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The pig industry's transition to group sow housing: economic and welfare assessments

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This paper represents the results of a joint project between *agri benchmark*, the Thünen Institiute and World Animal Protection. This paper has been prepared jointly between these institutions and Good Food Futures Ltd.

agri benchmark is a project of the Thünen Institute of Farm Economics (TI-BW). TI-BW is a specialised Institute within the Thünen institute, a public research organisation under the auspices of the Federal Ministry of Food and Agriculture. Within the *agri benchmark* Network, we analyse production systems, their economics, framework conditions and perspectives for different branches world-wide.

Good Food Futures Ltd. is an international sustainable food consultancy, working to drive forward sustainable livestock solutions through technical advice, advocacy and communications. It has specialist animal welfare expertise. The organisation works in partnership with *agri benchmark* to deliver sustainability frameworks and assessments and promote these in the global arena.

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World Animal Protection, London ,UK
World Animal Protection works in more than 50 countries to find practical ways to improve the lives of animals in the wild, in communities, in disaster zones and on farms. Through our farming work, we do whatever is needed to persuade governments, businesses and consumers to join us in improving farm animal welfare, creating a better world for all. World Animal Protection generously funded the work that led to this report.

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IRTA Monells is a leading pig research institute in Catalunia.

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Hijdeporc is a pig advisory company in the Netherlands, They facilitated the contacts to the two Dutch farms taking part in the analysis.

In **Brazil**, we were working with a leading edge farmer with some eight years experience in group sow housing as well as a processing company with own pig production in an integrated system.

Special thanks goes to the farmers which have strongly contributed to this study through the provision of information required, as well as allowing to implement the farm's assessments.

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1 Executive Summary

The global pig industry is facing major pressure to improve animal welfare, driven by growing public animal welfare concern, legislation, increased attention to corporate social responsibility and global recognition of animal welfare through international agreements of major institutions such as the International Organisation for Standardization (ISO, 2016) and World Organisation for Animal Health (OIE, 2014). European welfare legislation (EU, 2009) on sow stalls is now well established, and similar guidelines and commitments are being made by countries, wider food industry and major producers. These global societal and business commitments to better animal welfare will impact producers, so this project aimed to assess the economic viability of transition to group sow housing, how well the methods adopted deliver welfare, and what is making the transition work.

Economic and animal welfare evidence was developed in partnership between *agri benchmark*, based at the Thünen Institute of Farm Economics in Germany, and animal welfare scientists based at World Animal Protection, an international animal NGO. *agri benchmark* undertook assessments of economics and productivity, while World Animal Protection scientists delivered on farm animal welfare assessments. The case studies covered different forms of group sow housing in Brazil, Netherlands and Spain. Wherever possible, data was obtained to compare group housing with stall systems.

These case studies showed that group sow housing systems are highly viable in terms of economics and productivity. Oft-cited perceptions of a negative impact on efficiency, higher operating costs or lower profits was not found. Obviously, investment costs are affected as the adoption of group housing implies several changes in the system, but changes such as electronic sow feeding could also increase efficiency. Overall, evidence from the case studies shows better productivity for group housing, with more piglets at better weights. In general, because of higher productivity and roughly similar/slightly lower feed costs and labour input across group housing systems, group sow housing offered a higher level of profitability. Developing experience in management of group sow housing takes time, and an effect of time since transition was seen: the more established group sow housing farms performed better.

The biggest animal welfare benefit of group sow housing was the basic freedom for pigs to move around and exercise, which was not possible where sows were confined in stalls. Group sow housing also provided for social interaction and choice of environment and behaviour dependent on availability of resources and the experience animals have of using them. As basic elements of the globally recognised animal welfare concept the 'five freedoms' (OIE, 2014), these should be considered an essential aspect of welfare provision in pig husbandry.

Provision of enrichment is very important for sow welfare, allowing an outlet for exploratory and foraging behaviour and reducing levels of hunger. Farms with permanent enrichment showed an absence of abnormal behaviours, and this highlights the need for provision of effective manipulable material for pigs to root and forage. Health outcomes were variable across group and stall systems and it is hard to draw conclusions based on system.

Management and design of systems, based around delivering key welfare outcomes, increases the potential for good welfare, and systems may not deliver their full welfare potential until well established (which has implications for results of short term commercial trials).

It is likely that growing demands for good pig welfare from citizens and consumers will require the adoption of more than basic transitions in sow housing (for example where farms have simply removed the backs of stalls in existing systems, and provide no enrichment).

Looking forward, the positive impetus for adoption of group sow housing is likely to grow stronger for three reasons: firstly, increased company commitments to private standards as a result of consumer concerns and corporate social responsibility; secondly, guidance on implementation of existing EU legislation will require effective enrichment in pig housing, often more than is currently provided; non-EU countries may match or go beyond the existing EU-legislation in case of new investments in sow barns, to be prepared for these further developments in EU legislation and enforcement. This also has significant potential to increase emphasis on delivery of welfare outcomes in sow production, which may lead to increasing pressure on EU farms which are only just complying with the present legislation (such as those which do not provide enrichment).

In summary, the results here should act as a prompt to producers and across the food industry to explore the relevance of group sow housing systems in their supply chain. Good management and sound understanding of pigs' welfare needs is essential for success, as well as time to transition to new systems and adopt new practices. Across both the economic and welfare results, it seems that group sow housing can clearly be successful, not just for animals but for producers too.

2 Introduction, background and objectives

The global pig industry is increasingly moving away from sow stalls (gestation crates) for pregnant pigs, to group sow housing (GSH) systems. Propelled by the implementation from 2013 of EU legislation (EU, 2009) banning sow stalls for the majority of a sow's pregnancy, the industry has begun to reshape on-farm practice dramatically. New developments are driving this change within and outside the EU, including growing public concern for animal welfare and the inclusion of welfare in sustainability frameworks such as those of the Global Agenda for Sustainable Livestock (GASL, 2016). Most notably, international agreements and tools, including the ISO technical specification on animal welfare management, ISO TS/34700 (ISO, 2016), and globally agreed guidelines on animal welfare adopted by the World Organisation for Animal Health (OIE) recognise the importance of animal welfare (OIE, 2014). Major food industry companies are increasingly implementing animal welfare policies, even where animal welfare legislation does not exist, and producer organisations are committing to phase out sow stalls (Amos and Sullivan, 2017). But what does this mean for farmers and for the animals themselves? From an economic perspective, one barrier to change is industry perception that introduction of animal welfare measures in general and group housing of sows in particular will have negative impacts on profitability.

The primary reasons for producers moving to group housing of sows are the productivity and animal health and welfare benefits. Group sow housing allows freedom for pigs to move around and exercise, and provides the potential for social interaction, choice of environment and expression of natural behaviour dependent on availability of enrichment resources. Are these achieved in practice and can good welfare be delivered in profitable systems?

This project aimed to assess the reality of economic and animal welfare benefits, challenges and solutions for transition from sow stalls to group sow housing in case studies of farms representative of the industry in important pig production countries. The report brings together an analysis of the animal health and welfare on farm with the economic implications on the same farms.

Economic and animal welfare evidence was developed in partnership between *agri benchmark*, based at the Thünen Institute of Farm Economics in Germany, and animal welfare scientists based at World Animal Protection, an international animal NGO. *agri benchmark* undertook assessments of economics and productivity, while World Animal Protection scientists delivered on farm animal welfare assessments. The case studies cover different forms of group sow housing in Brazil, Netherlands and Spain. Wherever possible, data was obtained to compare group housing with stall systems.

3 Economics of group sow housing versus sow stalls

3.1 Methods and data

The methods, tools and analysis framework from the global network *agri benchmark* were made available for the project. *agri benchmark* analyses production systems, their economics, framework conditions and perspectives globally. *agri benchmark* uses the approach of **typical farms**. A standard operating procedure to define required data sets, collect, process and present the data is applied (Deblitz and Zimmer, 2005).

Contrary to the typical farm approach usually applied in the *agri benchmark* Networks – focus groups of producers for the data collections and validation of results- we have worked with individual producers who were willing to participate. Main reasons for different approach are a) the difficult economic situation in pig farming in the analysis year 2015 when addressing research questions had less priority for producers, b) the widespread reluctance of pig producers to share information with other producers in focus groups sessions and c) the sensitivity to reluctance to participate in animal welfare related research. Further, using individual farms ensured accurate and consistent information as well as securing the link to the animal welfare related data.

Thus, the main source of data was individual farm level information. The information was gathered through field visits to each of the farms selected for analysis. In all the cases a group of expert technicians and advisers gathered to discuss and complement the data supplied by the producers.

The TIPI-CAL model from the *agri benchmark* Network was used for the analysis of the stall and the group housing situations. TIPI-CAL is a production and accounting model and assessment tool. It has a 10 years dynamic-recursive structure and produces a profit and loss account, a balance sheet, a cash flow for the whole farm and all enterprises considered for each of the 10 years of simulation.

Of particular importance for the group housing study is the fact that TIPI-CAL provides very detailed information on activity levels, performance and productivity of the enterprises such as herd size, animal performance, weight of animals, feed rations, mortality, weight gains etc..

The farms selected are above average size and on an above average management level. Table 1 provides an overview of the main characteristics for the farms selected. Further details about the farms can be found in Annex 6.2.2.

Table 1 Main characteristics of the farms analysed

Farm code	Country	Region	Number of sows	Production system	Farm type
ES 1300 Stalls	Spain	Galicia	1 366	Farrow to rearing	Vertical integration Before GSH [1)] adoption
ES 1300 Group	Spain	Galicia	2 158	Farrow to rearing Duration group housing: 80 days	Vertical integration After GSH adoption
NL 460 Group	Netherlands	Gelderland	470	Farrow to rearing Duration group housing: 80 days	Single owner After GSH adoption
NL 490 Group	Netherlands	Gelderland	490	Farrow to rearing Duration group housing: 80 days	Single owner After GSH adoption
BR 2150 Stalls	Brazil	Goiás	2 150	Farrow to weaner	Single owner Before GSH adoption
BR 1280 Group	Brazil	Goiás	1 280	Farrow to weaner Duration of group housing: 80 days	Single owner After GSH adoption
BR 500 Stalls	Brazil	Santa Catarina	500	Farrow to weaner	Vertical integration Before GSH adoption
BR 570 Group	Brazil	Santa Catarina	570	Farrow to weaner Duration of group housing: 80 days	Vertical integration After GSH adoption

1) GSH = Group Sow Housing

Farm name syntax: Country – number of sows – Group or Stall
Source: Own survey

3.2 Results

It is important to note that, as these are the results of case studies, difference described between farms and systems are descriptive and should not be interpreted as offering statistical significance. Further, it should be noted that the harmonisation of national currencies into USD-figures has an impact on the international comparison of farms, but will not influence comparison between the baseline and the group housing scenarios on the same farm.

