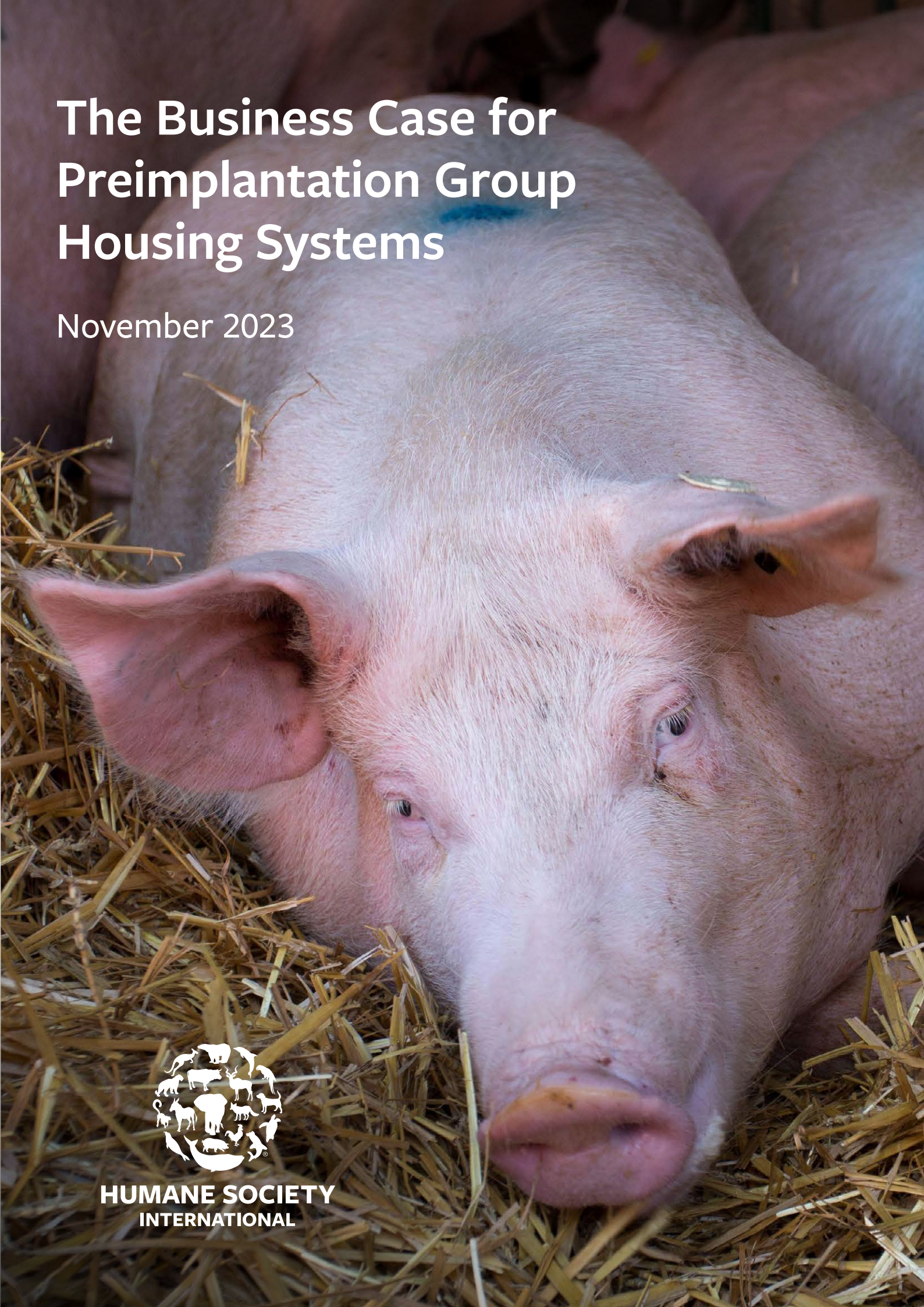
The Business Case for Preimplantation Group Housing Systems

November 2023



HUMANE SOCIETY INTERNATIONAL

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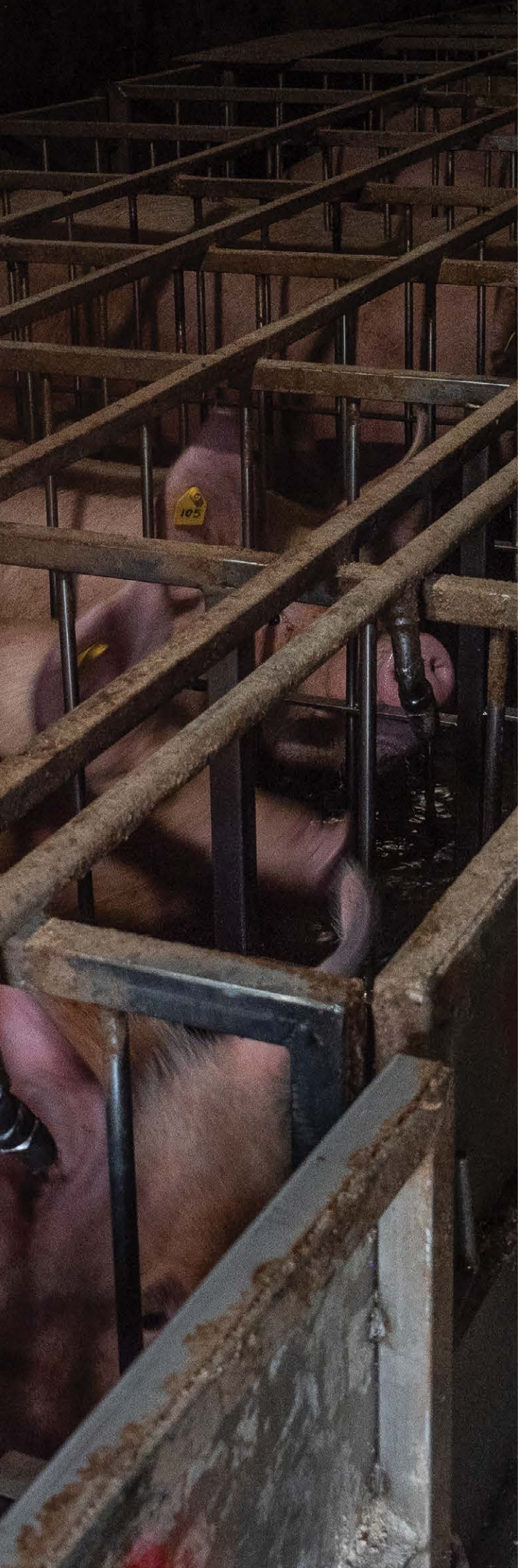


Executive Summary

Consumer demand for the "End the Cage Age" citizen initiative in the European Union and "Proposition 12", the ballot initiative that became law in California in the United States have local, regional, and global implications. Trade agreements increasingly include animal welfare. Corporate buyers are becoming more aware of and interested in how their purchasing decisions impact the welfare of animals in their supply chains, and they are enacting new purchasing requirements. These often include a pledge to move away from gestation crates, narrow metal enclosures used to confine breeding females (sows) in pig production. To meet this growing international demand, pork producers are moving to preimplantation group housing systems, which do not confine the sows for more than a few days for breeding. Both research and practical experience demonstrate that production results are comparable or better than temporary confinement systems that still rely on 28-days or more in crates, and they are successful in multiple counties across distant continents. These are sound production investments, which consider emerging best practices in animal welfare and are part of a strategy to achieve more sustainable production.

INTRODUCTION

PHOTO 1: **SOWS IN GESTATION CRATES**

Animal welfare is an important topic for both business and finance decisions related to animal agriculture. Based on a well-established body of scientific research, it is now widely accepted that animals kept for farming purposes have requirements beyond nutrition, health, and basic housing, and pigs are no exception. These intelligent, social, active animals have complex behavioral needs that must be considered as well.

The predominant form of housing for female breeding pigs (sows and gilts) around the world is still gestation crates (also called "sow stalls"). These narrow, metal stalls are typically just 0.6 meters (approximately 2 feet) wide by 2.1 meters (approximately 6.9 feet) long[1], barely larger than a sow's own body. She can take a step forward and backward, but she cannot turn around for the entire length of her gestation period, approximately 114 days.

