



Towards eliminating tail docking of pigs in the Netherlands

Exploration of economic aspects and opportunities for implementation

Robert Hoste, Anita Hoofs, Mariël Benus, Izak Vermeij, Marcel van Asseldonk and Kiki Verheijen

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For the transition towards pig farming without tail docking, an analysis has been performed of the cost increase, of conditions for supply chain implementation, and of the possibilities and feasibility of a calamity fund. Costs are mounting up to €26 per delivered pig, and to €29 per pig during the learning phase. Under the assumption that 5-15% of the pigs will have tail damage and thus will not be eligible for compensation, a remuneration of €28-31 per pig with undocked tail in good condition is necessary to cover costs on farm level. This derives from a model-based analysis, where assumptions were based on literature and interviews.

Voor de transitie naar een varkenshouderij zonder couperen van staarten zijn berekeningen gedaan naar het effect op de kosten voor varkenshouders, naar voorwaarden voor implementatie in de keten, en naar mogelijkheden en de haalbaarheid van een calamiteitenfonds. De kosten voor het houden van dieren met ongecoupeerde staarten lopen op tot 26 euro per afgeleverd varken, en tot 29 euro per afgeleverd varken gedurende de leerfase. Aannemend dat er voor 5-15% van de varkens geen staartenbonus zal worden betaald, in verband met staartschade, bedraagt de benodigde vergoeding 28-31 euro per goedgekeurd varken om de kosten te dekken van het houden van varkens met ongecoupeerde staarten. Dit is gebaseerd op modelmatige berekeningen, waarbij literatuur en interviews zijn gebruikt voor de aannames.

Key words: pigs, undocked, tails, curly tail, costs, calamity fund, production chain

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Preface

Pig farming is transitioning to a more sustainable sector. During this transition, requirements on aspects such as animal welfare play a major role, especially in the Netherlands. Pressure to stop docking pigs' tails is mounting from national and international government agencies and public bodies and from civil society organisations. This study addresses the question of how farmers can raise pigs with intact tails (i.e. without docking), from a supply chain perspective.

This transition is complex and its realisation requires efforts from all parties in the chain. Our thanks go to the interviewees, to the pig farmers of the study clubs in Didam and Wanroij, for their input and reflection, and to several practice-based experts from the Norvida (Sweden) programme and organic pig farming. Quotes have been included from some practice-based experts, with their permission. With this analysis, we hope to contribute to the transition to intact tails in pig farming.



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Summary

S.1 Key question

One of the ambitions of the so-called Coalitie Vitale Varkenshouderij (Coalition for Vital Pig Farming) is that, as of 2030, all pigs in the Netherlands will have undocked tails. This emanates from European and Dutch legislation and links to the covenant Dierwaardige Veehouderij ('Animal-worthy farming'). To be able to implement this ambition, insight is required into several areas. The research question consists of three sub-questions:

1. What compensation to farmers is necessary to be able to keep pigs with undocked tails?
2. Which conditions are to be met for a successful system implementation?
3. Which options are conceivable for a calamity fund?

S.2 Message

- **Costs for pigs with undocked tails amount to €26 per delivered pig, or €29 during the learning phase**

Farming costs for pigs with undocked tails strongly depend on the baseline situation on farms regarding equipment and management. Costs for pigs with undocked tails are mounting up to €26 per delivered pig, of which €10-11 for the piglet production (per 25kg piglet). For farms having invested already in (beyond-legal) animal welfare measures, costs may amount to about €9 per delivered pig, of which €4 for the piglet phase.

Additional costs have to be counted during the learning phase of farmers, amounting to €3 per delivered pig. It is assumed that these costs are applicable during some two to five years.

- **Assuming some 5-15% pigs with tail damage and where no compensation will be paid, the necessary compensation amounts to €28-€31 per pig with undocked tail in good condition**

It is assumed that not all pigs will be paid a compensation, since not all pigs meet criteria on tail damage. Therefore, the compensation for those pigs with a tail in good condition must be higher to cover the additional costs on farm level. To cover these additional costs, a compensation is necessary of €28-31 per pig with undocked tail in good condition, of which €11-12 are attributed to the piglet phase.