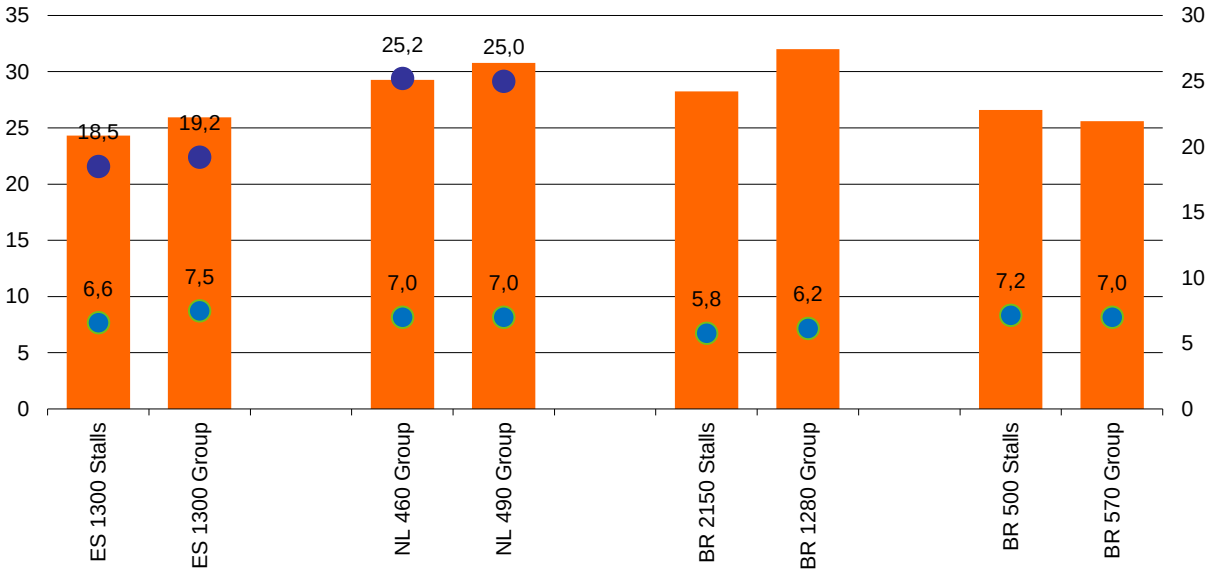
3.2.1 Productivity performance indicators

Note that the source for all data and figures shown in this section is from the farms themselves, processed through this research and subject to calculations in the *agri benchmark* model, so sources are not indicated below each of the figures. Figure 1 shows
(a) The number of piglets reared per sow per year
(b) Reared piglet weight

The weight differences between the European and the Brazilian farm originates in the fact that the EU-farms also rear the piglets after weaning whereas the Brazilian farms sell them as weaner piglets. This appears to be a typical for each country. Thus, the lower weights in the Brazilian farm do not mean that the farms are less productive than the EU-farms.

The number of piglets weaned/reared per sow per year varies between 24 and 32 piglets per sow.

Figure 1 Number and weight of weaned / reared piglets
(orange bars: numbers; dots: kg live weight)

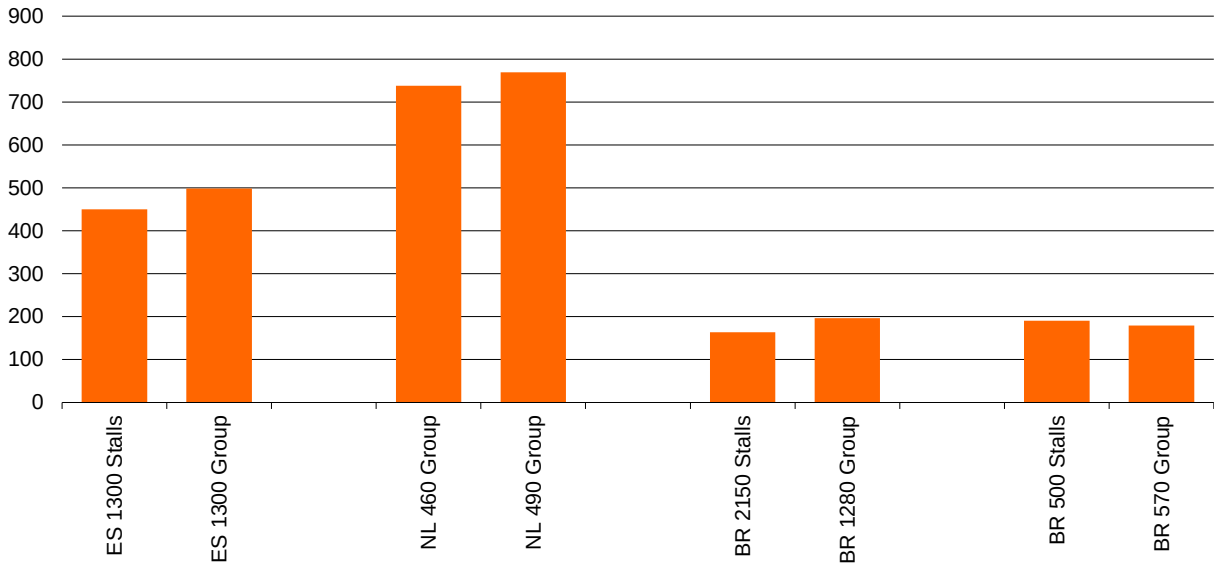


Source for all figures: Own calculations

- With one exception, the GSH systems are weaning more piglets than the stall systems.
- In the case of Spain, the GSH farm has a higher number of piglets (26 vs. 24.3) and a higher weight per piglet reared (19.2 vs. 18.5 kg per piglet) than the stall system. Piglet weights in Spain are relatively small due to market preferences.
- The Dutch farms (GSH systems) produce a large number of piglets per sow (29.3 and 30.8 respectively) with high weights (25.2 kg and 25 kg) which are mainly due to the different market.
- The same applies to the first of the Brazilian cases (32 piglets in groups vs. 28.2 piglets in stalls and 6.2 vs. 5.8 kg per weaned piglet)
- In the second Brazilian case, the number is slightly lower in the GSH (25.6 vs. 26.6 in stalls) and the weight, too (7.0 vs. 7.2 kg per piglet weaned in stall system). An explanation for this might be that (a) the experience with GSH in this farm is less than in the other Brazilian case (3 years vs. 8 years) and the duration of the GSH is longer.

Another option to reflect sow efficiency is to measure the total weight produced per sow, per year, including piglets and cull sows (see Figure 2).

Figure 2 Total weight produced per sow per year (kg live weight)



- Total weight produced shows higher levels in the Spanish and Dutch farms, compared to the Brazilians cases. The fact that these countries produce heavier reared piglets than the Brazilian farms is the main reason for that.
- Following the evidence from above, total weight produced per sow is higher in the Spanish GSH farm (498 kg vs. 450 kg per sow in stalls).
- The Dutch farms also show higher weights in comparison with all farms due mainly to higher piglet rearing weights (737 kg and 769 kg per sow, per year)
- The same applies to the first Brazilian case (197 kg vs. 163 kg per sow).

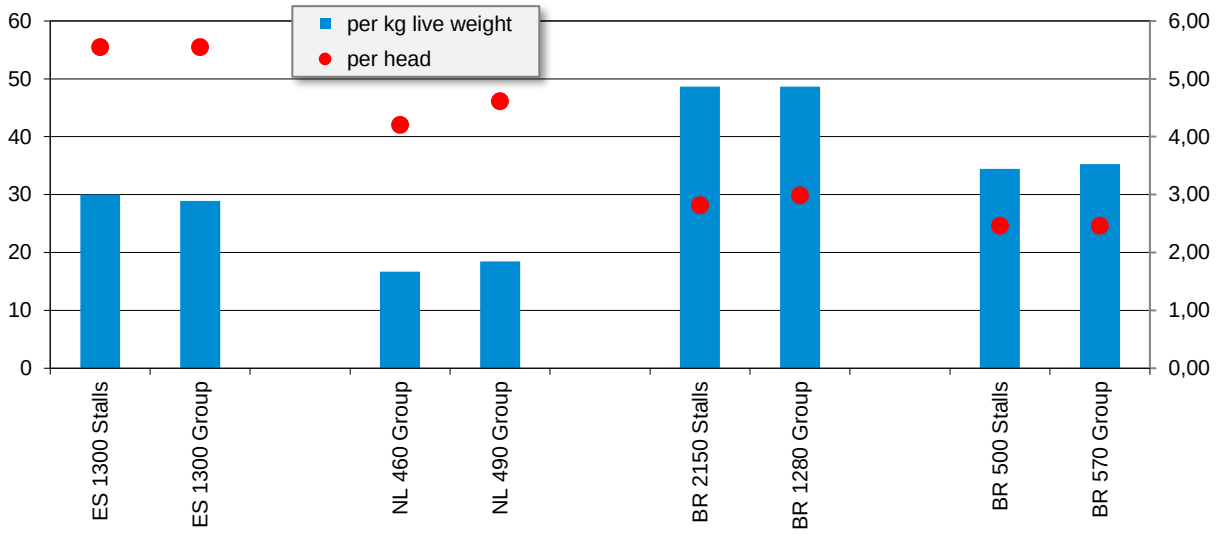
- In the second Brazilian case, the total weight produced per sow is slightly lower in the GSH farm (179 kg vs. 190 kg per sow). However, the total weight is almost as high as in the first Brazilian farm due to the higher sow replacement rates and a subsequent higher weight of sows sold.

3.2.2 Economic results

For the economic results, four components are analysed: prices, receipts, costs and profits.

Receipts are the product of the price per kg and the total weight sold. On a per kg basis, the two Brazilian farms have the highest price because they produce weaned piglets of low weight, whereas the Spanish and Dutch farms produce reared piglets with significantly higher weights (Figure 3, see also Figure 1). As shown below, the total weight per sow has great impact on results for which the weight is used as a reference.

Figure 3 Piglet prices (**left**: USD per head, **right**: USD per kg live weight)



Total receipts comprise total piglet sales as well as total cull sow sales. In the case of piglets, they can be sold or transferred to a rearing or fattening unit at a market price. Cull sow sales are sows going out of the farm and sent to the slaughter plant. Total receipts can be observed in Figures 4 and 5, expressed per sow and per 100 kg of piglet produced.

From both figures, the following can be observed:

- In general, the lower the piglet weights, the higher the difference between the per sow figures and the per piglet weight figures and vice versa.
- Thus, the GSH farm in Spain has higher receipts per sow and lower receipts per 100 kg piglet compared with the stall system.
- The same applies to the Dutch farms which on a per sow basis show higher receipts (> 1200 USD/sow), similar to the Spanish farms.

- Due to the low piglet weights in Brazil, per piglet receipts are higher than in the EU-farms.
- In the first Brazilian farm, receipts per sow are higher in the GSH system and receipts per 100 kg piglet are lower in the GSH system when compared with the stall system.
- In the second Brazilian case, the relation of the two figures is reverse: lower receipts per sow and higher receipts per 100 kg piglet.