Restrictive and barren, gestation crates have both physical and psychological impacts. In a natural environment, sows would normally spend about 31% of their time grazing, 21% rooting, 14% walking, and only about 6% of the time lying down (Figure 1).[2] However, when sows are locked inside gestation crates, the severe movement restriction and lack of exercise leads to reduced muscle weight and decreased bone density and strength.[3,4] In the crates, sows are also deprived of performing nearly all normal social behavior. The inability to express natural behavior leads to

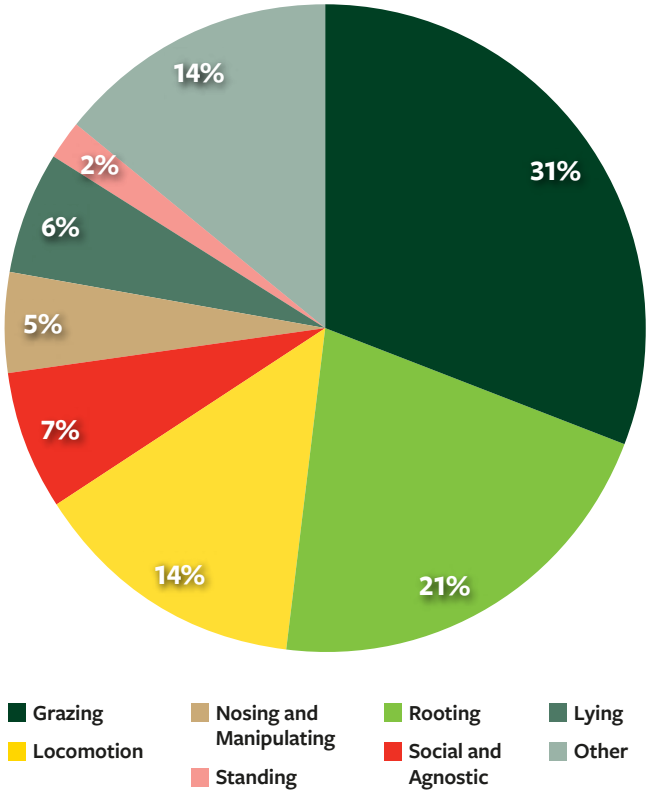


FIG 1: **BEHAVIOUR OF UNCONFINED PIGS.**[10]

abnormal substitutes, including repetitive bar-biting, head-weaving, drinker pressing, and sham- or vacuum-chewing (making chewing motions with an empty mouth).[5,6,7] This stereotypic behavior of pigs is thought to indicate "serious psychological and physical stress"[8] and is considered an indicator of poor welfare.[9]

With recent advances in housing designs, it is now commercially possible to accommodate more of the natural behavior of pigs without compromising productivity or profitability. Based on the science and growing public concern, gestation crates have been banned or restricted in several countries and regions of the world, including 11 U.S. states, New Zealand, the United Kingdom and throughout the entire European Union.

Gaining traction around the world, the alternative to gestation crate confinement is group housing. In group housing systems, sows are kept together in pens, rather than in gestation crates. Group housing designs vary widely, largely depending on the type of feeding system and the number of sows per pen, which may be small (4-6 sows per group) or ranging to more than 300 in large dynamic groups, as in European systems. However, in each case the sows have much more freedom of movement.

While group housing is becoming much more widespread, and the welfare of sows has improved substantially in these systems, some producers using group housing still confine sows in crates for up to 6 weeks or 45 days after breeding[11] before moving them into group housing. This is done to avoid mixing sows during the sensitive period in early pregnancy (see text box opposite), around 14-19 days after breeding. Sows may lose their pregnancy if they become stressed during fighting to establish a dominance hierarchy in the group, so they are commonly not mixed until the second pregnancy check, at day 28 of gestation or later. The EU Directive that covers the welfare of pigs currently permits the temporary crate confinement[12] of sows for 28-days and this practice is widely emulated around the world. However, a citizen initiative to "End the Cage Age" has been taken up by the European Commission, which would extend the ban on gestation crates and prohibit the 28-day period of confinement.

It is no longer best practice to confine sows for gestation, and new facilities must consider the potential for stranded assets and the long-term viability of investment in such systems. There are many successful cases around the world where the 28-days period of confinement has been eliminated. Future-proof systems are crate-free. The improved alternative to 28-days or more in crates is a "preimplantation" group housing system, where sows are mixed prior to the sensitive period. The terminology for this system varies around the world and is also known as a "serve and let loose", "early mixing" or "inseminate and release" (these terms all refer to the same type of system). In preimplantation group housing systems, sows can be mixed directly after weaning their most recent litter of piglets or following breeding. Most commonly, the sow is released directly after artificial insemination is complete or shortly after when there are no behavioral signs of heat. In some cases, sows may be held in stalls for only a few hours for breeding or they may be bred in

Porcine reproductive biology and the sensitive period.

Following insemination of the sow and successful fertilization, the developing conceptus spend 2-3 days in the proximal portion of the uterine horns. They reach the blastocyst stage at 5-6 days of age and 16-32 cells. By day 11-12, the growing blastocysts change shape, elongating from a sphere to a filamentous form while spreading evenly through the sow's uterus, becoming regularly spaced by day 12. Implantation is the attachment of the blastocysts to the uterine wall. Hormonal signals lead to continued function of the corpus luteum and rapid growth of the placentas (from day 20-70), in preparation for greater fetal growth between days 70 and 114 of gestation.[13,14,15] The implantation period is sensitive to stress, which can cause the sow to lose her pregnancy.

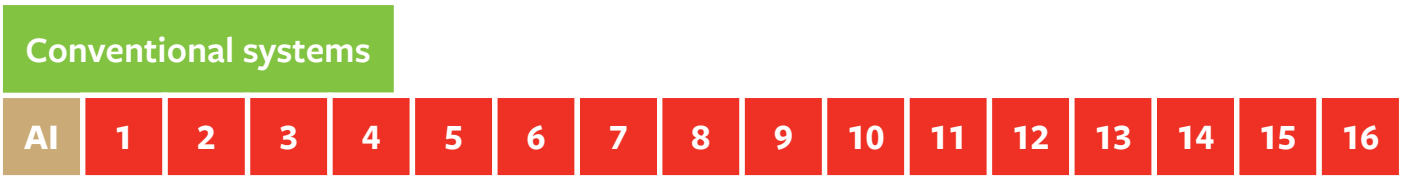
PHOTO 2: **GROUP HOUSING OF SOWS IN THE NETHERLANDS**

INTRODUCTION

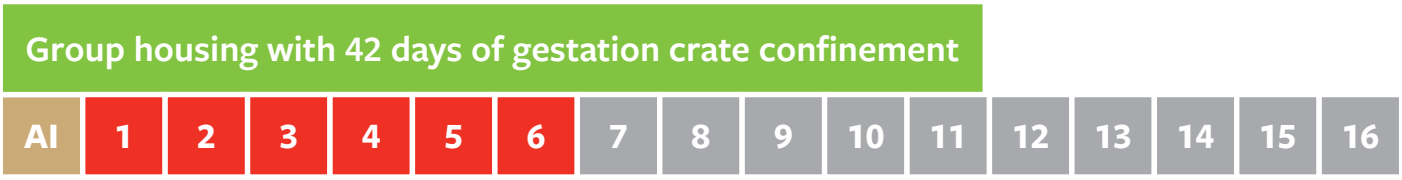
groups. Figure 2 (see below) illustrates how the holding period after breeding can impact the length of confinement for breeding females.