On top an amount of €3 per delivered pig is to be compensated during the learning phase. For pigs being remunerated for production under a market programme on the basis of the Beter Leven hallmark (1 star), an amount of €8 per pig is to be deducted from the aforementioned €28-31 per pig, to prevent double count.

- **In the pioneering phase, a link with the Beter Leven hallmark is desirable; at the same time, efforts to ensure a level playing field within the EU should continue**

Within Dutch retail supply chains cooperation takes place among chain partners, so additional demands regarding a ban on tail docking can rather easily be agreed. An adequate compensation to be paid by supply chain partners downstream is necessary. To prevent deterioration of the competitive position of producers outside Dutch retail chains, a level playing field within the European Union has to be endeavoured. Without adequate compensation of additional costs, pig farmers will not be able to make the transition towards undocked tails. A compensation can come from supply chain partners, or from a generally higher level of the market price. The latter will only take place if the European market will jointly ban tail docking and customers have no choice between pigs with or without curly tail.

-
- **The possibilities and feasibility of a calamity fund, either as livestock insurance, mutual insurance, or a livestock slaughter insurance, are limited in the short term**

Only if a large group of pig farms will stop tail docking, there will be sufficient market potential for insurance companies. By analogy with the former livestock slaughter insurance initiative, a compensation system could be elaborated by the meat industry, to compensate for entirely or partly disapproved animals. The development of any mode of risk covering will take several years, among others, because information on damage prevalence and costs is lacking. A calamity fund has little support from pig farmers, who rather prefer a sufficient remuneration to compensate for tail biting damage.

S.3 Methodology

A model-based analysis of additional costs has been performed, based on some scenarios of farm situations. These farm situations have a different baseline on necessary adaptations of equipment and management, to be able to stop tail docking. To that end we used the Welzijnscheck 2.0 as a starting point. Assumptions were based on literature, and experiences collected via interviews (see Section 2.1 and Appendix 1). Given the quite limited experiences, some assumptions are rather uncertain. In the cost calculations, we used investment amounts of the most recent KWIN (budgeting handbook). Prices in KWIN, however, are based on the cost situation pre-Ukraine war; additional housing costs are therefore underestimated. Tentative results were checked with several (experience) experts (see Appendix 2).

For the analysis of conditions for a successful system implementation, about ten semi-structured interviews were held. Also the analysis for a calamity fund was partly based on interviews, along input from the literature.

Samenvatting

S.1 Kernvraag

Een van de ambities van de Coalitie Vitale Varkenshouderij is om stapsgewijs en verantwoord ernaar toe te werken dat per 2030 de varkens met krulstaart gehouden worden, dus dat staarten niet meer gecoupeerd worden. Dit vloeit voort uit Europese en Nederlandse regelgeving en sluit aan bij het convenant Dierwaardige Veehouderij (in wording). Om deze ambitie waar te kunnen maken is inzicht nodig op diverse gebieden. De onderzoeksvraag bestaat uit drie deelvragen:

1. Wat is de benodigde vergoeding voor het houden van varkens met ongecoupeerde staarten?
2. Wat zijn randvoorwaarden voor een succesvolle implementatie van varkenshouderij met een krulstaart?
3. Welke opties zijn er voor een calamiteitenfonds?

S.2 Boodschap

- **Kosten voor het houden van dieren met ongecoupeerde staarten bedragen tot 26 euro per afgeleverd varken, of 29 euro gedurende de leerfase**

De kosten voor het houden van varkens met een ongecoupeerde staart hangen sterk af van de uitgangssituatie qua uitrusting en management van de varkensbedrijven. Kosten lopen op tot 26 euro per afgeleverd varken; hiervan is 10-11 euro voor de zeugenhouderijfase (per big). Voor bedrijven die al (bovenwettelijke) investeringen hebben gedaan, bijvoorbeeld omdat ze meedoen aan een marktconcept, liggen de kosten op circa 9 euro per afgeleverd varken, waarvan 4 euro voor de bigproductie. Additioneel dient nog gerekend te worden met kosten voor leergeld van 3 euro per dier gedurende de eerste twee tot vijf jaar.

