements in both welfare and pig production."

The comments from a leading UK pig producer referred to earlier suggest that it may already be possible for free farrowing systems to produce, as compared with farrowing crates, piglets that achieve higher weights at weaning, sows with better body condition and gilts with lower piglet mortality.

<u>Systems for keeping growing pigs</u>

A 2003 UK study investigated the cost of pig rearing (6–95 kg) in a fully-slatted system (fulfilling minimum EU space requirements); a partly-slatted system; a high-welfare, straw-based system (complying with the RSPCA *Freedom Food* standards) and a free-range system.[37] The total cost of pig rearing in each system was calculated using data on daily liveweight gain, feed conversion ratios and mortality as well as capital costs including costs of construction, energy and labour requirements for each housing type, machinery use and feed prices.

The cost of rearing pigs ranged from €1.08/kg carcass weight (cw) and €1.11/kgcw for the partly-slatted and fully-slatted systems, to €1.16/kgcw and €1.17/kgcw for the *Freedom Food* and free-range systems respectively. The authors commented: "These results suggest that improved pig welfare can be achieved with a modest increase in cost".

The study shows that rearing pigs in a system which provides them with straw bedding and additional space such as the *Freedom Food* system results in a price increase of only around 6 eurocents per kilo. However, this is only economically viable if farmers receive a price premium to cover the extra cost.

Research in Italy and the Netherlands compared the cost of keeping growing pigs with and without straw. It found that the provision of 0.35kg of straw per pig per week on solid floors overall added just 0.1 eurocent to the cost of producing 1kg of pig meat.[38] The research reports that the provision of straw would increase production costs by just 0.7% in Italy and 0.9% in the Netherlands. Labour costs would rise and the cost of the straw must be taken into account but – crucially – health care costs would fall as would mortality rates.

**The business case for good standards of animal welfare**

The International Finance Corporation (IFC) has published a Good Practice Note entitled *Animal Welfare in Livestock Operations*.[39]

The IFC Good Practice Note stresses that "Businesses that address or enhance animal welfare are likely to win or retain a competitive advantage in the global marketplace in a variety of ways, such as:

- realizing growing market opportunities for food produced in animal welfare friendly systems
- becoming the producer of choice for retailers and consumers concerned with animal health and welfare, food safety and quality, human health, and the environment."

The IFC has also produced a Note on *Creating Business Opportunity through Improved Animal Welfare*.[40] This states that "The sustainability of your business depends, among other things, on you responding positively to marketplace trends and grasping new opportunities. Consumers globally are increasing their demand for animal welfare assurances in their food supply. Meeting

[37] Bornett, H.L.I., Guy, J.H. and Cain, P.J. (2003). Impact of animal welfare on cost and viability of pig production in the UK. *Journal of Agricultural and Environmental Ethics* 16, 163-186

[38] De Roest K., Rossi P. And Ferrari., 2009. Presentation at European Commission workshop on pig welfare. Brussels. 17 November 2009.

[39] International Finance Corporation, Good Practice Note No 6, October 2006. Animal welfare in livestock operations. http://www.ifc.org/wps/wcm/connect/7ce6d2804885589a80bcd26a6515bb18/AnimalWelfare_GPN.pdf?MOD=AJPERES&CACHEID=7ce6d2804885589a80bcd26a6515bb18

[40] http://www.ifc.org/wps/wcm/connect/633e46004885558fb714f76a6515bb18/Animal%2BWelfare%2BQN.pdf?MOD=AJPERES&CACHEID=633e46004885558fb714f76a6515bb18

these demands is not only good for the animals involved, but also greatly enhances animal production and business efficiency."

The IFC Note also points out that "many parts of the international food supply chain now have animal welfare assurance programs that are likely to influence large livestock producers in emerging markets. For instance, leading major international food service retailers increasingly require suppliers to be guided by their animal welfare principles".

The Good Practice Note explains that "Initial steps to improve animal welfare may mean an additional financial cost for a company. However, experience shows that the long-term savings and commercial benefits can outweigh initial expenditures. Sometimes very simple changes in how animals are treated can have dramatic effects on the bottom line."