Pregnancy is the longest part of a sow's reproductive cycle, but not the entirety of her productive year. In a simplified example illustrated in Figure 3 (see page 9), the sow's cycle will last at minimum 20 weeks, where in a conventional system she will spend up to 17 of those in gestation crates and 3 or 4 in farrowing crates. If the desired average number of litters per sow is achieved, this cycle will occur approximately 2.5 times per year. By adopting a preimplantation system, the time spent in gestation crates will be reduced to one week at the maximum, or as little as no time at all when the breeding is done in groups. This is a reduction of 80% of the sow's time in crates yearly.[†]

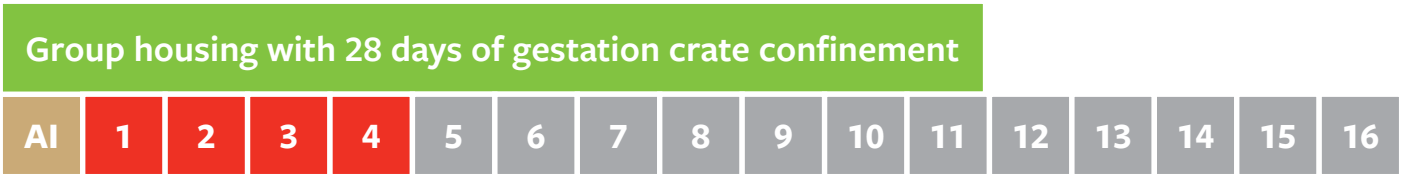
FIG 2: **LENGTH OF GESTATION CRATE CONFINEMENT IN DIFFERENT TYPES OF GROUP HOUSING SYSTEMS**



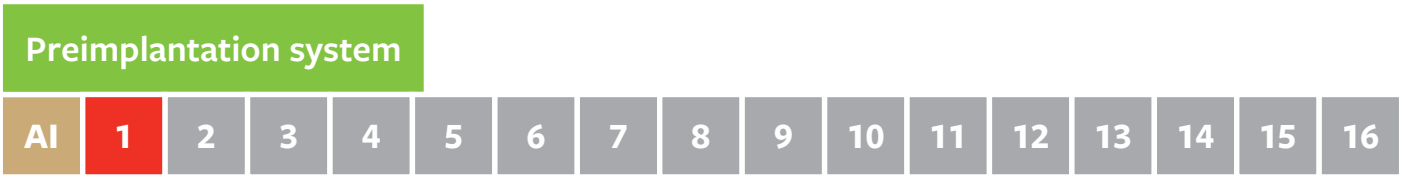
Sows are confined in gestation crates throughout the length of their pregnancy. The graphic above represents a typical sow pregnancy, where following artificial insemination (AI), the subsequent 16 weeks of pregnancy are endured in a gestation crate. (Red squares represent weeks confined).



Sows are mixed into groups only after 6 weeks or 42 days in crates. (Green squares represent weeks in group housing).



Sows are mixed after 4 weeks in crates. The confinement period is still significant, restricting the sow's movements and behavior for a quarter of her entire pregnancy.



The sows are confined only to a maximum of 7 days after breeding and grouped in collective pens for the remainder of their pregnancy.

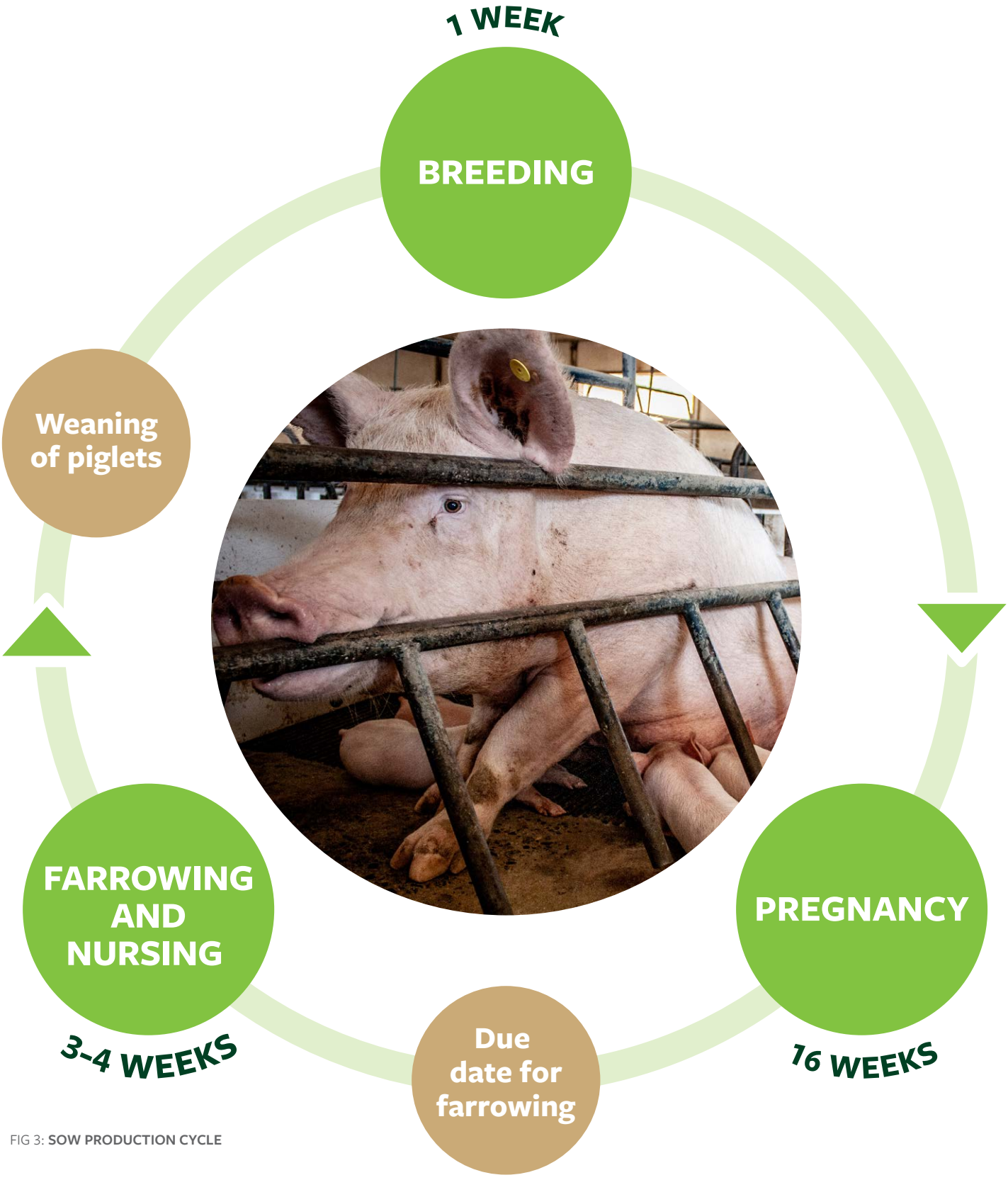


FIG 3: **SOW PRODUCTION CYCLE**

†Calculated as follows: 52 weeks / 20 week cycle = 2.6 cycles a year; 16 week reduction x 2.6 cycles a year = 41.6 fewer weeks in crates; 41.6 weeks x 100% / 52 weeks = 80% of the year.

Production comparisons

With good management, the productivity of sows in preimplantation systems is as good as group housing with 28-days in crates, or even better. There are several published research comparisons from different countries, the results of which are summarized in this section.which consider emerging best practices in animal welfare and are part of a strategy.

Brazil

A 2020 study carried out on a commercial farm in Santa Catarina, Brazil, compared 524 female breeding pigs housed in groups either directly after breeding (the preimplantation treatment) or following 32 days of pregnancy in individual stalls and then group housed. Group size was 11 animals per pen with a partially slatted floor and space allowance of approximately 1.81m^2 per female. The feeding system used in the study was an automated drop feeder.[16]

The study measured pigs born per litter, pregnancy rate and farrowing rate. They found no statistical difference in any of these production parameters, but figures were numerically better for the preimplantation group housing system in each case (Table 1).

TABLE 1: **PRODUCTION RESULTS**

Gestation housing system	Number of piglets born	Pregnancy rate (%)	Farrowing crate
Preimplantation group housing	15.27	92.86 (273/294)	91.50 (269/294)
Group housing after 32 days	14.55	91.70 (201/229)	91.23 (208/228)
Pr > F	0.0696	0.8216	0.8438

Canada

A 2015 Canadian study funded by the U.S. National Pork Board compared the effects of different mixing strategies in fully slatted group pens, with free-access feeding stalls. Sows were grouped with 14 individuals per pen and 2.2m^2 of space each. In the early mixing treatment, sows were mixed into groups directly following weaning of their last litter. They were fed, checked for heat, and bred in the free access stalls. In the late mixing group, sows were housed in individual stalls until five weeks of gestation prior to mixing in groups.[17]

The early mixing treatment had the highest conception rate (98%) and a significant reduction in the number of stillborn piglets. There were no other differences in production performance among the treatments (Table 2).