- **Bij een verwachte 5-15% van de varkens met staartschade, is de benodigde vergoeding in de orde van 28-31 euro per dier waarvan de staart in goede conditie is**

Verwacht wordt dat 5-15% van afgeleverde varkens dusdanige staartschade zal hebben, dat deze niet in aanmerking komen voor een vergoeding voor ongecoupeerde staarten. Daarom moet de vergoeding per dier mét een staart in goede conditie hoger zijn dan de meerkosten per afgeleverd dier. Om de meerkosten van het houden van varkens met ongecoupeerde staarten te dekken is een vergoeding vanuit de afnemer nodig in de orde van 28-31 euro per afgeleverd varken met een staart in goede conditie. Hiervan is een bedrag van 11-12 euro per dier toe te rekenen aan de big van 25 kg. In de aanloopfase dient hier nog een bedrag van circa 3 euro per afgeleverd varken bijgeteld te worden.

Voor varkens die een vergoeding ontvangen voor houderij in een marktconcept op basis van het Beter Leven-Keurmerk (1 ster) dient een bedrag van 8 euro in mindering te worden gebracht op de genoemde vergoeding van 28-31 euro, om dubbeltelling te voorkomen (denk aan vergoeding voor leefoppervlakte).

- **In de pioniersfase is een koppeling met het Beter Leven keurmerk wenselijk; tegelijkertijd dient gewerkt te worden aan Level Playing Field binnen de EU**

Binnen de Nederlandse retailketens wordt al samengewerkt en kunnen aanvullende eisen eenvoudiger overeengekomen en vergoed worden dan bij niet-gecontracteerde afnemers buiten deze retailketens. Om verslechtering van de concurrentiepositie buiten de retailketens te voorkomen, is het nodig om te werken met gelijke eisen binnen de hele EU (Level Playing Field). Zonder adequate vergoeding van de additionele kosten zullen varkenshouders niet in staat zijn deze transitie in houderijsysteem te maken. Een vergoeding kan bij ketenpartners vandaan komen, of vanuit een hoger niveau van de marktprijs. Het laatste zal alleen plaatsvinden als een ban op staarten couperen Europa-breed wordt toegepast en afnemers geen keuze hebben tussen dieren met of zonder krulstaart. Er is een diepgevoelde zorg van varkenshouders over de vraag of het stoppen met staarten couperen leidt tot beter dierenwelzijn. Dit is een afbreukrisico voor deelname aan het transitietraject.

- **Mogelijkheden en haalbaarheid van een calamiteitenfonds in de vorm van een veeverzekering, onderlinge fonds of slachtveeverzekering zijn op korte termijn beperkt**

Pas als een grote groep varkensbedrijven stopt met couperen van staarten is er voldoende marktpotentieel voor verzekeraars. Naar analogie van de voormalige slachtveeverzekering kan de vleesindustrie een vergoedingssysteem uitwerken voor het compenseren van geheel of gedeeltelijk afgekeurde dieren. De ontwikkeling van een vorm van risicoafdekking zal meerdere jaren in beslag nemen omdat onder meer schadestatistieken ontbreken. Ook heeft een calamiteitenfonds weinig draagvlak onder varkenshouders en zien deze liever voldoende vergoeding om de optredende schade te kunnen compenseren.

S.3 Methodologie

Een modelmatige kostenberekening is opgesteld op basis van enkele scenario's van bedrijfssituaties. Deze bedrijfssituaties zijn onderscheidend naar de mate waarin de huidige bedrijfssituatie aangepast moet worden om geschikt te zijn voor het houden van varkens met ongecoupeerde staarten. Hiervoor is uitgegaan van de Welzijnscheck 2.0. Uitgangspunten zijn gebaseerd op literatuur en ervaringen die door middel van interviews zijn verzameld (zie 2.1 en bijlage 1). Gezien de relatief beperkte ervaringen zijn sommige aannames echter onzeker. In de kostenberekeningen is uitgegaan van investeringsbedragen voor de huisvesting uit de meest recente KWIN. Prijzen hierin zijn echter gebaseerd op de kostensituatie van voor het begin van de oorlog in Oekraïne; berekende additionele huisvestingskosten zijn daarmee onderschat. Voorlopige uitkomsten zijn getoetst met diverse (ervarings)deskundigen (zie bijlage 2).