Figure 4 Total receipts of the sow enterprise (USD per sow)

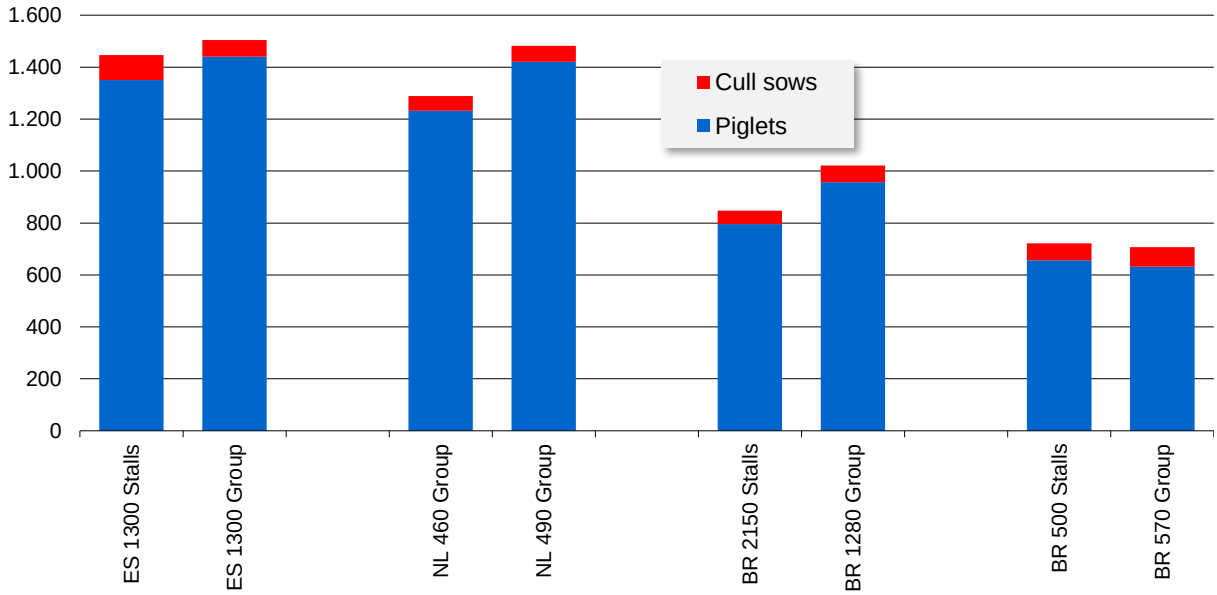
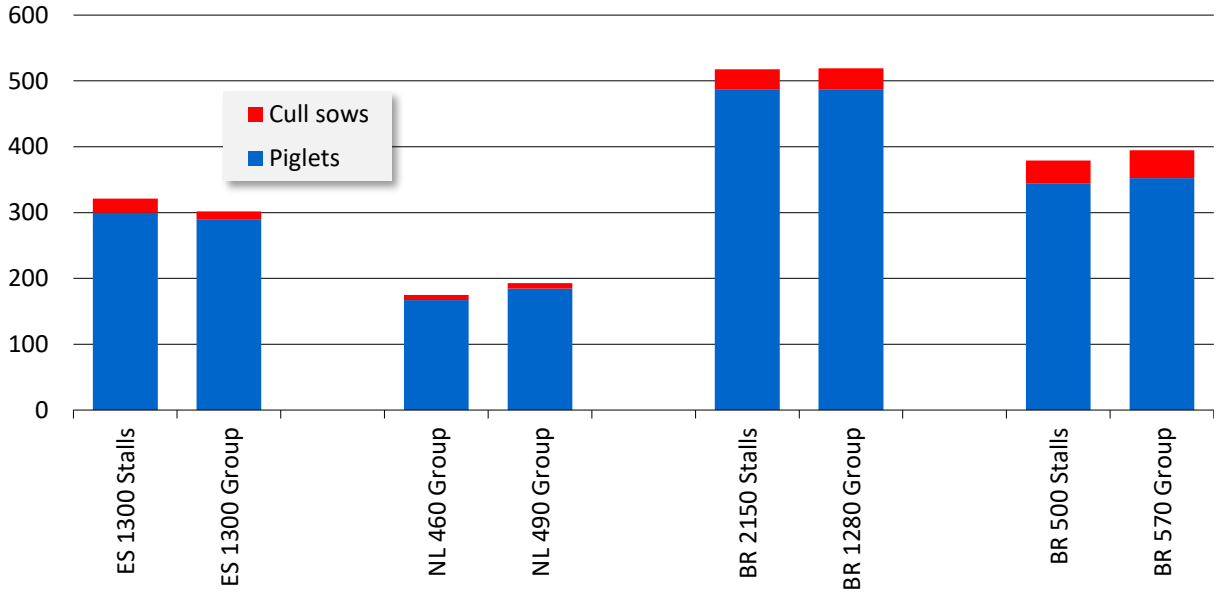


Figure 5 Total receipts of the sow enterprise (USD per 100 kg of piglet produced)



The same principles apply to the cost and profit figures. Because the figures expressed per 100 kg piglet reflect the different productivity levels of the sows, it is better suited for international comparisons than the per sow figures. As consequence, the per 100 kg figures are further shown in the text and the per sow figures are displayed in the Annex.

Production costs are analysed using the profit and loss account statement plus unpaid family labour (only in the Dutch farms). It comprises all operating costs, including fixed (known also as overhead) and variable costs, as well as depreciation but plus opportunity costs for own labour (calculated costs for family labour). The level of opportunity costs for land and capital in the farms is extremely low.

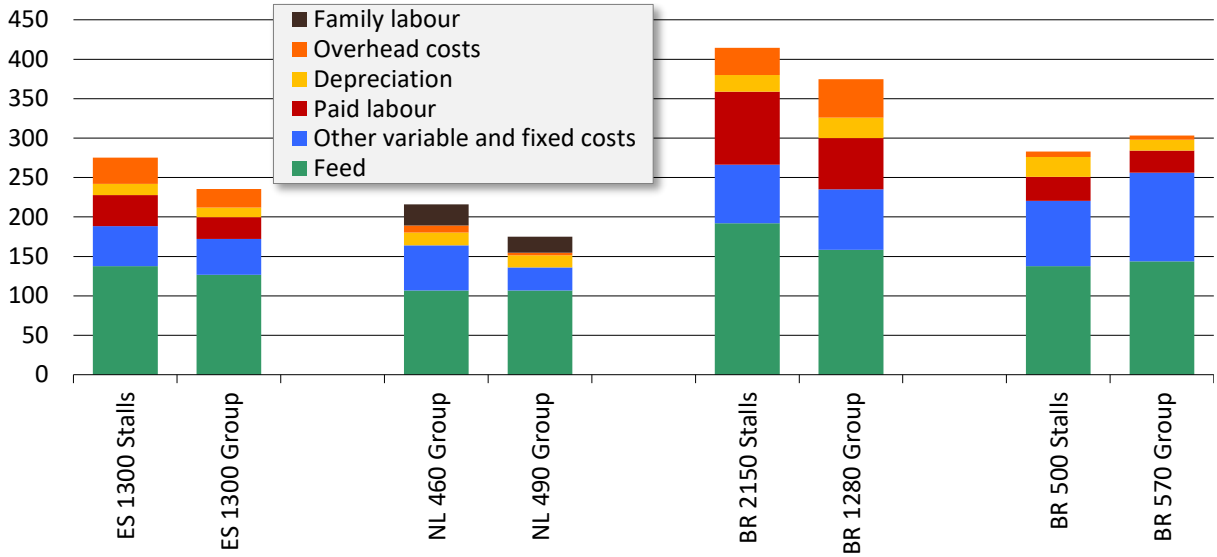
The costs can be observed in Figure 6, expressed in USD per 100 kg of piglet produced.

- Feed costs represent the majority of the costs (between 40 and 70 percent), followed by the other variable costs (veterinary, medicines, artificial insemination and other) and fixed costs (maintenance, insurance, fees and contributions).
- Paid labour is included as well as depreciation. Unpaid labour such as family labour is only shown in the Dutch farms as the other farms do not have unpaid labour.
- The GSH farm in Spain has lower costs compared with the stall system.
- In the first Brazilian case, costs are lower in the GSH system when compared with the stall system – this is due to the higher productivity of the animals in the GSH system.
- In the second Brazilian case, costs are higher due to the slightly lower productivity.

As feed costs are the most important component of the variable costs, its efficiency analysis for the sow enterprise is vital. Feed costs can be split into feed costs for the sows and feed costs associated with the piglets. They are presented in Figure 7.

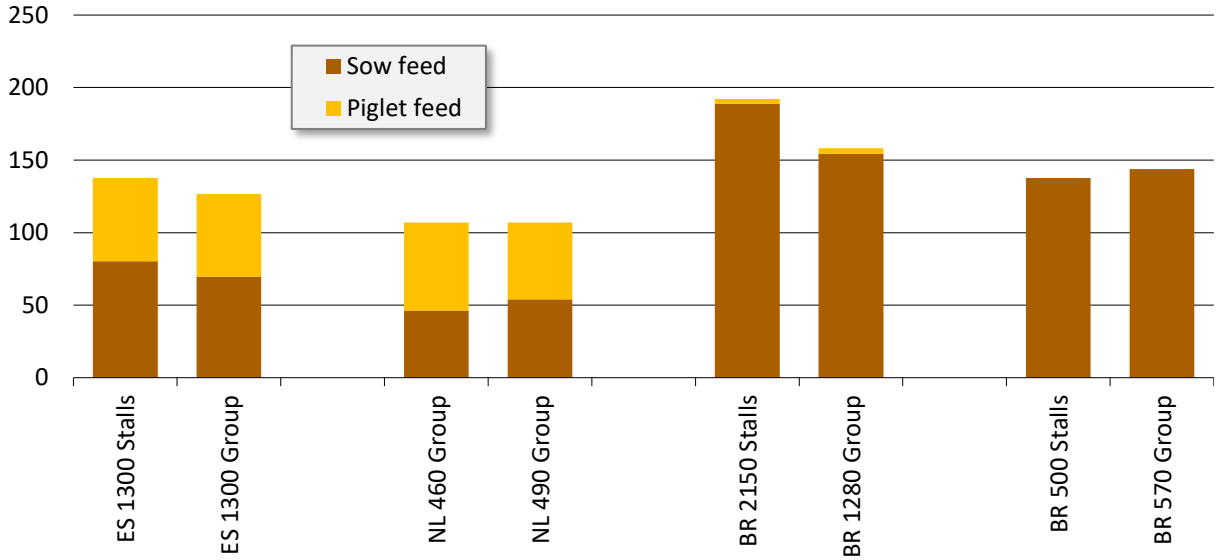
- Most of the GSH systems have lower feed costs compared with the stall systems.
- In the case of Spain, the GSH system has lower costs than the stall systems (127 USD vs. 137 USD).
- The Dutch farms (both with group systems) presents the lowest feed costs of the whole comparison (107 USD).
- The first Brazilian case presents similar conditions (lower costs in the GSH systems), whereas in the second Brazilian case, GSH systems has higher costs (144 USD vs. 138). The reasons are similar as for the total costs above.

Figure 6 Costs of the profit and loss account (USD per 100 kg piglet produced)



Other variable costs = purchase of animals + vet. and med. + insemination + other
Overhead costs = maintenance + fuel + insurance + fees and contributions + other

Figure 7 Feed costs (USD per 100 kg of piglet produced)



Labour cost is also an important economic indicator as it is one of the main efficiency factors at the farm level. For hired labour (paid), the average wage paid within the analysed year is taken. For unpaid family labour, the average wage rate for hired labour substituting the family labour is used. Figure 8 shows the labour costs per 100 kg of piglet produced.

- The GSH systems present lower costs compared with stall systems.
- For the Spanish cases, the GSH labour costs are lower compared with stalls.
- In the case of the Brazilian farms, GSH systems present lower costs compared with stalls system

Profit is the main summary of the financial performance of a business over time (generally one year). It summaries the income for a period and deducts the expenses / costs incurred for the same period to calculate the profit or loss of the business.

There are different types of profits according to the level of costs included:

- Net cash farm income (also known as short-term profit) measures the difference between all cash receipts and cash costs incurred over a period of time. Thus, it does not include depreciation or opportunity costs.
- Profit from the profit and loss account (mid-term profit), also takes into account depreciation, changes in inventories, interest on savings and capital gains and losses. If a farm covers theses costs, it can afford reinvestments but it might not have enough cash to pay all private expenses and increase equity.
- Net profit (long-term profit) takes into account all receipts and all costs including opportunity costs (labour, land and capital), if a farm covers these costs
- In Figures 10 the different profit levels are shown.

The GSH systems analysed showed better profits than the stall systems. This means that GSH systems do not have to be less profitable than stall systems – provided they are managed well.