TABLE 2: **PRODUCTION RESULTS**

Mixing treatment of sows	Conception rate	Stillborn piglets
Early mixing (EM)	98%	0.95
Late mixing (LM)	87%	1.58

Italy

A study published in 2022 carried out at a 600-sow farrow to finish farm in Northern Italy kept sows in breeding stalls for either 4 or 28 days. They were then mixed into static groups (with no further introduction of new animals) for the remainder of the gestation period. Each group had 21 sows per pen and provided a space allowance 2.25m^2/sow. Sows were floor fed by manually spreading feed in a wide clean area of the pen floor. Measures in the study included the number of fresh skin injuries and old scratches (indicators of fighting) and salivary cortisol concentration, a measure of stress. The only significant treatment effect was the number of old scratches, which was worse on day 3 after mixing, only in the 28-day stall treatment. They used pregnancy rate, farrowing rate and litter size as indicators of reproductive efficiency. There were no statistical differences in any of these measures (Table 3).[20]

TABLE 3: **PRODUCTION RESULTS**

Production measure	Mixing at 4 days	Mixing at 28 days	p-value
Pregnancy rate (%)	88	85	0.64
Farrowing rate (%)	84	81	0.52
Total pigs born	14.4	14.3	0.81
Piglets born alive	13.0	12.8	0.80
Stillbirths (%)	8	7	0.76

United States

A study carried out at a demonstration farm in Kansas compared stalled sows to those in group pens with an Electronic Sow Feeding (ESF) system, which is an automated, gated stall that uses microchips to individually recognize each sow and provide a specific quantity of feed according to her body condition and gestation length. The flooring was half solid and half slatted. In this study, estrus detection was done in pens. Non-pregnant females were checked with a boar for standing estrus, were naturally mated, and then placed into stalls. Subsequent mating was with artificial insemination in the stalls. Next, the sows either remained in the breeding stall for the duration of gestation or were moved into group pens within 2-4 days. The pens measured 11.99 x 7.32 meters and group size varied between 30-60 sows, depending on the production schedule.

Better production results were achieved in the group housing treatment. Group housed sows had improved return to estrus within 7 days post weaning and better farrowing rate, higher litter birth weight and higher litter wean weight compared to those confined to stalls (Table 4). There was no overall difference in the number of piglets born alive or weaned.[21]

The study concluded that sows in groups with ESF systems had either similar or improved performance compared to sows confined to gestation crates.

TABLE 4: **PRODUCTION RESULTS**

Production measure	Gestation crate	Group pen
Return to estrus (%)	91.7	94.5
Return to estrus within 7 days post-weaning (%)	68.4[c]	72.0[d]
Farrowing rate (%)	89.4[c]	94.3[d]
Litter birth weight (kg)	16.7[e]	17.7[f]
Mean litter weight (kg)	56.2[e]	57.1[f]

c,d Percentages with different superscripts differed, P < 0.05
e,f Percentages with different superscripts differed, P < 0.001

Poland

In a study published in 2021, researchers in Poland were specifically interested in the period between weaning and estrus. They studied over 3,000 sows in a large commercial facility over two years and compared two groups: 1.) sows bred in individual stalls and confined for 28 days, and 2.) sows bred in groups, put back into stalls for 28 days and then moved back into groups. This allowed the researchers to isolate the specific effects of early grouping to breeding in stalls.[18]

For second parity sows (those in their second pregnancy), the proportion showing estrus within 7 days of weaning was significantly greater for those bred in group pens compared to those bred in individual stalls, with a pronounced seasonal effect (the better rate of return to estrus was mainly found in summer and fall). Except for the number of stillbirths, almost all reproductive measures improved when the sows were housed in groups directly after weaning (Table 5).

TABLE 5: **PRODUCTION RESULTS**

Variables	Individual stalls		Group pens	
	Mean	SD	Mean	SD
Conception rate (%)	84.2[A]	8.1	87.4[B]	6.3
Farrowing rate (%)	82.0[A]	8.7	85.3[B]	7.1
Weaning-to-first-service interval (days)	6.6	7.1	6.3	6.3
Weaning-to-effective -service interval (days)	13.9[A]	24.3	10.8[B]	17.2
Litter size (piglets/sow)	11.6[A]	2.7	12.2[B]	3
No. of live born piglets/sow	11.4[A]	2.4	11.6[B]	2.9
No. of stillborn piglets/sow	0.25[A]	0.96	0.54[B]	1.43
No. of mummified piglets/sow	0.02	0.16	0.01	0.22
Farrowing interval (days)	158.9[a]	23.8	157.3[b]	17.6
Farrowing index (litters/year)	2.33	0.25	2.34	0.2
No. of live-born piglets/sow/year	26.5[A]	6.8	27.2[B]	7.1

A,B P < 0.001
a,b P < 0.05

A key conclusion of the study is that group housing during the wean to estrus interval allows more social interaction and greater movement, which may stimulate behavioral estrus, improving (reducing) the weaning-to-effective service interval. Moreover, this strategy allows the sows to establish a stable and cohesive group before the critical phase for embryo implantation. It also allows for early detection of estrus, as unrestricted behavior in pens facilitates accurate and timely estrous detection, because the behavioral changes are clearly visible.[19] This has implications for early mixing systems, generally.

Current scientific understanding

European Food Safety Authority

The European Food Safety Authority (EFSA) is an agency of the European Union that appraises and integrates scientific evidence to answer questions about risks in the food supply chain. As part of its evaluation of animal welfare legislation, through the 2020 Farm to Fork strategy[22] the European Commission requested EFSA to give an independent view on the welfare of pigs kept in different types of husbandry systems, including breeding females. EFSA reviewed the relevant literature, including in languages other than English, finding 20 studies that reported reproductive outcomes depending on the time of sow grouping. The report was published in 2022. They concluded that "In general, if grouping takes place immediately or in the first days after service, reproductive performance can be as good as that with grouping at 4 weeks after service".[23] They further recommend: "To avoid the welfare consequences of stall housing and the possible consequences of stress during early pregnancy for reproductive performance, it is recommended to group sows at the time of weaning"[24]

Since the housing conditions in the studies reviewed by EFSA differed widely (different group sizes, static vs dynamic management, flooring type, space allowance, etc.) there was large variation in the results. The conditions that result in superior performance and the reproductive benefits of permitting animals more freedom of movement will become better elucidated as more practical experience and continued research accumulates. However, many ways of managing the mixing of sows to improve success are well established. These include providing adequate space, providing straw or other bedding, keeping familiar groups together, providing fiber-rich diets, reducing competition during feeding, and positive human interactions.[25]

Research on piglet immunity

The environment in which sows are kept has an impact on the fetuses developing in her womb. While the research is in an early stage, a study published in 2021 found compelling evidence that there may be benefits for the immunity of piglets if the sow has more freedom of movement. Researchers collaborating in the United Kingdom and Poland compared sows kept in crates from day 1 through day 100 of pregnancy to those group housed from day 1. They measured stress indicators and immune-based indexes in the piglets and found that "... piglets delivered by sows kept under movement restriction conditions exhibited higher cortisol and acute phase protein levels as well as a lower lymphocytes proliferation index. This suggests that lack of movement in sows during the gestation period influences piglets' physiology and indicates that the piglets are suffering from prenatal stress caused by insufficient housing conditions of their mothers potentially leading to poor health and welfare of their offspring."[26]

Cost

Capital and operating costs for sow housing vary greatly between regions, and depend on farm size, design and layout options and whether the project is a new building or a renovation. For an update to an existing barn, the ability to reuse equipment, the flooring, the manure handling system, among many other factors, will have large impacts, so generalizations regarding cost differences are difficult. However, when the layout is well planned, some preimplantation designs can house more sows in the same building footprint as a stall barn.