Voor het onderzoek naar randvoorwaarden voor een succesvolle implementatie van varkenshouderij met ongecoupeerde staarten zijn een tiental semigestructureerde interviews gehouden. Ook het onderzoek naar een calamiteitenfonds is mede gebaseerd op interviews, naast input vanuit de literatuur.

1 Towards eliminating tail docking of pigs in the Netherlands

1.1 Current situation: tails are docked

In current pig farming practice, the tails of most piglets are docked to prevent tail biting. Tail biting can lead to wounds and abscesses (Zonderland, 2010). Tail biting is a multifactorial problem. Climate, nutrition, water, environment, animal-related indicators and genetics all affect this, and an imbalance can result in tail biting. Some pigs are obsessive biters; these are often the lighter animals with aberrant social behaviour. All this makes tail-biting a complex issue. Implementing appropriate modifications for rearing pigs with undocked tails (curly tails) is therefore a challenge. Ancillary measures to prevent discontent are difficult to implement in current farming systems. This is linked to restrictions on buildable area on the farms and on permits, the investments required and the associated increased costs, while there is no reimbursement for the time being.

To protect animal welfare, the European Commission (EC) banned routine tail docking in 2008 (Directive 2008/120/EC), but docking is still permitted on farms if tail biting cannot be prevented by other means. However, this exception is now standard practice on most pig farms. Therefore, in 2013, the EC again addressed the topic of tail docking.

In 2013, LTO, Dutch Confederation of Pig Farmers (NVV), the Dutch Animal Protection Society and various chain parties drew up the Verklaring van Dalfsen (Dalfsen Declaration), with a roadmap towards the long-term responsible cessation of tail docking. Based on this initiative, a demonstration project was carried out in 2014 and 2015 at the Sterksel Pig Farming Innovation Centre, and a networking group of eight pig farmers experimented with modified tail docking. Both pathways have started searching for approaches to stop tail docking on farms. Sweden's Norvida, in cooperation with Germany's Tönnies, set up a programme to deliver pigs with undocked tails during the years 2016-2022. Around 10 Dutch pig farmers participated in this programme. A larger number of pig farmers began the programme, but stopped raising pigs with undocked tails due to disappointing results and declining reimbursement.

LNV minister Schouten stated in a 2019 parliamentary letter (Kamerstuk 28973) that she wants to end tail docking in Dutch pig farming by 2030. This has provided clarity to the sector. The Coalition for Vital Pig Farming (CoViVa) is working on a programme of activities that will lead to full implementation of undocked tails in Dutch pig farming. In line with this, the public-private partnership Vitale Varkenshouderij (Vital Pig Farming) initiated a sub-project called Krulstaarten (Curly Tails). The present study is part of this sub-project.

1.2 Desired situation: tails are no longer docked

A prerequisite for the elimination of tail docking is that pig farmers receive at least cost-covering reimbursement for the necessary changes in the farming system, farm management, and the additional labour. In addition, sufficient transition time is needed to learn how to work with this approach, and the production chain should be organised in such a way that this reimbursement is accessible by pig farmers. Moreover, clarity is needed on who will cover the costs if tail-biting outbreaks do occur.

1.3 What reimbursement is needed and what preconditions need to be met to enable the elimination of tail docking?

This study addresses the question of the required compensation for raising pigs with undocked tails and facilitating implementation in the pig-farming chain in the Netherlands.

It involves the following sub-questions:

1. What is the required reimbursement for raising pigs with undocked tails?
2. What are preconditions for successful implementation of intact-tail pig farming?
3. What options are there for a calamity fund?

These three sub-questions are answered in Chapters 2, 3 and 4, respectively. Chapter 5 provides a discussion and recommendations.

1.4 Reimbursement of €28 to €31 and linkage to the Beter Leven hallmark is necessary, feasibility of a calamity fund is limited in the short term

The additional costs of keeping pigs with undocked tails are up to €26 per animal delivered. Assuming that 5% to 15% of the pigs will have tail damage and will not be eligible for compensation, a reimbursement of €28 to €31 per approved pig is required to cover the cost of raising pigs with undocked tails. In the learning phase, around €3 per pig delivered should be added to this.