- The first Dutch farm shows losses. This cannot necessarily be attributed to the production system but rather to the low prices in the analysis year 2015.
- The GSH farm in Spain has a long-term profit of approximately USD 60 per 100 kg. This is almost 50 percent more than in the stall system.
- In the first Brazilian case, profitability per sow is USD 78 per 100 kg vs. USD 42 in the stall system.
- In the second Brazilian case, the profits in the GSH system are also higher (USD 76 vs. USD 72 per 100 kg).

Figure 8 Labour costs (USD per 100 kg of piglet produced)

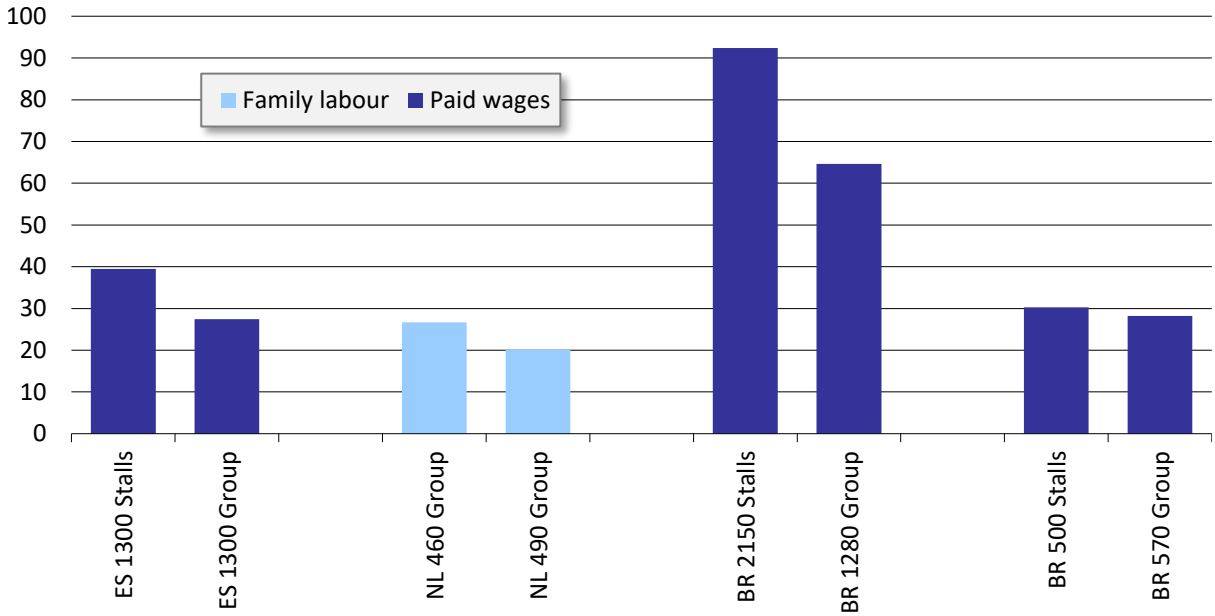
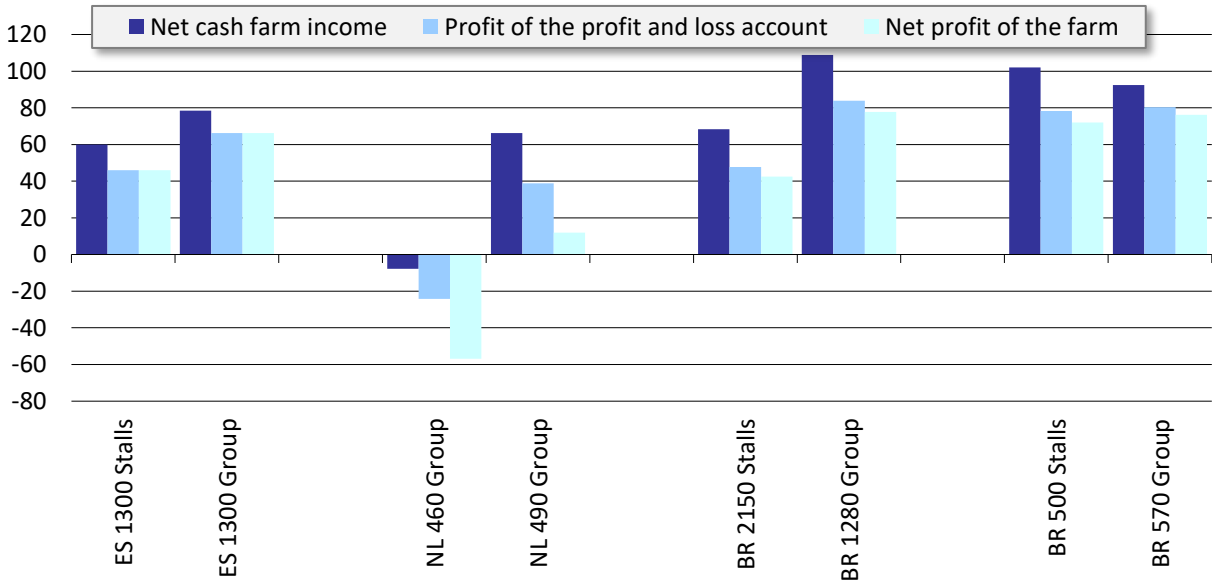


Figure 9 Farm profits (USD per 100 kg piglet produced)



3.2.3 Conclusions from economic analysis

It should be mentioned that all farms analysed are above average to top performing farms and they do not reflect the average of farm management in the countries.

- The case studies selected apply different levels of management according to the type of ownership (single owner, vertical integration), which could differ in economies of scale as well as availability of resources.
- When analysing the group sow housing system, it is important to take the time of implementation of the system into account as it evolves with time. It seems that the longer the farm is implementing the GSH, the better the results.
- From the evidence, it can be observed that the adoption and implementation of the GSH system does not necessarily imply lower efficiency levels, higher operating costs and lower profits. Obviously, investment costs are affected as the adoption implies several changes in the system, as well as a time reduction of the production period.
- When adopting the GSH, some farming systems tend to increase the number of sows in order to produce the same level of piglets over a period of time. This results in higher replacement rates for the sows.
- Introducing GSH systems does not necessarily imply lower efficiency gains. Evidence from the case studies shows better productivity (piglets produced) for the GSH systems. Additionally, some cases reflect more piglets with better weights in the GSH system.
- It should be mentioned that an additional positive effect of the GSH is the introduction of electronic sow feeding systems (EFS) which had usually not been in place before. This constitutes an indirect impact of the GSH in terms of better feed efficiency.
- Total costs are not necessarily higher after the implementation of the GSH systems. In most of the cases GSH systems show lower costs than the stall systems. Feed costs are very similar in both type of systems and labour costs are lower in the GSH systems.
- The level of profit is not affected by the adoption of the GSH system. In general, as a result of higher productivity and lower costs, GSH system presents higher level of profitability.
- When comparing total receipts with total costs, the case studies show that the GSH scenarios are either more profitable than the stall systems (in the Spanish and the first Brazilian case) or have the same profitability (in the second Brazilian case). This also means that the farms were able to manage the transformation from stall to GSH system.
- The relatively lower productivity and profitability of the second Brazilian GSH case is most likely due to the fact that it has less experience with GSH (2-3 years) than in the other Brazilian case (8 years).

4 Welfare Assessments

4.1 Methods and data

Health and welfare assessments were carried out on the same eight farms as the economic assessments. Assessments were carried out during 2016 in May (Spain and Netherlands) and August and September (Brazil).

The farms represented a wide range of commercially available sow production systems. They included dynamic groups with Electronic Sow Feeding (ESF), smaller stable groups with automatic feeding, and both semi-slatted and straw-based systems. All the farms were representative of common farm systems in their respective countries.

Welfare assessments were carried out on each farm on a random selection of sows/pens per farm. In line with Welfare Quality protocols, welfare criteria for the assessment protocol were grouped under one of four principles. Indicators for each of these criteria were then defined (Table 2).The welfare assessment protocol included both environmental measures and welfare outcomes and incorporated measures from Welfare Quality and AssureWel protocols (Assurewel, 2017; Botreau et al., 2009).

Table 2 Principles for welfare, criteria and welfare indicators

Principle	Criteria	Indicators
Good Feeding	Appropriate nutrition	Body condition
Good Housing	Thermal comfort Comfort around resting	Ventilation rate Cleanliness
Good Health	Absence of disease Absence of injuries	Infections Lesions Body marks Lameness Leg swellings Evidence of aggression
Appropriate Behaviour	Social behaviour Enrichment use Emotional state	Stereotypic behaviours Enrichment use Positive/negative social behaviour Mutilations Response to humans

Source: Welfare Quality, Assurewel (2017)

Sample sizes met or in some cases exceeded AssureWel recommendations on sample size. A minimum of 70 sows were assessed on the smaller farms in the Netherlands and a minimum of 100 sows on all other farms. On Brazilian stall farms, every eighth sow (Farm BR 2150 Stalls) and every third sow (Farm BR 500 Stalls) were assessed to capture all age groups.

To ensure consistency, the first assessment (Spain) was undertaken jointly by two assessors and results were cross-checked. All other assessments were undertaken by one of the two assessors. The assessments were undertaken in warm/ summer months in all countries, although climatic conditions did differ between countries.

It should be noted that all comparisons are descriptive rather than statistically significant as each farm was a case study. In terms of limitations, behavioural measures were affected by the time of the day that sampling took place. Although assessors strived to maximise consistency, some assessments were undertaken at different times of the day due to individual farm routines. Feeding time varied between farms and the stage of pregnancy, temperature and difference in climatic condition must also be considered when reviewing the results.

4.2 Welfare assessment results

Detailed graphs of welfare results can be found in the Annex. This section provides a summary.

Freedom of movement and choice of environment was possible in group systems but not in stalls. Stereotypies were evident at variable levels across all systems but they were lowest in group housed systems where enrichment was an established element of housing and management (Netherlands and the straw based farm in Brazil). They were not observed in the Netherlands straw-based farm.

Positive social behaviour was only recorded in group housing and negative social behaviours recorded at low levels in each type of system but highest in Spain.

There was no difference in body condition between stalls and group housing. All farms were well managed and body condition was monitored closely in all systems so feed amounts could be adjusted accordingly.

Cleanliness was variable and there was no correlation according to system. The proportion of clean sows was consistently high in stall systems but was variable across group housing systems. All farms were scraped through regularly and were well managed to maintain cleanliness although factors such as slat width, location of resting areas, lack of comfortable resting area and ventilation can all effect sow cleanliness.

The occurrence of skin conditions was highest in stalls. These were observed as large patches of dry, blotchy, irritated skin. Skin conditions and shoulder lesions (which although were variable across systems were more severe in stalls) are likely to be caused by inability to move freely and rest comfortably.

Local infections were consistently evident in stalls although at the highest levels on Spanish group housed farm.

Vulva lesions were considerably higher in the Spanish unenriched pens. Lesions observed appeared to be caused by vulva biting which can occur as a result of boredom and lack of stimulating environment but also as sows are waiting to enter the feeding area.

Presence of body marks (total mild and severe) was higher in group housing systems in comparison to stalls.

Lameness was variable across all systems. The highest levels of swellings (small and large) was observed in stalls. The occurrence of small leg swellings was highest in stalls although occurrence of large leg swellings was highest in Spain group housing.

The results show that sow hunger and frustration can be an issue in both group housing and stalls if this is not managed and the environment is barren. This is evidenced by the high levels of stereotypies in barren systems and lower levels in farms with suitable enrichment. The absence of stereotypies in the Netherlands straw-based farm suggests that the straw allowed sows to fulfil behavioural needs for rooting and exploring, while also providing gut fill. Sows were found to use enrichment wherever it was provided.