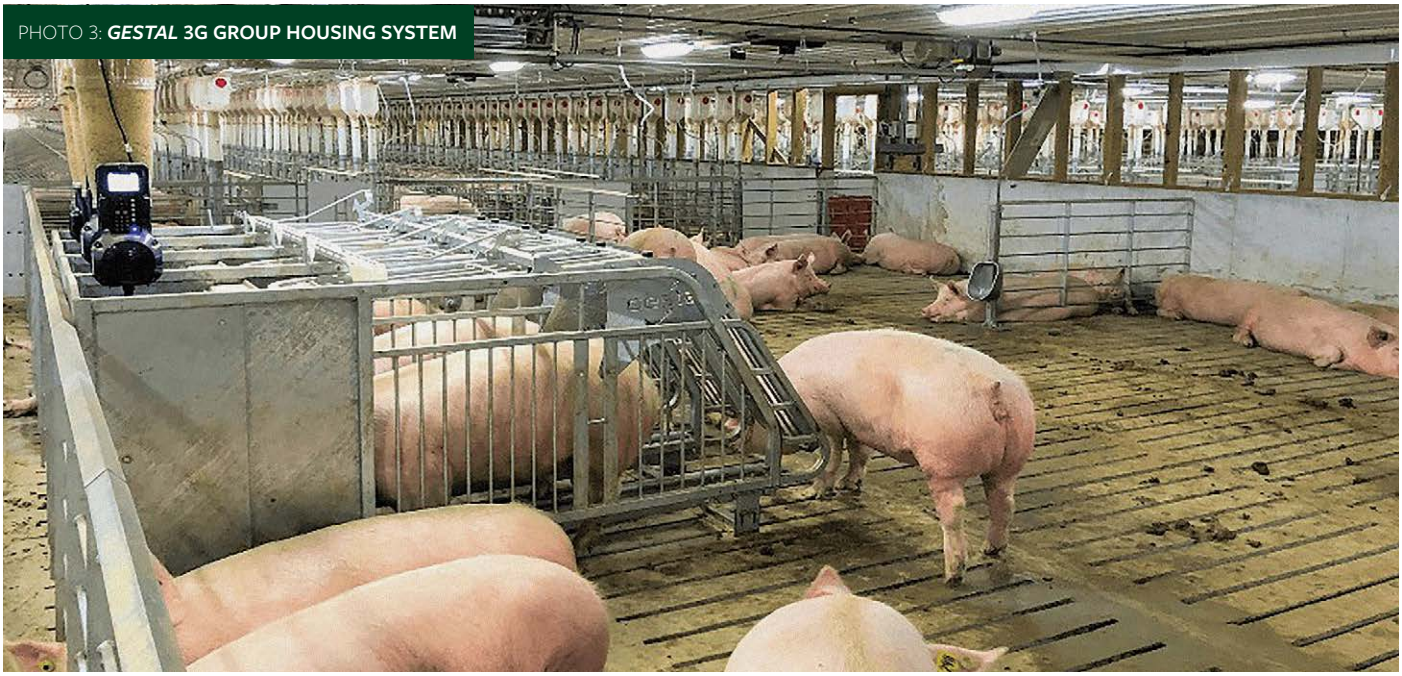
According to Jyga Technologies,[††] a manufacturer of software and automated equipment for electronic feeding systems (ESF) based in Canada with equipment sold around the world, the reduction in gating (steel or iron needed) in a group housing system with Gestal 3G (photo 3) is a cost savings compared to a house with sows fully confined in crates throughout pregnancy. It's not only the materials, but the labor costs of installing each crate and the upkeep and maintenance, particularly if they are not constructed from quality materials and break down over time. Additionally, in a stall barn, each sow space requires plumbing for a nipple drinker, which substantially adds to the cost. While a feeding station with ESF does have an initial investment cost, each station can feed up to 20 sows, spreading the expense over many animals. Depending on the layout of the barn, and the space provided per sow, some group housing designs can house up to 18% more sows in group housing pens than they can in a fully crated system, because the aisleway space between rows of stall is better utilized. One layout, which includes free-access stalls with ESF, has lower capital costs to build. For an average farm with more than 5,000 sows, the cost per sow space can be reduced by up to 35% (depending on the space allowance per sow).

All these factors result in substantial cost savings. Jyga customers who have received quotes from different equipment manufacturers shared that the ESF system is less expensive to build (Table 6).

TABLE 6: **THREE COST ESTIMATES FOR A NEW BUILD FROM DIFFERENT EQUIPMENT PROVIDERS**[27]

Category	Gestation stalls	Shoulder stalls	Gestal
Total sow spaces	4610	5528	5454
Total sow spaces	100%	120%	118%
Gating	100%	118%	24%
Electronic feeders			100%
Feed system	100%	60%	13%
Plumbing	100%	98%	40%
Install labor	100%	73%	99%
Total	100%	98%	77%
Cost/sow space	100%	81%	65%
Square foot/sow space	18.8	20.4	19.67[†††]
Cost/square foot	100%	75%	62%
Cost/sow space (USD)	490.30	399.12	318.66

PHOTO 3: ***GESTAL* 3G GROUP HOUSING SYSTEM**



[††] Interview conducted August 30, 2023.

[†††] Note that this system would not comply with the space requirements of Proposition 12.

Case study 1: Brazil

Hartos Agropecuária, Granja Miunça is located in Basília, Federal District of Brazil. The farm has 4,000 breeding females and is a full cycle (farrow to finish) operation.

Hartos Agropecuária is a 4,000-sow breeding farm in the Federal District of Brazil started in 2010. They use static groups of 80 sows with an Electronic Sow Feeding (ESF) system. Sows are confined to breeding stalls for just 4 days, on average.

Interest in animal welfare at Hartos Agropecuária started with the former owner in 2010-2011, and continued when the new owners took over the operation in 2018. The former owner valued technology, and at that time he heard about group housing systems, including automatic feeding stations, and that these systems were already being adopted in Spain. Interest in the concept led him to visit farms in Europe where he studied the possibility of bringing these systems to Brazil to promote higher welfare for the animals. The farm at that time used 100% gestation crates. An expansion project began, however the initial system was designed around keeping the females for 35-40 days post-breeding in crates. After the initial transition, it took time to learn to work with the new equipment, since only manual or semi-automated feeding systems had been used before, and there were some initial challenges. Some of the important points learned were about preventive maintenance and ensuring a backup power source. Following improvements to the Spanish system for Brazil, Hartos Agropecuária achieved even better production results than the same system in Spain.

While there was already a well-structured group housing system in place when the new owners took over in 2018, the farm made further animal welfare improvements and moved to a 100% early mixing (or preimplantation) system.

Description of the system

Sows are transferred to groups on average 4 days after keeping them in breeding stalls, where they are artificially inseminated.

The group size has varied over time and between different facilities, depending on the type of feeding station and genetics used. The group housing started with pens of 80 animals (which was the group

PHOTO 4: **SOWS IN PREIMPLANTATION GROUP HOUSING AT HARTOS AGROPECUÁRIA**

size dictated by the electronic feeding equipment), but currently 40% of the facilities now have smaller groups of 15, 30 or 45 animals.

The stocking density is adjusted according to the size of the pen, the size of the animals (whether gilts, adult sows, heavier genetic strains, etc.), and the availability and placement of feeding stations. The flooring is 40-50% slatted and the rest is an area for resting.

The current practice is to use static groups (this was another change adopted with the higher welfare improvements). The static group needs more available space to work, but Hartos Agropecuária believes it is essential for the well-being of the animals at their farm. In the previously used dynamic groups, there was more fighting among the sows, which sometimes led to loss of productive performance. In the previous dynamic group management system, females were introduced in sets of 10 at a time and this caused fights throughout the housing period. For this farm, static groups work better as the group composition remains stable until the transfer to the farrowing ward. Sanitation is another benefit of static groups, as when all the animals are removed for farrowing, the pens can be washed and disinfected, reducing the infection pressure. From the employees' point of view, the static group is easier to work with as well, because removing and inserting small sets of animals into the dynamic group was a lot of work. The static system is much easier for the employees and the sows are calmer. Production results at Hartos Agropecuária are good (Table 7).