For pig farmers that are paid for production under the Beter Leven hallmark (1 star), €8 should be deducted from the aforementioned reimbursement of €28–€31 per animal to avoid double reimbursement.

Several preconditions for implementing pig farming with undocked tails come into play. In the pioneering phase, a link with the Beter Leven hallmark is desirable; at the same time, efforts to ensure a level playing field within the EU should continue.

Possibilities and feasibility of a calamity fund in the form of livestock insurance, mutual fund or livestock slaughter insurance are limited in the short term.

2 Required reimbursement for raising pigs with undocked tails

2.1 Methodology, assumptions and measures

2.1.1 Calculation model for four farm situations and three production phases

The reimbursement required to keep pigs with undocked tails varies between pig farms due to a wide variation in farm facilities and management. This chapter addresses the calculations to arrive at a proposed reimbursement. In a first step, the cost of rearing pigs with undocked tails is calculated; after this the required premium price per pig with an undamaged tail is addressed.

To understand the costs of modified housing and management to enable undocked tails, four farming situations were modelled for a farm with sows and a farm with finishing pigs. These four farming situations are distinguished by the extent to which the current farming situation needs to be modified to be suitable for raising pigs with undocked tails. This was based on the Welzijnscheck (animal welfare check) 2.0 (POV, 2021), where a distinction was made by selecting a number of criteria from the categories Feed/water, Space, Thermal comfort, Pen enrichment and Animal health.

The calculations distinguished three production phases: farrowing, piglet rearing and finishing pigs. The four farming situations – Farm types A, B and C, and Pioneer, are outlined below:

- a. Farm type A
Traditional farm. Facilities are technically obsolete, there is little space per animal, ventilation is poor, there are insufficient drinking and feeding facilities, and piglets are raised on plastic grid flooring.
- b. Farm type B
The farm is partly modernised and has taken steps for better animal welfare: a more spacious farrowing pen and more drinking and feeding facilities. However, additional living space for piglets and finishing pigs is needed.
- c. Farm type C
Modern farm with living space per animal above the legal minimum. Farm facilities and management are up-to-date, but additional steps are still needed for raising pigs with undocked tails.
- d. Farm type Pioneer
In terms of facilities and farm management, pigs can be raised with undocked tails on this farm. The required modifications have already been made. This type of farm is the benchmark against which the additional costs of the other farm types are compared.

Although farm size was not specified, a representative farm size of 900 sows was assumed. For finishing pigs, the size was set at 8,000 animals, which is appropriate for the 900 sows, but is larger than the average pig farm in the Netherlands.

The calculations include additional costs and benefits of farm modification, such as the costs for rebuilding, labour and use of pen enrichment materials. Only the costs of measures exceeding the legal minimum requirements were taken into account. A calculation model in Excel was prepared for the calculations. Additional costs have been determined as the costs to achieve a farming system in which undocked tails are possible (such as the Pioneer type), and are expressed in euros per finishing pig raised, excluding VAT, with costs also split out for the sow unit (per 25 kg piglet) and per finishing pig.

2.1.2 Assumptions for the model were based on literature and interviews

To establish starting points, literature research was conducted and various people were interviewed (Appendix 2). Experiences from the demonstration project in Sterksel and the network group of eight pig farmers, organic pig farmers and pig farmers who participated in the programme of the Swedish Norvida (and Tönnies), and pig farming in Finland were also used. However, given the relatively limited experience,

some assumptions were uncertain. Assumptions were also reviewed by experts, by two pig farmers' study clubs, and by the project working group and the steering committee on animal health and welfare of CoViVa.

In some situations, reductions in the numbers of animals have used to achieve an increase in living area per animal. In that case, that reduction applies equally to farrowing sows, piglet rearing and finishing pigs.