4.3 Conclusions from welfare analysis

Group housing of sows provides major improvements for pig welfare compared to sow stalls - allowing sows freedom of movement, choice of environment and social companions. This is a dramatic welfare improvement against stalls and is a key element of all concepts of welfare such as the Five Freedoms.

Managing aggression can be a challenge in group housed sows, especially shortly after mixing of animals or when introducing new animals into a group. This can be successfully managed by minimising competition for limited resources in the following ways:

- Providing adequate floor space and appropriate group size
- Adequate resource provision and pen layout allowing separation of activities
- The right choice and design of feeding system
- Management of satiety with the right feeding strategy and provision of enrichment materials

The extent of physical lesions and / or signs of injury was variable, but it was notable that in general in the group housing systems, fewer health-related issues were present, such as leg swellings and skin disorders. Where lesions were seen, this was often in a barren environment, and provision of greater complexity through effective enrichment could divert animals toward appropriate positive behaviours. Health-related issues are not just a concern for welfare, but have the potential to increase on farm costs, reduce productivity and require greater use of antibiotics.

The success of group housing is dependent on a range of management factors, including animals' prior experience of group housing, social contact and enrichment. It is likely that more established systems, where gilts are familiarised with group housing systems, will be more successful than using prior stall-housed gilts.

The results demonstrate that provision of enrichment is very important for sow welfare, allowing an outlet for exploratory and foraging behaviour and reducing levels of hunger. This is a major issue in gestating sows as they are feed restricted. Where enrichment was provided as a standard aspect of the system, in sufficient quantity, some abnormal behaviours were totally absent. Again, while enrichment may be seen as an additional expense, it has major potential benefits not just for animal welfare, but for reducing business costs associated with aggressive and injurious behaviour.

5 References

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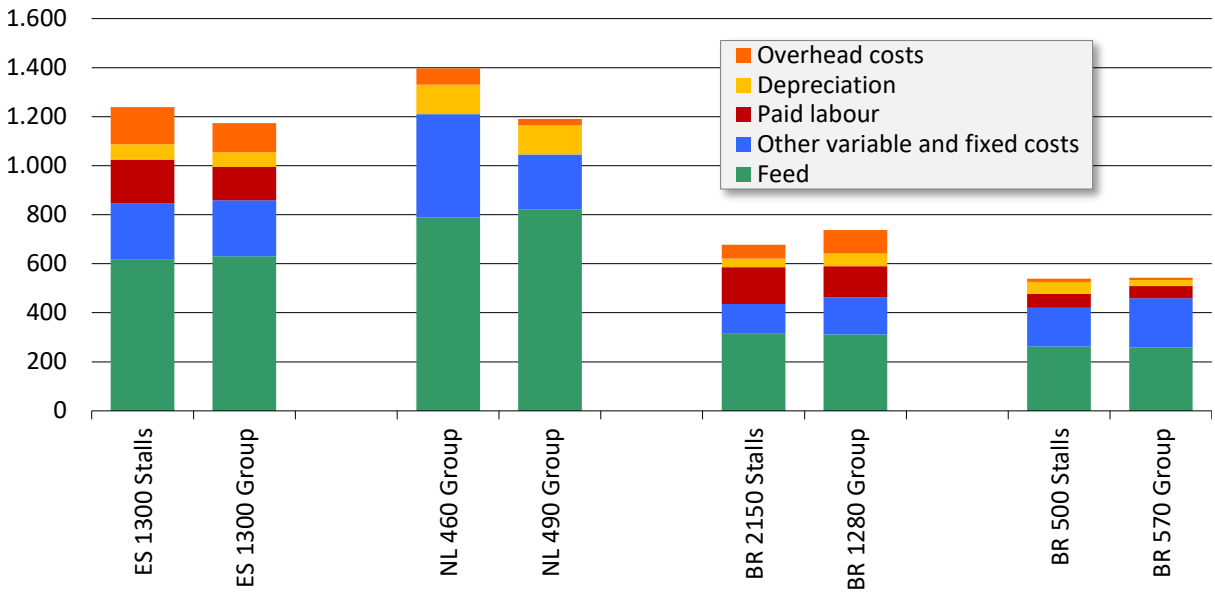
6 Annex

6.1 Economic Results

Figure A.1 Costs of the profit and loss account (USD per sow and year)



Other variable costs = purchase of animals + vet. and med. + insemination + other
Overhead costs = maintenance + fuel + insurance + fees and contributions + other

Figure A.2 Feed costs (USD per per sow)

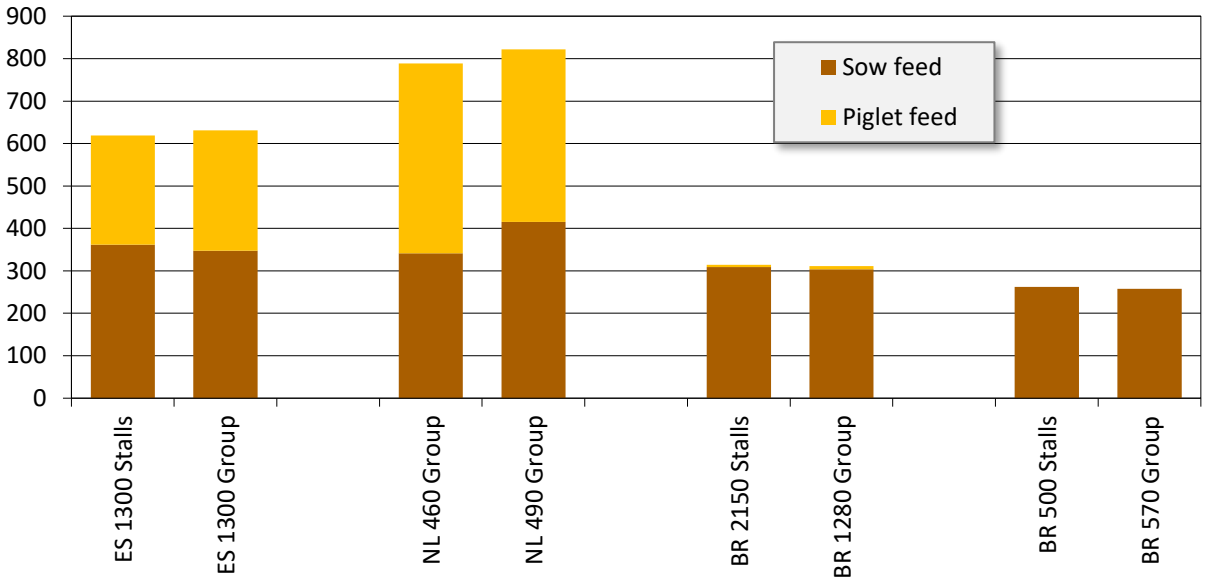


Figure A.3 Labour costs (USD per per sow)

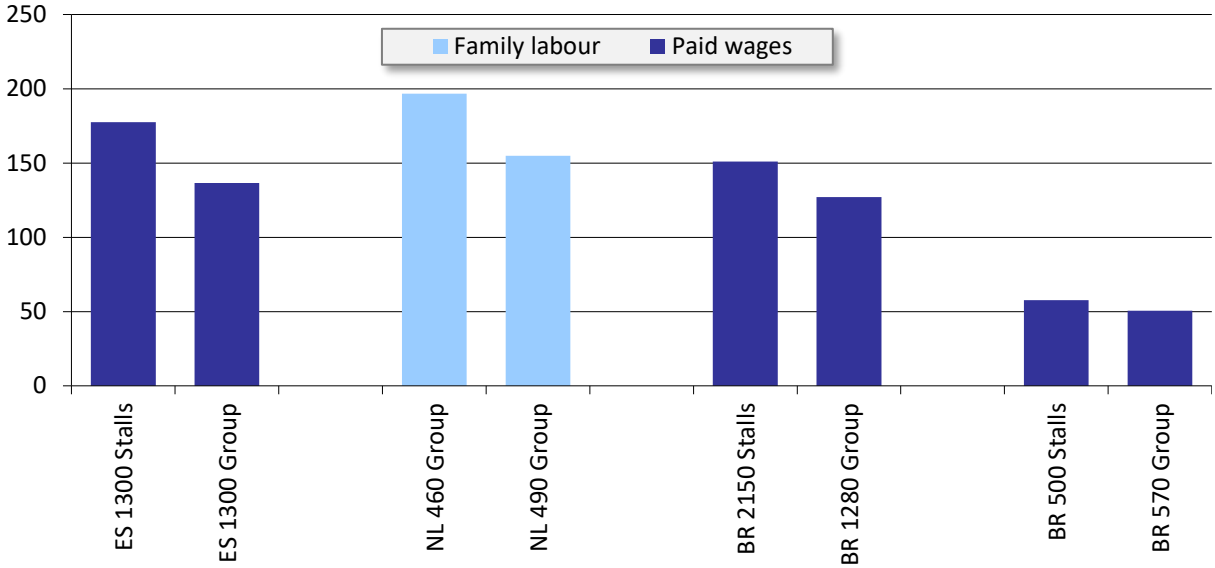
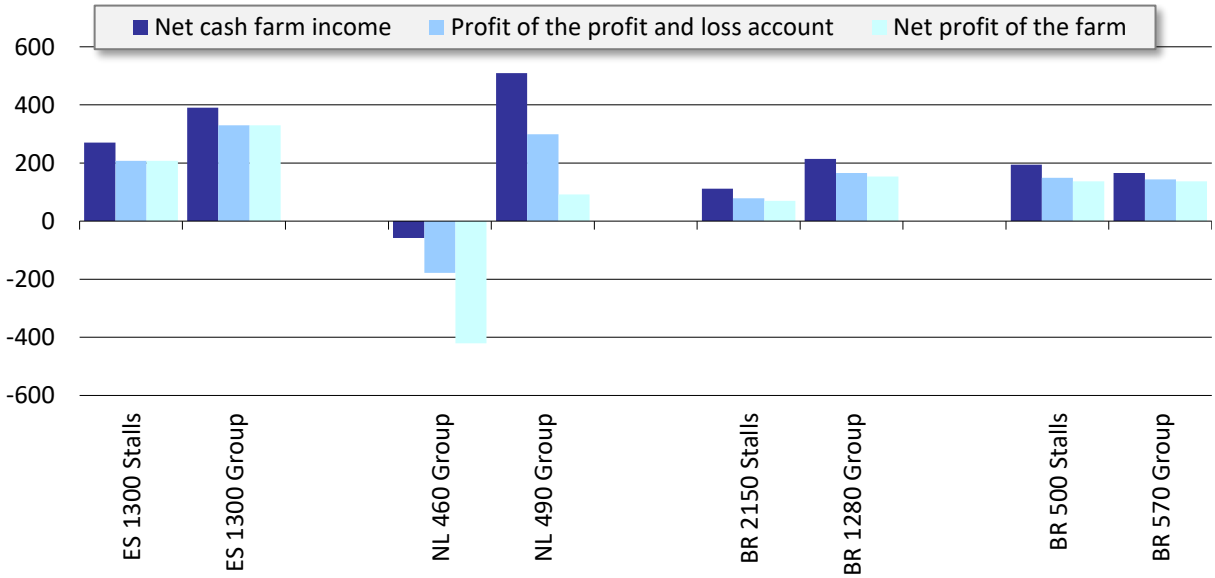


Figure A.4 Farm Profits (USD per sow)