The IFC Notes provide a number of case studies showing the business case for improving animal welfare. These include the following:

Reducing downgrades: An IFC client addressed the issue of chicken downgrades by upgrading the practices of the catching gang and training them with various instructional videos. They modified the catching system by placing birds into containers with both hands, rather than throwing as had been done previously.

On arrival at the slaughterhouse, the birds were tipped from a height of 6 feet from the crates to a belt that took the birds to the hanging line. This caused significant distress to the birds. In addition, there was damage (broken wings and legs and bruising) that was causing 8% of birds to be downgraded. The unloading system was modified to stop birds being "dumped" from a height onto the intake belt. As a result downgrades dropped by 8%. This reduction in downgrades was worth US$320,000 [€241,362] per annum and showed clearly the benefits of handling animals gently, transporting them with care, and slaughtering them in a quiet, efficient and compassionate manner.

Converting broiler systems: Many Soviet-style broiler operations used caged rearing. By converting some sheds to floor rearing, a client was able to provide a better brooding environment with a resulting drop in mortality of 0.5%. The conversion to floor rearing also allowed for improvements in the ventilation system, which resulted in improved livestock performance. In addition, live bird quality was significantly improved by a reduction in the incidence of breast blisters. This enabled higher yields, and higher profit margins, to be obtained in the processing plant. The overall improvement in profitability from converting sheds to floor rearing systems convinced the company to convert all cage sheds to floor rearing systems.

Two linked studies looked at pig carcase condemnation rates at slaughterhouses in the Republic of Ireland (ROI) and Northern Ireland (NI).[41] 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

---

[41] *Laura Boyle, Sarah Harley, Niamh O'Connell, Simon Moore, Alison O'Hanlon and Dayane Teixeira.* Improving pig welfare reduces carcass and financial loss. Pig Farmers Conference, 23-24 October 2012 http://www.thepigsite.com/articles/contents/12-11-10Teagasc_Pig_Conference_Proceedings_2012.pdf

conditions are the main causes and 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.

Training can improve the skills of stock keepers leading to improved economic returns. Research shows that good stockmanship (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. In one study, English (2002) 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%.[42]

Aggressive handling of cattle can result in bruising and damage which lowers carcass value. Low-stress handling can bring economic benefits as well as animal welfare gains.[43] The benefits of low-stress handling include increased efficiency, increased weight gain without additional inputs and reduced carcase downgrades.

***Improved welfare can lead to reduction in certain production costs***

In better welfare systems, animals will tend to be healthier. This can lead to savings in terms of reduced expenditure on veterinary medicines, and lower mortality rates. Healthier animals also can produce economic benefits in terms 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. The potential for economic benefits is illustrated by the studies referred to below that relate to growing pigs.

A range of studies show that providing enrichment materials and/or more space for growing pigs can produce improved growth rates. A review of the literature concluded that alternative higher-welfare production systems lead, in the majority of studies, to equal or faster growth.[44]

Ruiterkamp (1987) found that high levels of penmate-directed behaviour in barren rearing environments have a negative effect on the productivity of pigs due to disturbances in feeding patterns.[45] Morgan et al (1998) also found lower growth rates among pigs in barren rather than enriched environments and suggested this was due to increased energy requirements for heat maintenance in the absence of substrates.[46]

[42] English P., 2002. Improving stockmanship through training and motivation. Paper presented at the USA National Pork Board conference. Des Moines, Iowa, 18-19 June 2002.

[43] Proctor M and Payne C, 2012. Low-stress cattle handling makes good sense. Cattle Today. http://cattletoday.com/archive/2012/July/CT2772.php Accessed 29 September 2013

[44] Millet, S; Moons, CPH; Van Oeckel, MJ; Janssens, GPJ (2005) Welfare, performance and meat quality of fattening pigs in alternative housing and management systems: a review. Journal of the Science of Food and Agriculture, 85 (5): 709-719.

[45] Ruiterkamp W.A., 1987. The behaviour of growing pigs in relation to housing systems. Netherlands Journal of Agricultural Science 35: 67-70.

[46] Morgan C.A., Deans L.A., Lawrence A.B. and Nielsen B.L., 1998. The effects of straw bedding on the feeding and social behaviour of growing pigs fed by means of single space feeders. Applied Animal Behavioural Science 58: 23-33.