Economic damage due to yield loss and mortality, as a result of tail biting, has been taken into account (for assumptions on frequency and cost per affected animal, see Table B1.1). For piglets and finishing pigs injured by tail biting, a growth retardation of one week was assumed. Otherwise, the calculations assumed no effect of farm modifications on technical results, such as daily growth, feed conversion, mortality, number of piglets for slaughter, piglet yield price, or rejection. In cases where more attention is given to animal-centred management and craftsmanship, an improvement in technical results could occur. The effects of this cannot be unequivocally deduced from literature, and practical experience with this approach is not yet sufficiently clear and unambiguous. Therefore, the net effect has been set to zero for these calculations.

Furthermore, for comparability, feeding dry feed was assumed for all farm situations. Also for comparability, non-castration was assumed in all situations, thus excluding any possible effect of non-castration.

2.1.3 Selected modifications for farms to raise pigs with undocked tails

To enable pig farming with undocked tails, several measures are needed on the farms. Table 2.1 lists these measures by theme.

Table 2.1 Modifications required to enable pig farming with undocked tails, by theme

Theme	Modifications
Feed and water	Modification of drinking nipple farrowing pen, number of drinking nipples for piglet rearing and finishing pigs Enlarge feeding areas Modification of feed composition: optimisation of Na, Mg, Try, SID Lys (a) and raw material composition
Space b)	Expand farrowing pen to 5.4m ² provide 1.1 m ² isolated piglet nest Expand area for piglet rearing to 0.4m ² with partly solid floor; expand area for finishing pigs to 1.0m ² Additional space for biters/bitten animals
Thermal comfort and air quality	Cover piglet nest Optimise ventilation, including pre-heating incoming air
Pen enrichment	Efficient use of sufficient continuous pen enrichment and 2x daily rooting feed
Animal health	Optimal barn cleaning
Labour	Extra time due to more living space per animal Time in the barn for animal attention Time for optimal cleaning Extra time during the learning phase Time to deploy contingency plan
Contingency plan	Emergency shelter availability Various pen enrichment materials
Learning phase	Deploy animal welfare specialist, deploy climate specialist/climate monitoring

(a) Na: Sodium, Mg: Magnesium; Try: Tryptophan; SID Lys: Standardized Ileal Digestible Lysine; b) If living area is expanded, the number of animals is reduced by 20%.

Tables B1.2, B1.3 and B1.4 in Appendix 1 show the modifications made for each farm situation and animal category.

2.2 Farm modification costs vary between farming situations from €9 to €26 per delivered animal

The additional costs for the farm modifications needed to raise pigs with undocked tails compared to the current situation without these modifications are shown in Table 2.2 and Figure 2.1.

Table 2.2 *Added costs of pig farming with undocked tails for various farm types, classified by area of interest, cost factor and animal category (euros per animal delivered)*

Theme	Farm type A	Farm type B	Farm type C
Classified by area of interest			
Water and feed	2.4	1.9	1.4
Living area	11.2	2.5	0.7
Floor	0.9	0.0	0.0
Pen enrichment	2.1	2.1	0.5
Cleaning	0.6	0.6	0.0
Ventilation	1.8	1.8	0.0
Observation time	4.5	4.3	3.5
Bite damage/injury	2.8	2.8	2.8
Total	26.2	16.1	8.8
Classified by cost factor			
Barn	12.7	4.1	0.6
Labour	5.3	5.1	3.7
Other costs	5.4	4.1	1.8
Bite damage/injury	2.8	2.7	2.8
Total	26.2	16.1	8.8
Classified by animal category			
Sow unit	10.5	5.0	3.5
Finishing unit	15.7	11.1	5.3
Total	26.2	16.1	8.8

Sums may differ due to rounding. Additional costs are defined as the costs to achieve a pig farming system in which undocked tails are possible (i.e. the Pioneer farm type).

Table 2.2 shows that the cost for raising pigs with undocked tails is as high as €26 per animal in the scenario with the most farm and farm management modifications (Farm type A); of this, €10 to €11 is for the sow phase (per piglet) and €16 for the finishing pig phase. For Farm type C, with the fewest modifications, the cost is almost €9, of which €3 to €4 is for piglet production.

The main cost items are those for enlargement of the living area (up to €11 in Farm type A), for damage/injury due to biting (around €3 per animal) and for pen enrichment (rising to around €2). On top of these costs comes the additional cost of the learning phase of €3 per animal. It is assumed that these costs for the learning phase are no longer applicable after two to five years. This learning period can vary greatly between farms.