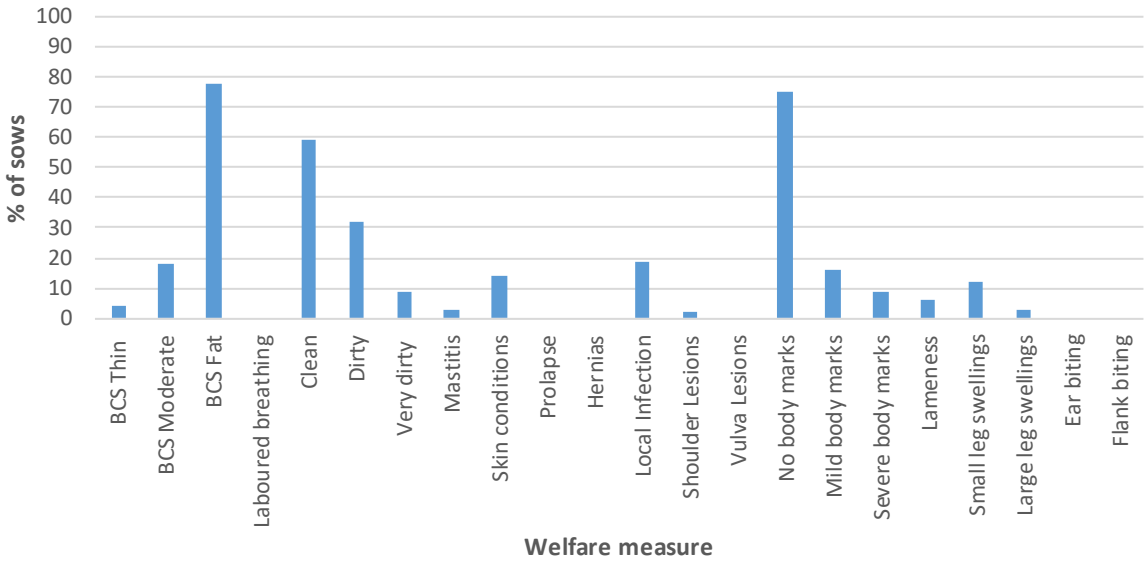
6.2 Detailed Welfare Results

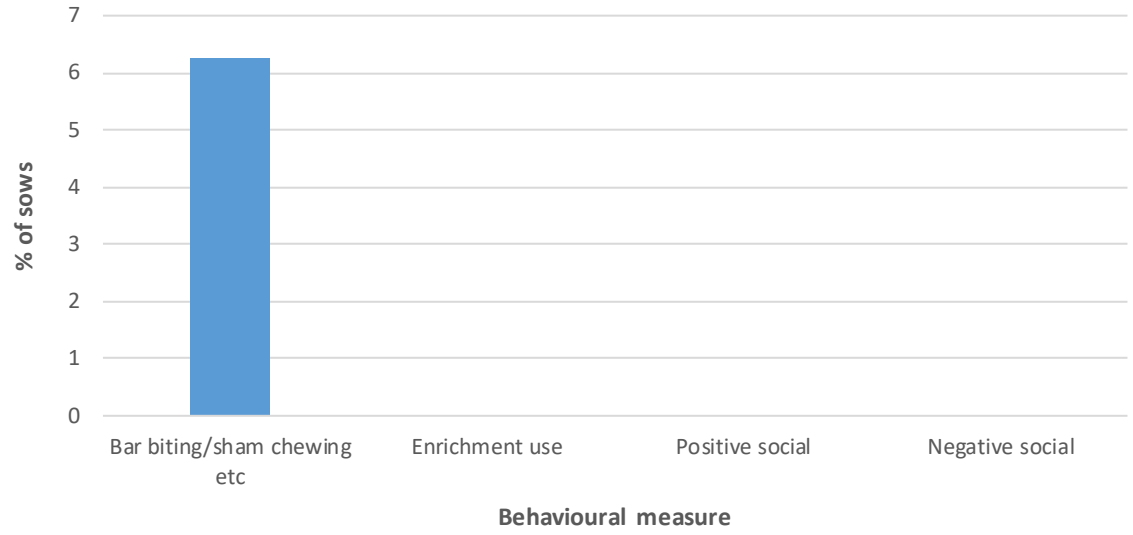
6.2.1 Stall systems

Brazil BR 2150 – Sow stalls

Farm details:

- This farm houses 2150 sows in stalls in naturally ventilated sheds. 6 boars are housed with the sows.
- The farm is 30 years old and in the process of transitioning to group housing.
- 5 sheds were sampled on the day of assessment, 1 of which housed sows in their first cycle, all other sheds were mixed parity. Every eighth sow was assessed (100 sows in total across 5 sheds).

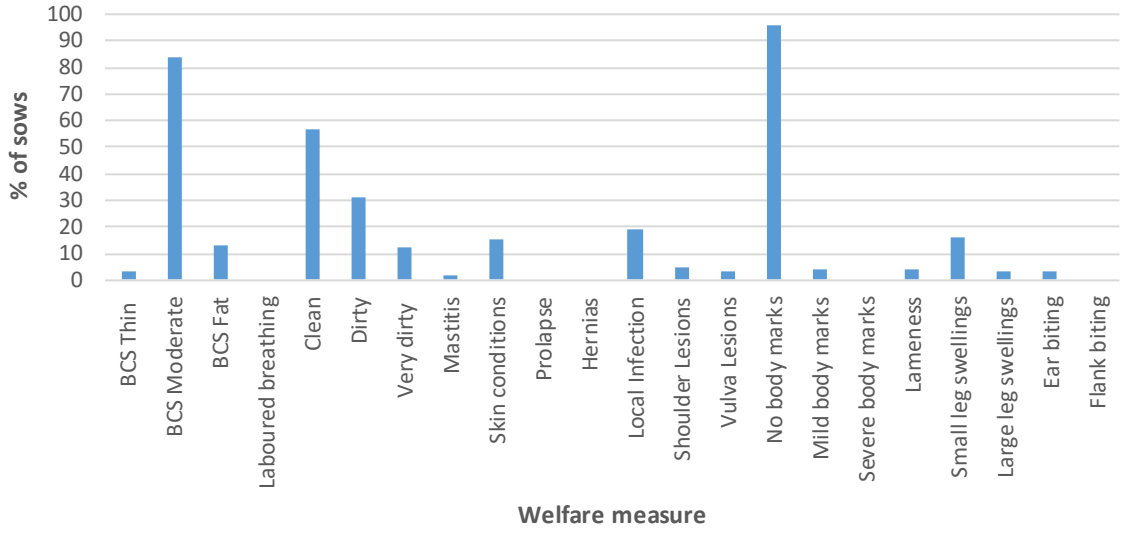


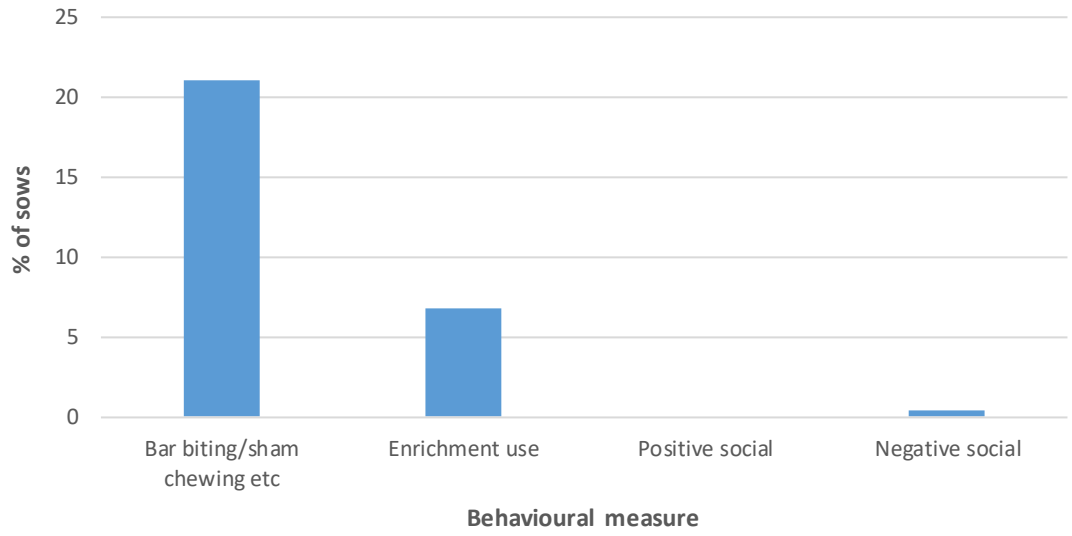


Brazil BR 500 - stalls

Farm details:

- This farm houses 556 sows total with 412 sow stall places in use on the day of assessment. Gilts are housed in small groups in a separate area and provided wood shavings throughout the pen. They are moved to stalls after 60 days on farm (at 210 days old & 15 days before insemination).
- Sows in gestation stalls are housed in one shed according to number of days in gestation. Every third sow was assessed.
- Sow replacement rate: 50%.
- Some sows were in their eighth parity but the majority were in their first to fourth pregnancy.
- Av. Sow mortality: 8.34%
- Av. Pre-wean mortality: 7.34%
- Weaning age: 25-27 days (piglets then sent off farm).
- The housing is naturally ventilated and natural light is provided when the curtains are up (temperature dependent).
- Flooring is solid with slats running along the back of each stall.
- Pellet feed is provided through automatic drop feeders and water via bite drinkers.
- Enrichment in the form of hanging ropes is provided to more aggressive sows.
- Comment: This was an extremely clean and well managed farm and stockmanship observed was exceptional. This farm will be transitioning to group housing under the company programme to transition to group housing across their supply base.



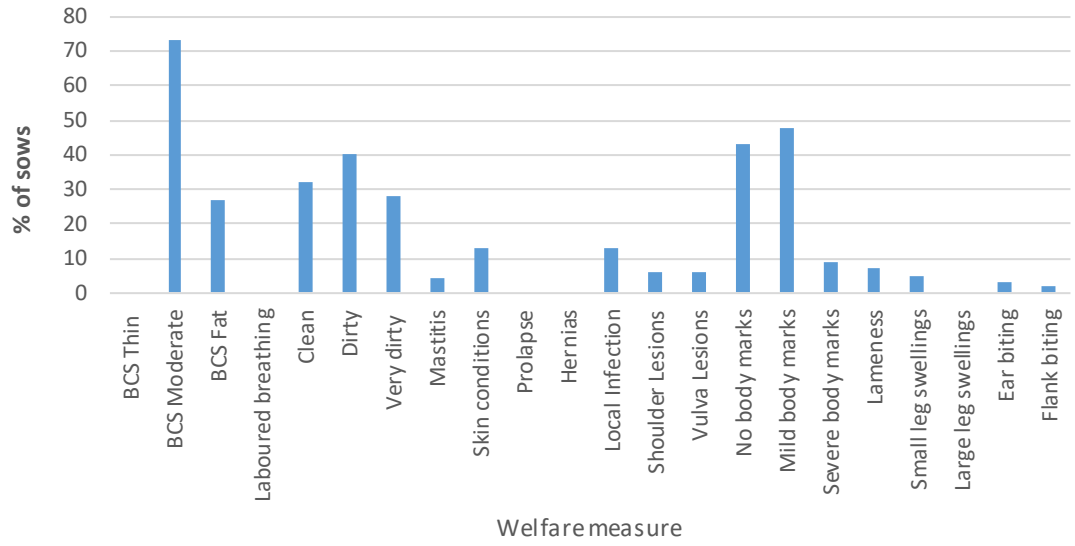

25
20
15
10
5
0
% of sows
Bar biting/sham chewing etc
Enrichment use
Positive social
Negative social
Behavioural measure