Beattie et al (2000) compared the rearing of fattening pigs in either barren or enriched environments.[47] The latter incorporated extra space and an area which contained peat and straw in a rack. During the finishing period (15 – 21 weeks) mean daily food intakes were higher and food conversion ratios were better for pigs in enriched environments compared with those in barren environments. Growth rates were also higher for the pigs in enriched environments during this period and this resulted in heavier carcase weights. The authors report that environmental enrichment also had a small but significant effect on meat quality, with pork from pigs reared in barren environments being less tender and having greater cooking losses than pork from pigs reared in enriched environments.

A range of studies have produced substantial evidence that increasing the available floor area will benefit the growth rate of finishing pigs[48] [49] [50] A Swedish study also concluded that giving more space to fattening pigs led to higher growth rates, better feed efficiency and improved health which in turn led to fewer veterinary treatments, lower death rates and less rejections at slaughter.[51] This study also found that the economic benefits of providing straw for slaughter pigs outweigh the costs of the straw and the associated additional labour costs.

A Danish study has analysed housing systems for slaughter pigs and shows that the straw-flow system has better profitability than traditional systems with fully or partially slatted flooring.[52] The study reports that the straw-flow system requires 20% less capital and that these lower capital costs outweigh the higher labour input and the straw consumption of the straw-flow system.

A study of 23 pig farms in Scotland collected data on management practices, genotype, feed and housing characteristics.[53] Sixteen attributes of bacon samples were assessed describing appearance, texture, taste and aroma. The main differences were found to be due to housing conditions, floor type and breed type, with pigs reared in straw courts giving rise to bacon of superior eating quality compared to those kept on concrete or slatted floors.

The provision of straw bedding has also been found to reduce the incidence of stomach ulcers to a very low level compared with pigs in barren partly-slatted pens.[54] The authors attributed this to the lower levels of stress when provided with straw bedding and/or a positive effect of straw intake on stomach content firmness.

Levels of other injuries have been found to be higher in fully-slatted systems. The incidence of foot and limb lesions and adventitious bursitis of the hock were significantly higher in fully-slatted systems than in straw-bedded systems. Ramis *et al* (2005) found that the prevalence of limb lesions was much greater in barren-housed pigs (24% of observations) compared with pigs

---

[47] Beattie, VE; O'Connell, NE; Moss, BW (2000). Influence of environmental enrichment on the behaviour, performance and meat quality of domestic pigs. Livestock Production Science, 65: 71-79.
[48] Brumm et al, 1996. Journal of Animal Science 74: 2730-2737.
[49] Gonyou & Stricklin, 1997. Journal of Animal Science 76: 1326-1330.
[50] Pearce et al, 1992. Applied Animal Behaviour Science 36: 11-28.
[51] Agr. D. Lars Jonasson & Docent Hans Andersson, 1997. Optimering av svenska modellen-Delprojekt 1. Den svenska modellen-havstang eller ok for svensk svinproduktion?
[52] Norgaard N.H. & Olsen P., 1995. Economic analyses of new pig production systems – focused on reduced capital input. Statens Jordbrugs – og Fiskeriokonomiske Institut. Report No. 83. Copenhagen, 1995.
[53] Maw S.J., Fowler V.R., Hamilton M. and Petchey A.M., 2001. Effect of husbandry and housing of pigs on the organoleptic properties of bacon. Livestock Production Science 68 (2001) 119-130. Elsevier Science.
[54] Bolhuis, JE; van den Brand, H; Staals, S; Gerrits, WJJ (2007). Effects of pregelatinized vs. native potato starch on intestinal weight and stomach lesions of pigs housed in barren pens or on straw bedding. Livestock Science,109: 108-110.

housed in sawdust-bedded barns (1% of observations).[55] The provision of bedding has been found to be the most important factor in reducing the incidence of bursitis in finishing pigs.[56] A reduced incidence of lesions and bursitis is economically beneficial.

[55] Ramis, G; Gomez, S; Pallares, FJ; Munoz, A (2005). Comparison of the severity of esophagogastric, lung and limb lesions at slaughter in pigs reared under standard and enriched conditions. Animal Welfare, 14: 27-34.

[56] Mouttotou, N; Hatchell, FM; Green, LE (1999). Prevalence and risk factors associated with adventitious bursitis in live growing and finishing pigs in south-west England. Preventive Veterinary Medicine, 39: 39-52.