The total additional costs for housing and facilities are almost €13 per animal for Farm type A, €4 for Farm type B and less than €1 for Farm type C. Additional labour costs amount to €4 to €5 per animal delivered.

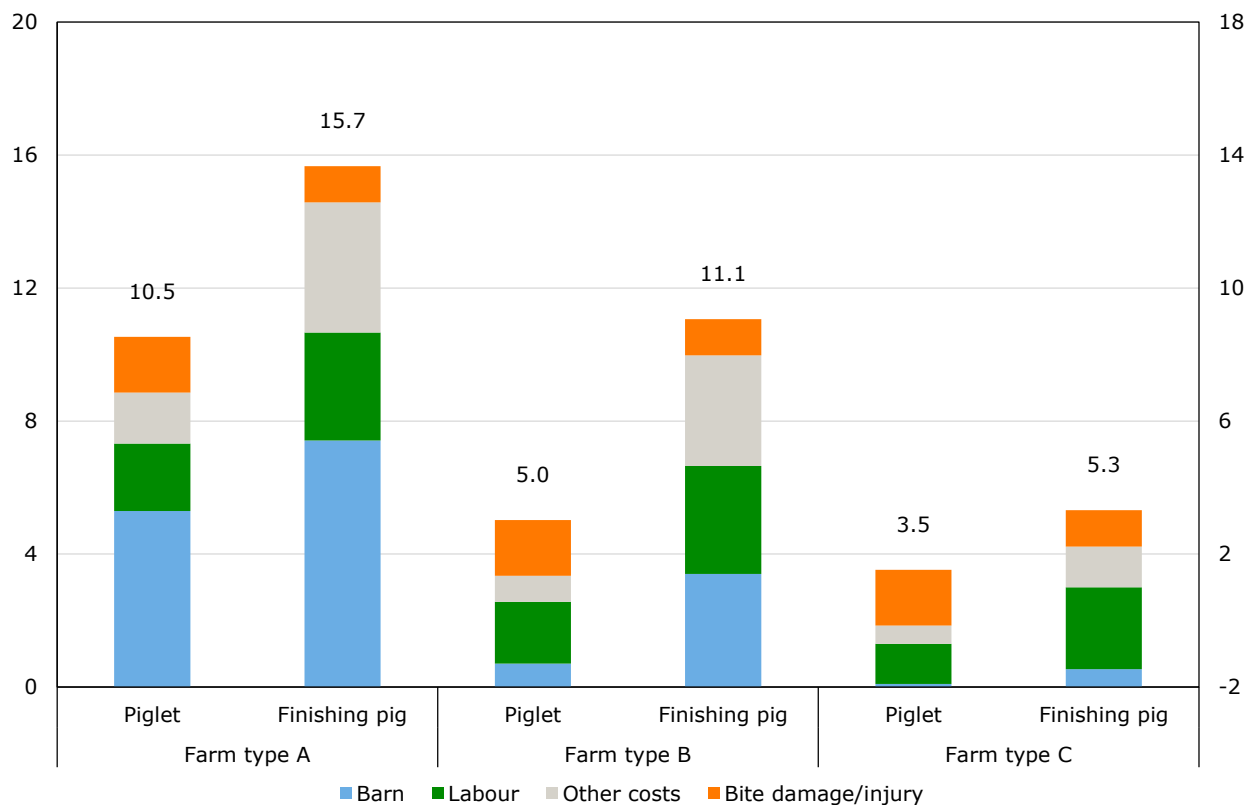


Figure 2.1 Additional costs per farm type, classified by animal category (euros per animal delivered)

2.3 During the learning phase, initial costs are €3 higher

Pig farmers need a period of time to optimise operations for raising pigs with undocked tails. During this period, extra labour is required and more pen enrichment material will be used. It was assumed that there are additional costs for deploying an animal welfare specialist, a climate specialist and for climate monitoring. Also assumed was that in the learning phase, there is also increased mortality/euthanasia, growth retardation and penalties at slaughter due to bite damage. These costs total almost €3. This is in addition to the amounts per animal shown in Table 2.2. Thus, of the total calculated costs, the costs of learning will no longer apply after the learning phase. The duration of this learning phase varies greatly between farms, and will take an estimated two to five years.