TABLE 7: **2022 PRODUCTION RESULTS FOR HARTOS AGROPECUÁRIA**

Production measure	Farm result
Average weaning-to-estrus interval (days)	3.69
Average conception rate (%)	93.84
Average farrowing rate (%)	92.43
Average number of total piglets born/litter	16.34
Average litter weight (kg)	20.64
Average weight at birth/piglet (kg)	1.36

Case study 2: Spain

Albesa Ramadera combines a commercial farm with a research and training center in Catalonia, Spain, with 3,300 sows. Built in 2009, Albesa Ramadera was one of the first farms to begin trialing preimplantation systems. The consulting arm of the business, Optimal Pork Production (OPP) has assisted farms in Spain, Brazil, Guatemala and other countries to also install preimplantation group housing systems.

Albesa Ramadera is a commercial farm and research and training center in Catalonia, Spain. Construction started in 2009, after the owners received European funding to compare 3 breeding systems ("serve and let loose", 4 weeks or 28-days in crates, and 6 weeks or 42 days) in a large-scale production environment. Other important areas of focus were the promotion of transparency and a system that was successful in animal welfare. To facilitate teaching and education, Albesa Ramadera partners with universities and was built with a separate visitors' center. To ensure biosecurity, visitors can view the group housing system through windows in the classroom (Photo 5), which has a separate entrance from the animal buildings.

Albesa Ramadera uses an ESF system and decided on groups of 160 animals (Photo 6). Flooring in their barns follows EU requirements combining solid and slatted floor with a space allowance of 2.025m^2 per sow in semi-static groups (one mixing). EU Directive restricts stocking density to 2.25m^2/sow, but a 10% reduction is permitted in larger group sizes.

Albesa Ramadera prefers working with bigger groups because the larger pens, and the separations with walls inside the pen offer more opportunities for sows to avoid negative interactions (Photo 6). With the ESF, even in bigger groups, there is still control of the animals, because each sow is fed individually.

ESF also offers the most opportunity for precision feeding. Piglet mortality is reduced with micronutrition through intrauterine effects. The ESF system is a good option for providing supplements in the diet, to improve colostrum quality or bone density, for example.

PHOTO 5: **CLASSROOM VIEWING AREA AT ALBESA RAMADERA**

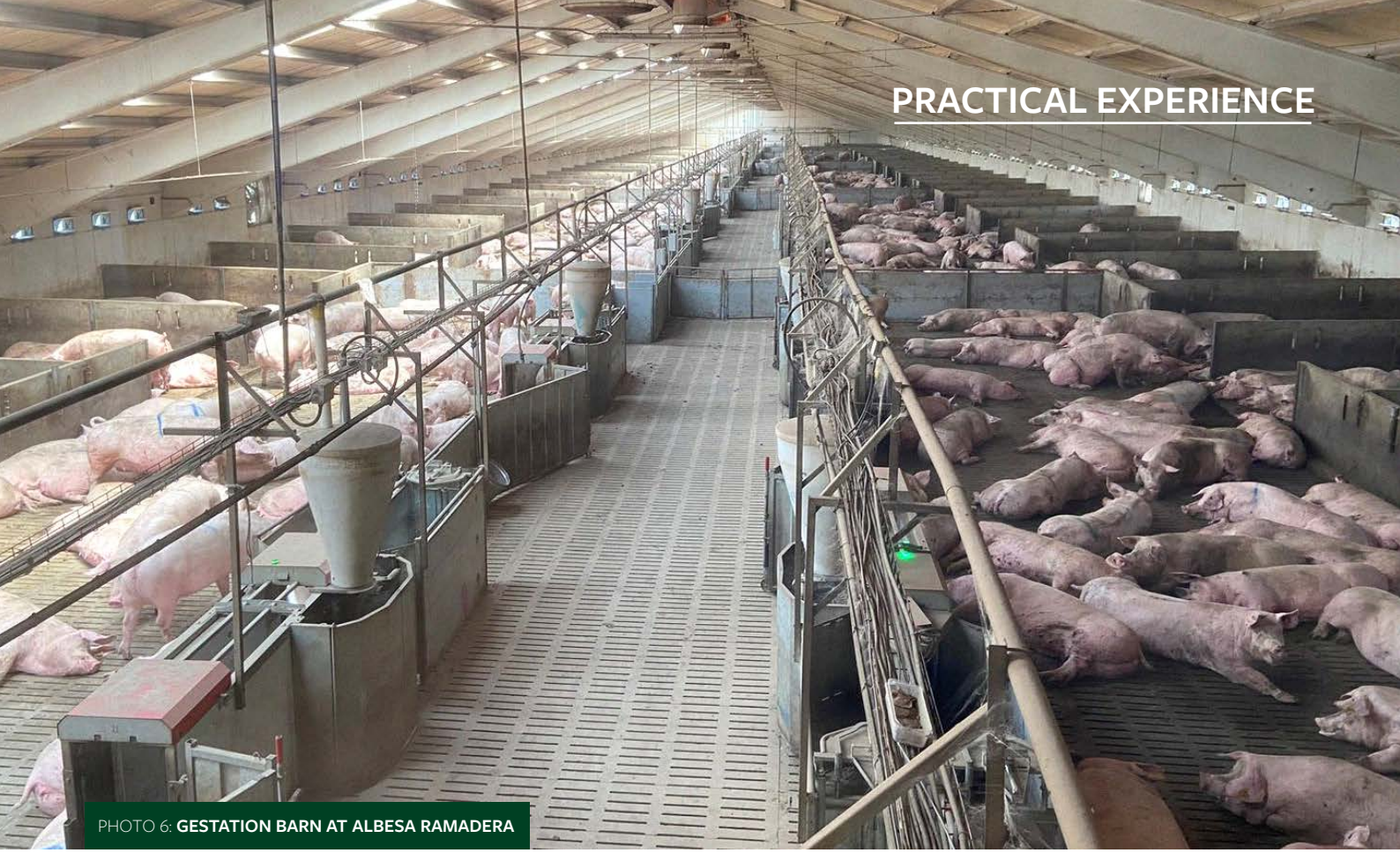


PHOTO 6: **GESTATION BARN AT ALBESA RAMADERA**

Another benefit of ESF is that the technology that comes with the system is attractive to young people entering the field, and this helps bring in and keep bright new employees.

For enrichment, logs of wood were tried, and this worked, but the sows went through it fast, and it "bumped" and bruised the sows. The logs also rolled into the feeding stations if they were loose. They also tried compacted straw, compressed wood, herbal mixes, plastic balls, among others. These enrichments were student thesis projects. Now they are using chains and chewable plastic that are durable. Labor to provide the enrichment is a challenge, during summer people leave, so the farm is seeking something practical and viable to be applied throughout the integration chain. Environmental enrichment is important to Albesa Ramadera and they are committed to finding a good solution.

Gilt pens are outfitted for training, so the young animals learn to use the ESF while they are in holding pens, from 110 to 130kg, before they are ready for breeding. The training period takes from 2-5 weeks. The training starts with the gate to the feeding stall open, then it is half closed to encourage the gilts to start pushing open the doors.

When gilts are ready for breeding or sows have weaned last batch of piglets, they are moved to crates for breeding. After coming into heat (within 4-5 days on average), they are bred according to the artificial insemination protocol, typically once a day. Heat detection is done by passing the teasing boar. Employees are trained to look at the ears, stance and vulva coloring and swollenness. One to two days after the inseminations are done, they are moved into the groups in weekly batches.

TABLE 8: **PRODUCTION RESULTS FOR ALBESA RAMADERA***

Production measure	Farm result
Average farrowing rate (%)	91.2
Average number of total piglets born/year	35.2
Average number of piglets born alive/year	33.6
Average number of weaned piglets/year	30.4
Average weight at birth/piglet (kg)	1.32

**Note: Farm positive for Porcine Reproductive and Respiratory Syndrome (PRRS).*

At Albesa Ramadera, it is believed that animal welfare and productivity go together. Better production results (Table 8) can be achieved with a preimplantation ESF system, because precision feeding can start earlier. Micronutrition programs start immediately after breeding, and this produces healthier piglets with more stable immunity. Precision feeding results in feed savings cost and helps keep sows in correct body condition with better reproduction.