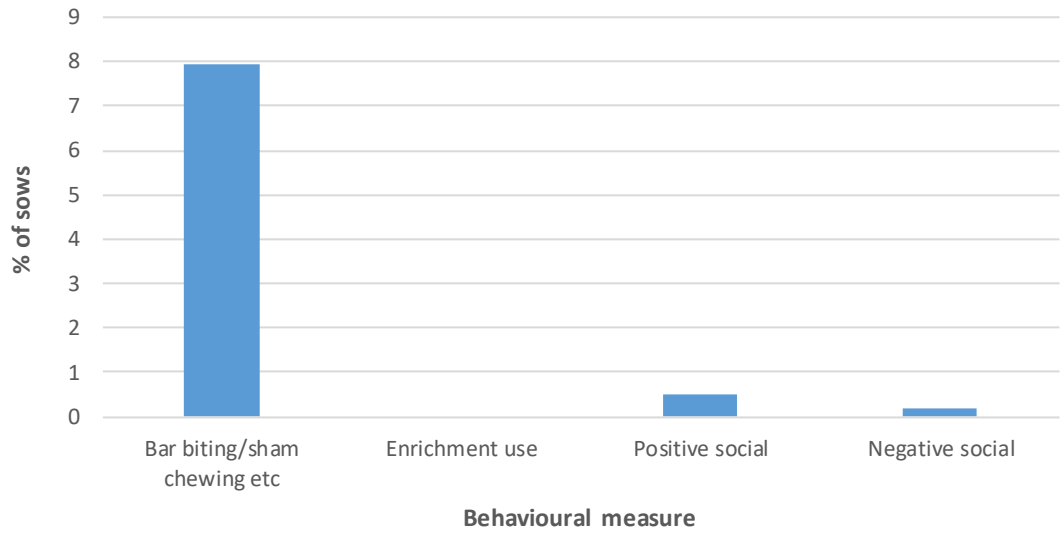
6.2.2 Group housing

Brazil BR 1280 - Group housing (No enrichment)

Farm details:

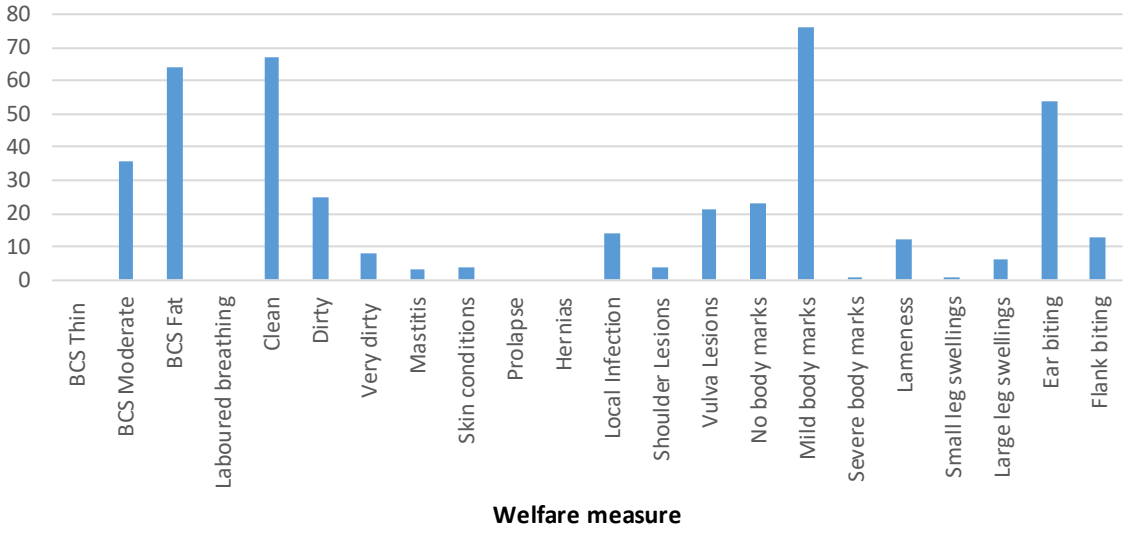
- The farm is 5 years old and houses 650 sows in dynamic groups of 120-160 sows per group in one shed. Eight to ten sows at a time are introduced to a group when mixing takes place (1300 sows in total across group housing, service and farrowing accommodation). Three boars are housed for the sows in group housing. This farm also has its own boars for semen.
- Sows are housed in service stalls for 42 days.
- Sows are generally slaughtered after their seventh parity although sows maintaining good performance are kept beyond this (just over 100 sows between eight to ten parities).
- Sow replacement rate: 45%
- Weaning age: 24 days
- The flooring is partially slatted with approximately 40% solid, partitioned resting areas.
- Housing is naturally ventilated with natural light provided through large side openings.
- The farm uses ESF (one feeder per 80 sows). Feed is mixed with water and separate water also provided through bite drinkers. The majority of sows ate their daily food allowance in one visit to the feeder.
- No enrichment was provided.

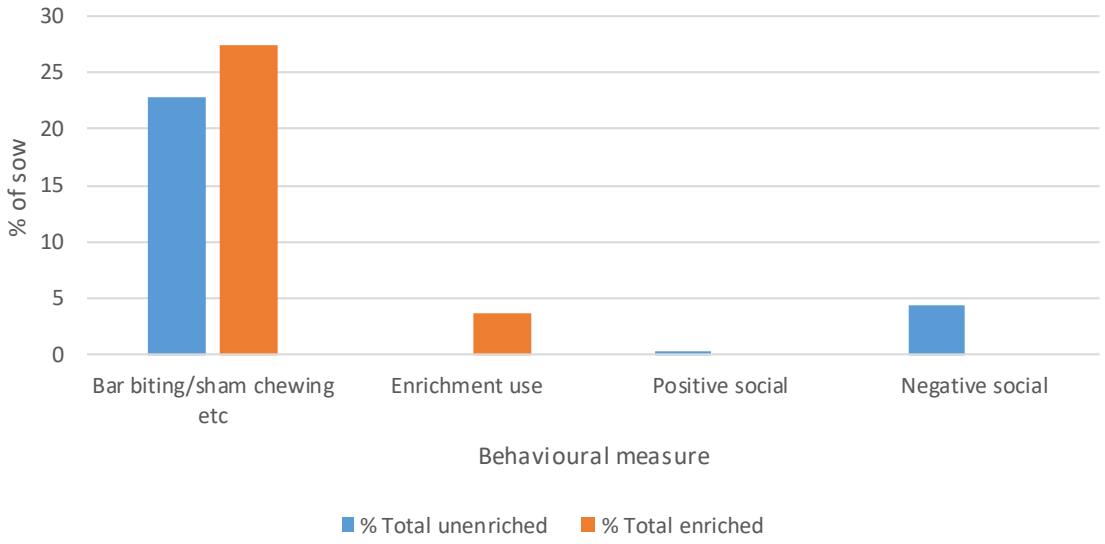




Spain ES 1300 - Group housing (Trialling point source enrichment)

- This farm houses 1296 sows in group housing in one building. At the time of the visit there was a total of 2300 sow places on site (560 in service stalls for 28 days).
- Sows in their second parity onwards are housed in dynamic groups of 80 sows per group (gilts and sows in first parity are housed in groups of 160).
- Sow replacement rate: 40-45%
- Ventilation is automatic (extractors and side vents) and natural light is provided through side windows.
- Flooring is partially slatted with approximately 65% solid, partitioned resting areas.
- Pellet feed mixed with water is delivered via ESF (one per 80 sows) and additional water provided via drinking troughs. Sows have their daily food allowance during one visit to the feeder.
- During the assessment the farm was trialling point source enrichment (straw rack) in one pen. The rack had been placed in one of the resting areas although this location meant that not all sows could access it. The trial commenced approximately 6 weeks prior to the welfare assessment being undertaken and stockmen reported an anecdotal reduction in stereotypical behaviour (sham chewing). Results shown for individual welfare measures combine both enriched and unenriched pens as the enrichment trial only took place in one pen.



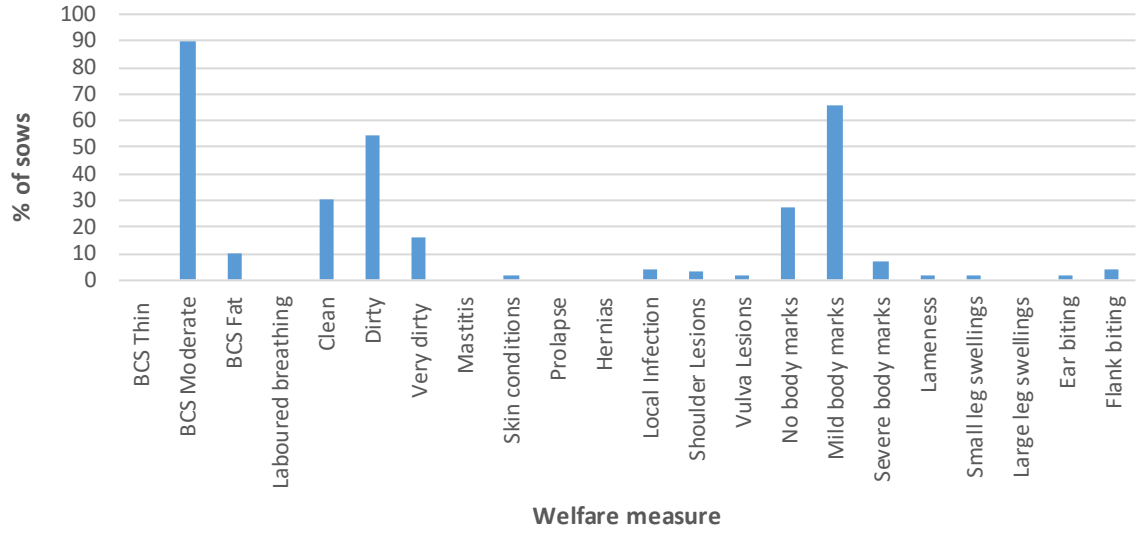


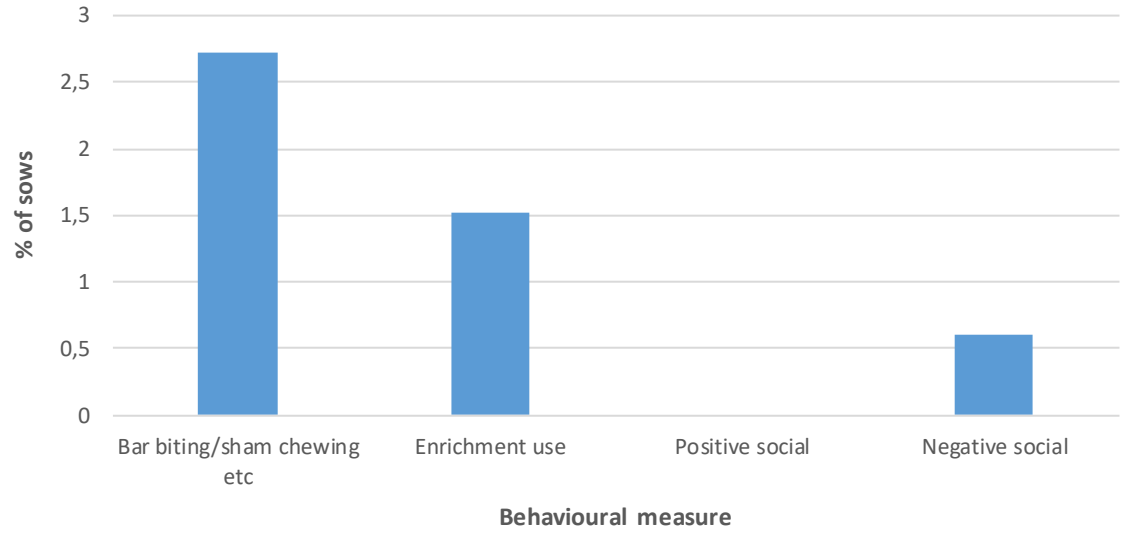
Netherlands NL 490 - Group housing (point source enrichment)

<u>Farm details:</u>

- This farm houses 500 sows in total in dynamic groups of 120-210 sows per group.
- Sow replacement rate: 35%
- Av. Sow mortality rate: 7%
- Av. Pre wean mortality: 14%
- Pellet feed mixed with water is provided via ESF (2 per group although larger group usually has 4 feeders) with additional water provided via bite drinkers (4 per pen).
- Flooring is partially slatted with approximately 40% solid, partitioned resting areas.
- Ventilation is automatic (fans and side vents) and natural light provided through side windows.
- A variety of point source enrichment is provided including straw racks (4 per pen of about 120), wooden blocks and chains (4 per pen) and rotating scratching brushes (1 per pen)

- Comment: Sows were observed to be using all areas within their pens and using the enrichment provided.