When this farm was built, it was the first of its kind. Albesa Ramadera concedes they made mistakes at first, but every farm that came after improved. Because the project was funded by the EU and the proposal was to test the 3 systems, the facility has more crates than they would like. If they were to do it again today, they would only keep the crates for insemination and expand the space available for pens. Preimplantation (serve and let loose) systems are now widespread and in big farms all over Europe, and many other farms inspired by Albesa Ramadera and their consulting company are successful internationally.

Case study 3: Spain

Granja La Almenara, a 3,200-sow farm built in 2018 in Tauste, Spain uses a unique free-stall breeding system for the first 28-days, to allow sows more freedom of movement, while still offering a safe and efficient way to perform pregnancy checks.

Granja La Almenara is located close to the city of Tauste (Zaragoza) in Spain. The farm, which specializes in piglet rearing, was built in 2018 and the first animals entered in 2019. In total, the farm has capacity for 3,200 sows. There are four buildings at the site: a quarantine area for new sows, a farrowing barn, a breeding facility (Photo 8), and gestation facility (Photo 7). The gestation barn uses an ESF, which provides a specific quantity of feed according to body condition, physiological state, and age. Granja La Almenara uses a ratio of 20 animals per feeding station (3 in groups with 60 sows and 2 in groups of 40 sows).

Description of the system

The breeding facility is specific to the period between insemination and Day 28. The system uses self-locking stalls. The stalls have two positions: open, where the animal can enter and exit freely, and closed. The sows are closed inside the crates for 3 days, for breeding, and once all the animals have been inseminated, the doors are unlocked and the sows can move freely around the intermediate corridors, which are wide enough for a subordinate animal to avoid a dominant sow while passing in the alleyway (Photo 8). However, if a sow chooses, she can access the self-locking stalls, and stand or lie down where she will not be disturbed by other sows. Subordinate sows often use the stalls to avoid aggressive encounters from more dominant individuals. Importantly, the animals can choose to be in the stalls or to be in the corridor with other sows. When the group is nearing 28 days after insemination, the animals are again enclosed in the stalls temporarily to confirm pregnancy, and if the sows have been successfully bred, they are then moved to the gestation barn. The gestation building has the capacity for 30 groups of animals, 48 animals per group.

The Granja La Almenara system is unusual, with the separate breeding building for the first 28-days but is a good example of innovation to permit animals to have more freedom of movement without compromising productivity. A risk with this system though is that a producer could leave the animals in the crates longer than necessary for breeding.

PHOTO 7: **THE GESTATION BUILDING AT GRANJA LA ALMENARA**

The farm has made additional animal welfare improvements, including the employment of a permanent veterinarian. Because of this, the rate of sows dying from prolapse is 50% lower than other farms. They also do not use hyper prolific sows, limiting litter size to reduce preweaning mortality.

Economic considerations

The investment that Granja La Almenara made for animal welfare improvements, including the specialized breeding barn and additional ESF feeders is calculated to be 10% more than if they had installed a conventional group housing system with 28-days in crates and one ESF feeder per 50-70 animals, close to 600,000 euros. This extra cost will be amortized over six years.

PHOTO 8: **SOWS IN THE INSEMINATION AREA OF GRANJA LA ALMENARA, KEPT IN FREE STALLS TO 28 DAYS AFTER INSEMINATION**

TABLE 9: **PRODUCTION RESULTS FOR GRANJA LA ALMENARA**

Production measure	**Farm result**
Conception rate after first insemination (%)	91.5
Farrowing rate (%)	85.6
Piglets born alive	15.1
Mean birth weight (kg)	1.325

THE CHANGING MARKET

Consumer awareness and concern regarding farm animal welfare is increasing and is not limited to high income countries. A study published in 2022 surveyed over 4,000 members of the general public in 14 countries on their perceptions of animals and animal welfare. Most participants agreed that the welfare of farm animals is important, without distinction between developed and developing regions (Table 10).[28]

Compassion is a cross-cultural value. Public polling shows that concern for animal welfare is not limited to developed countries.

Corporate pork buyers, aware of consumers' evolving values, stay ahead of customer concerns. Most major corporations now have responsible sourcing practices integrated into their business models and entire departments devoted to sustainability. Animal welfare is a top concern for corporations with responsible sourcing objectives. Over 70 major brands have public-facing commitments to improve the welfare of pigs in their supply chain, by phasing in crate-free pork. These commitments are summarized at cratefreeworld.org.[29] For instance, in 2022, the U.S. based retail chain, Target, renewed their commitment, stating:

In 2012, we pledged to eliminate gestation crates from our pork supply chain by 2022. As of September 2022, 100% of Good & Gather brand fresh pork will be produced using open pen gestation systems. (In this system, breeding sows are housed in gestation crates at the onset of each pregnancy cycle, and then moved into group pens once pregnancy is confirmed.) Good & Gather currently represents the majority of all fresh pork sold at Target. As we look ahead, ***we continue to expect that all pork suppliers further reduce, and eventually eliminate, the number of days sows are housed in gestation crates.***[30] [emphasis added]

The market for higher welfare products is growing in every region of the world, including in Asia. Multi-national brands that have policies to address intensive confinement in gestation crates include Campbells, Carl's Jr./Hardee's, Carnival Cruises, Chili's, The Cheesecake Factory, Conagra, Hyatt, Marriott Hotels, Papa John's, Royal Caribbean, Target, Waitrose, Wendy's and Whole Foods.[31] Regional companies such as Central Food Retail's Tops Market in Thailand is transitioning to crate-free for their brand name products by 2027.[32] And in Japan, Nippon Food is moving to gestation crate free housing by 2030.[33] The market trend is coming to Asia, and investments in crate-free systems now will prepare production facilities for the growing demand.

TABLE 10: **SURVEY RESPONSES**

"The welfare of farm animals is important to me"			
Country	**Proportion of respondents agreeing**	**Country**	**Proportion respondents agreeing**
Australia	91.2	Nigeria	77.8
Bangladesh	82.5	Pakistan	95.2
Brazil	90.2	Philippines	87.7
Chile	96.8	Sudan	85.0
China	81.5	Thailand	83.0
India	85.0	United Kingdom	88.6
Malaysia	85.4	United States	86.5

Laws and legislation

Many countries already use preimplantation group housing including in the United Kingdom[34] Sweden, The Netherlands[35] and New Zealand.[36] In Germany, there is a gradual phaseout of gestation crates by 2029 and in Denmark by 2035.[37] In Australia, there is a voluntary ban on the use of crates for more than 4 days for breeding.[38]

Direct comparisons of productivity between specific countries are available through the Agriculture and Horticulture Development Board of Great Britain. In the Netherlands, just 4 days are permitted in crates for breeding[39] yet in 2021 producers reached over 32 piglets weaned per sow per year. The same year, productivity in the United States was only 27.35 piglets weaned per sow per year and Canada was just 25.34, two countries where preimplantation group housing is not the dominant form of production. Production results have improved continually in the Netherlands for the past 3 years, while Canada and the United States have remained the same or decreased (Table 11).[40]

TABLE 11: **PRODUCTION RESULTS BY COUNTRY**

	Netherlands			United States			Canada		
	2019	2020	2021	2019	2020	2021	2019	2020	2021
Pigs weaned/ sow/year	30.1	30.8	32.1	27.9	27.2	27.3	25.3	25.3	25.3
Pigs reared/ sow/year	29.3	30.1	31.3	26.7	26.0	26.2	24.8	24.8	24.8
Litters/ sow/year	2.3	2.3	2.3	2.4	2.4	2.4	2.30	2.30	2.30

End the Cage Age

The "End the Cage Age" proposal was a European citizens' initiative, which gathered over 1.3 million signatures in 2019. It called on the European Commission (EC) to propose new legislation to prohibit the use of all cages for farm animals, including gestation crates for sows. The initiative was supported by multi-national food companies (Unilever, Nestle, Mondelez)[41] and other major food brands. In 2021, the EC, responding to the Initiative, pledged to introduce new legislation. This legislation would prohibit the 28-day period of temporary confinement now permitted under the EU Directive on the welfare of pigs (Council Directive 2008/120/EC) along with cages for other farm animals including hens, rabbits, and quail. The EU Commission is additionally exploring trade measures.[42]

End the Cage Age.

New legislation in the European Union is expected to prohibit the 28-day period of temporary confinement in gestation crates that is currently permitted, throughout the European Union. Trade measures are expected to follow.

Animal welfare is increasingly being integrated into bilateral trade agreements, including the EU-Vietnam Free Trade Agreement (FTA), the EU-Australia FTA, and the EU-Chile FTA. To export animal products into Europe, animal welfare will continue to be a matter of concern, and investments in housing systems should consider the evolving landscape of animal welfare requirements in the EU and other countries.

Proposition 12 in California

Proposition 12 was a citizen initiative in California that created a law requiring enough space for egg-laying hens, veal calves and breeding pigs to stand up, lie down and turn around. Proposition 12 passed with 63% of citizens supporting it in 2018. It requires 24ft^2 (2.25m^2) of space for sows and gilts at all times.[43] The law applies not only to pork products sold in California, but to products originating from other states that are sold in California. Since California imports most of its pork, the law impacts production throughout the country.

The law was challenged by the U.S. pork industry, advancing through the lower courts all the way to the U.S. Supreme Court. In May of 2023, the Supreme Court upheld Proposition 12, ruling that the law is consistent with the United States constitution.

In practical terms for pork producers, the California law means that systems using gestation crates, or even group housing with 28-days in crates, must change their animal housing if they want to access the California market. The exceptions to the space requirements in Proposition 12 are for the five-day period before the expected birth of the piglets and for temporary "husbandry procedures" lasting no more than 6 hours in a 24-hour period. The only option for producers to comply is with preimplantation systems.

A 2023 ruling by the Supreme Court of the United States upholds the 2018 California law prohibiting confinement in gestation crates. The law applies not only to pork produced in California, but also to pork sold in California, even if produced in another state. U.S. producers must use preimplantation group housing to comply.

The World Organization for Animal Health

The World Organization for Animal Health (WOAH) is the leading global veterinary authority. Comprised of 182 member countries, WOAH issues international guidelines for disease control and animal welfare through its Terrestrial Animal Health Codes. The Codes are adopted by consensus of the General Assembly of Delegates. Article 7.13.12 of the chapter on animal welfare and pig production systems chapter states:

"Sows and gilts, like other pigs, are social animals and prefer living in groups, therefore pregnant sows and gilts should preferably be housed in groups."[44]

Organization for Economic Cooperation and Development (OECD)

In 2023 the Organization of Economic Cooperation and Development issued updated Guidelines for Multinational Enterprises on Responsible Business Conduct. The Guide covers key areas, including climate change, biodiversity, technology, business integrity and supply chain due diligence. The updated guidelines were adopted by the Adherents to the Declaration on International Investment and Multinational Enterprises. The OECD Guidelines for Multinational Enterprises on Responsible Business Conduct now include a statement on animal welfare:

Enterprises should respect animal welfare standards that are aligned with the World Organisation for Animal Health (WOAH) Terrestrial Code. An animal experiences good welfare if the animal is healthy, comfortable, well nourished, safe, is not suffering from unpleasant states such as pain, fear and distress, and ***is able to express behaviours that are important for its physical and mental state.*** *Good animal welfare requires disease prevention and appropriate veterinary care, shelter, management and nutrition, a stimulating and safe environment, humane handling and humane slaughter or killing. In addition, enterprises should adhere to guidance for the transport of live animals developed by relevant international organisations.*[45] [emphasis added]

The International Finance Corporation

The International Finance Corporation (IFC) is the private sector arm of the World Bank Group. The IFC finances private sector projects in developing countries. The IFC works with clients to apply sustainability principles, including animal welfare standards. In 2014 the IFC published its Good Practice Note (GPN): "Improving Animal Welfare in Livestock Operations". This GPN was written to complement the IFC's 2012 Performance Standards on Environmental and Social Sustainability, particularly the animal husbandry requirements in Performance Standard (PS) 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.[46] The GPN states:

- Animal accommodation should be designed, constructed, and maintained to allow all animals space to stand, stretch, turn around, sit, and/or lie down comfortably at the same time.
- Accommodation should allow all animals to directly interact with herd or flock mates, unless isolated for veterinary or nursing reasons. [47]

International Sustainability Standards Board (ISSB)

The Sustainability Accounting Standards Board (SASB), now part of the ISSB, publishes standards that companies use to disclose relevant sustainability information to their investors. The SASB Standards identify sustainability-related risks that are most likely to affect an entity's cash flow, disclosure topics, and metrics for investors. They are available for 77 different industries. The 2018 SASB Food and Beverage Sector standard for Meat, Poultry and Dairy contains a section on animal care and welfare, which states:

Consumer demand has driven shifts in industry practices, such as eliminating the use of gestation in hog production and eliminating caged enclosures for poultry. Companies that are prepared to anticipate or adapt to these trends may be able to increase their market share by capturing this changing demand and being first to market with products that comply with new regulations.

Among its accounting metrics is disclosure of "...the percentage of pork produced without the use of gestation crates" which is defined as "... an enclosure for housing an individual breeding sow, where the enclosure fulfills the animal's static space requirements but does not allow for dynamic movement such as turning around, and is typically non-bedded, with concrete floors and metal stalls."[48]

Global Reporting Initiative (GRI)

The 2022 Global Reporting Initiative (GRI) sector standard for Agriculture, Aquaculture and Fishing includes animal welfare as a material sustainability topic and recommends several reporting line items related to animal welfare (including confinement). The standard states:

The conditions that animals are kept in can cause negative impacts on animal health and welfare. For example, terrestrial animals can be confined to small spaces, cages, or crates, preventing their movement and inhibiting normal behavior.[49]

Technical support for the construction and management of preimplantation group housing systems is widely available. Experts from academic research institutions, equipment manufacturers and independent consultants are available to assist. Humane Society International can facilitate contacts.

Sources of technical support and consulting on preimplantation group housing

- Prairie Swine Center, Canada: **prairieswine.com**
- EU Reference Center for Animal Welfare: The Netherlands, Germany, and Denmark: **eurcaw-pigs.eu**
- Optimal Pig Production, Spain: **oppgroup.com/en**
- Rotecna, Spain: **rotecna.com/en**
- Jygy Technologies, Canada: **jygatech.com**
- Akei Animal Research, Brazil: **akei.agr.br**
- VDL Agrotech bv, Netherlands: **vdlagrotech.com**
- Veldman Group, Netherlands: **veldmangroup.com/en**

Certification

Unfortunately, most certification schemes fail to meaningfully address key animal welfare issues. Some of these programs do not require every standard to be met, allowing farms to be certified by meeting only a certain proportion of the requirements and permitting poor welfare practices to continue. In other cases, certification schemes do not include any animal welfare standards, but rather are focused on, for example, product quality or food safety (which are important, but irrelevant to animal welfare).

While there are many inadequate schemes, there are also some very comprehensive, meaningful programs. Humane Society International suggests the farm animal welfare certification programs listed below to monitor welfare and ensure preimplantation group housing. Others can be reviewed on a case-by-case basis to ensure their requirements are aligned with global animal welfare concerns. The certification programs mentioned below are all science-based, prohibit intensive confinement systems (cages and crates) and go further by including dozens of additional animal welfare requirements. Every standard must be met, and they are administered by non-profit organizations aimed at protecting animals rather than promoting industry interests.

Animal welfare certification programs that require preimplantation group housing include:

Global Animal Partnership (G.A.P.)

globalanimalpartnership.org

- Label: Animal Welfare Certified
- Available globally

Humane Farm Animal Care (HFAC)

certifiedhumane.org

- Label: Certified Humane
- Available globally

The Dutch Society for the Protection of Animals (SPA)

beterleven.dierenbescherming.nl/zakelijk/en

- Label: Beter Leven
- Available in the Netherlands

A Greener World

agreenerworld.org/certifications/animal-welfare-approved

- Label: Animal Welfare Approved
- Available in the U.S.

RSPCA Assured

rspcaassured.org.uk

- Label: RSPCA Assured
- Available in European countries

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Our mission

Advancing the welfare of animals in more than 50 countries, Humane Society International works around the globe to promote the human-animal bond, rescue and protect dogs and cats, improve farm animal welfare, protect wildlife, promote animal-free testing and research, respond to disasters and confront cruelty to animals in all of its forms.

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