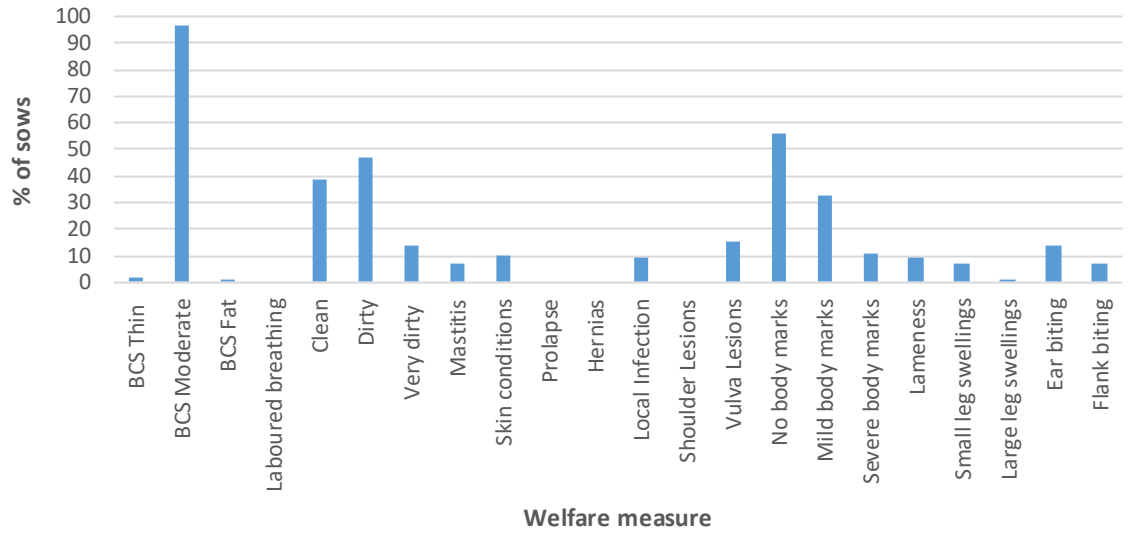


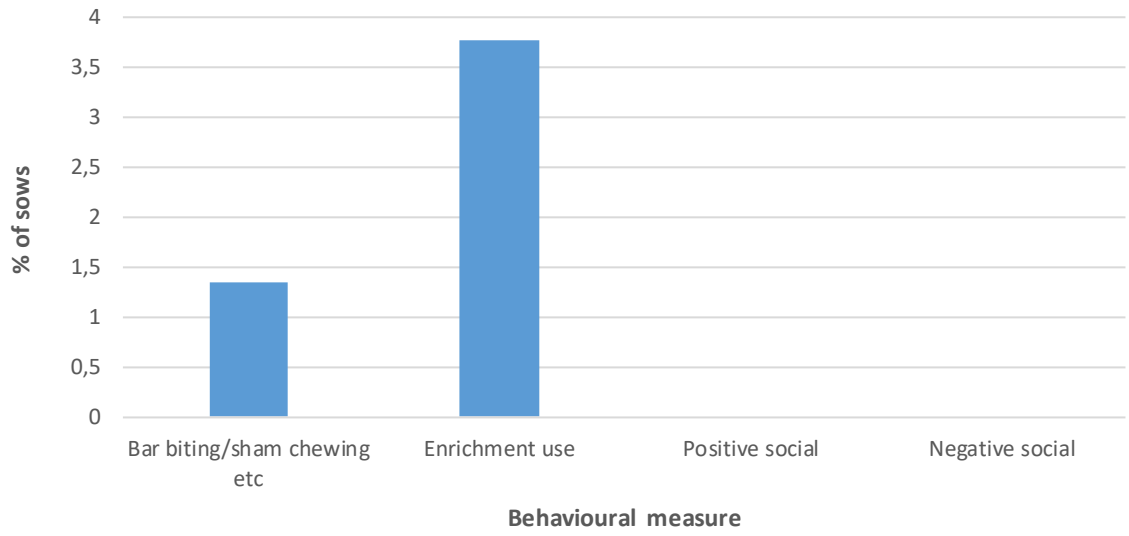


Brazil BR 570 – Group housing & straw bedding

Farm details:

- This farm houses 626 sows in total with 372 housed in four dynamic groups at the time of visit. There is 1 building per rearing stage (gestation, farrowing and nursery) and sows spend 7 days in service stalls.
- Sow replacement rate: 49%
- Av. sow mortality: 8%
- Av. Pre-wean mortality: 13.9% (reportedly mainly due to crushing of piglets).
- Av. Weaning age: 28 days.
- Housing is mechanically ventilated with both an automatic fan system and cooling pads. Natural light is provided when curtains are up (temperature dependent).
- Flooring is partially slatted with 40% solid, partitioned resting areas.
- Pellet feed mixed with water is provided via ESF (one per 80 sows) and additional water is provided via additional bite drinkers (one per ten sows). Sows ingest their daily allowance of feed in one visit to the feeder.
- The farm has been trialling straw bedding for approximately 60 days and additional point source enrichment is provided in the form of hanging ropes. The point source enrichment is rotated every few days (farm changes between using ropes, chains and logs).

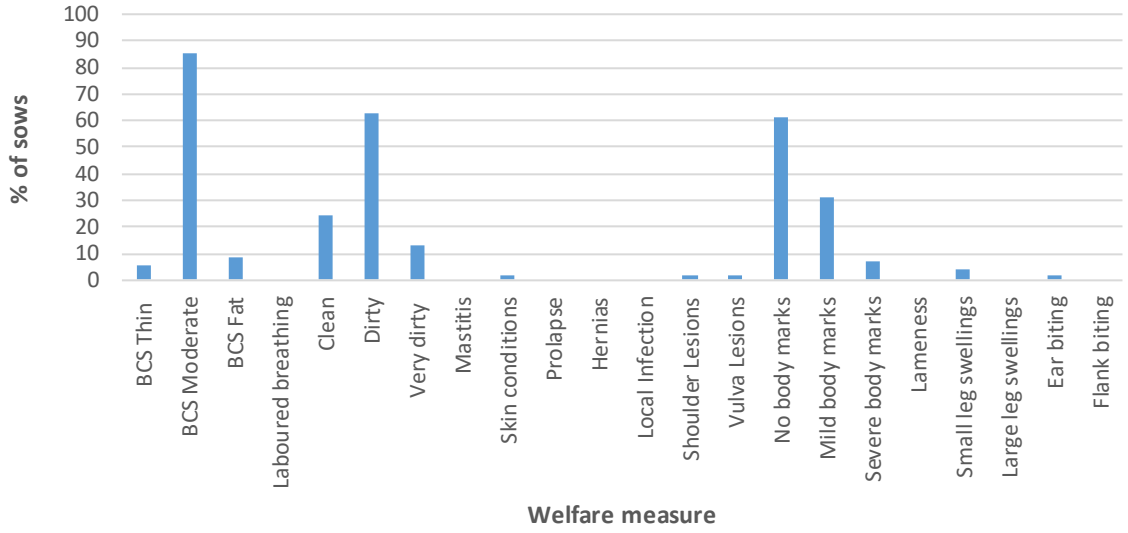


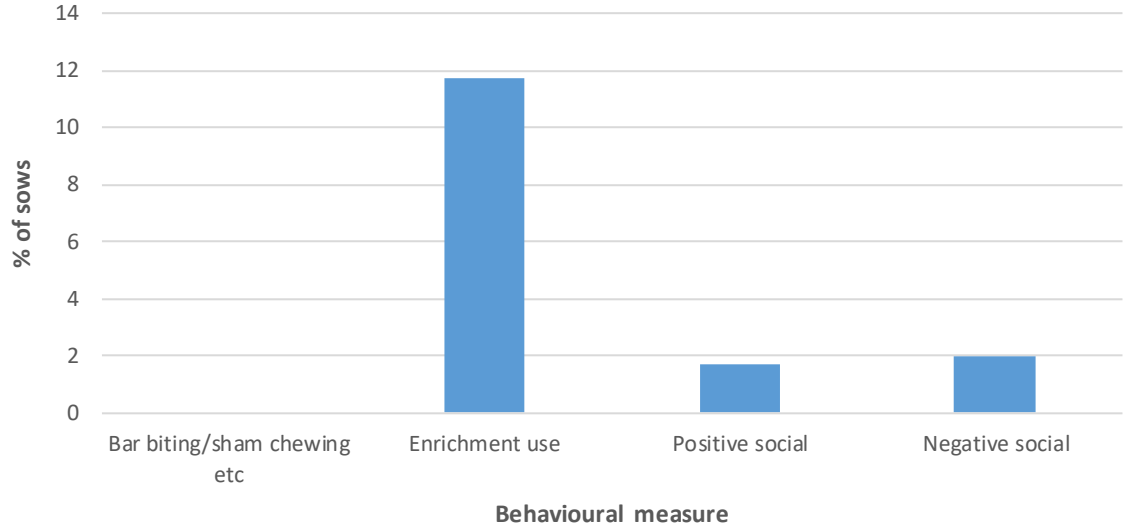


Netherlands NL 460 – Group housing – deep straw bedding

Farm details:

- This farm houses 460 sows in four dynamic groups of 50-110 per group.
- Sow replacement rate: 30-35% (average in Netherlands is 45%). Gilts are bought in at 214 days old from a separate farm.
- Pre-wean mortality: 13%
- Weaning age: 28 days
- Average of 30 piglets per sow per year.
- Flooring is predominantly solid with small areas of slats that provide drainage near to the drinker area. The farm uses deep straw bedding in the resting areas which is topped up every two weeks. The centre walkway is scraped though every day.
- Housing is naturally ventilated with large side doors and vents manually adjusted to control the temperature.
- Pellet feed mixed with water is provided via ESF. Sows have the opportunity to revisit throughout the day but reportedly ingest their daily allowance during one visit. Additional water is provided in water troughs (three per pen).
- This farm is Beter Leven 1 Star approved. Beter leven approval usually commands a premium of 12€ cents/Kg for a Finisher. Piglets are sold for an extra €1.5.


100
90
80
70
60
50
40
30
20
10
0
% of sows
BCS Thin
BCS Moderate
BCS Fat
Laboured breathing
Clean
Dirty
Very dirty
Mastitis
Skin conditions
Prolapse
Hernias
Local Infection
Shoulder Lesions
Vulva Lesions
No body marks
Mild body marks
Severe body marks
Lameness
Small leg swellings
Large leg swellings
Ear biting
Flank biting
Welfare measure


14
12
10
8
6
4
2
0
% of sows
Bar biting/sham chewing etc
Enrichment use
Positive social
Negative social
Behavioural measure