2.4 Reimbursement must be higher than the additional costs per animal

Although costs of mortality and euthanasia have been included in the calculations, no account has been taken of animals that are sold and receive no reimbursement (tail bonus) at the slaughterhouse. Here, the assumption is that reimbursement will be based on the condition of the tail in terms of injury that is incurred. This is conceivable if the tail length of all animals delivered is used as an objectively measurable criterion. The additional costs are incurred for all animals, but in this case, a reimbursement would not apply to all animals. To compensate for this, the reimbursement per animal with an intact tail should be higher than the average additional costs for all animals. The difference between average cost and tail bonus depends on the proportion of animals delivered for which no reimbursement is paid.

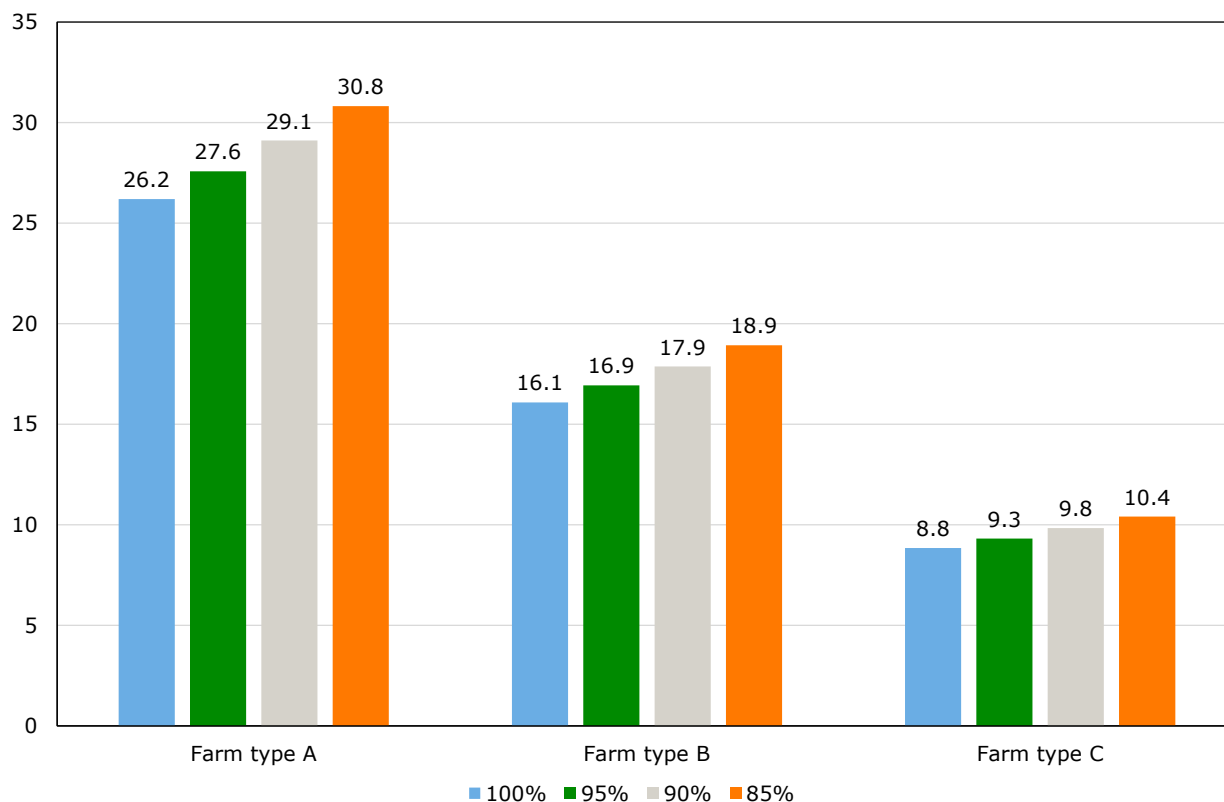


Figure 2.2 Required reimbursement per pig with an intact tail at various percentages of intact tails, for various Farm types (euros per finishing pig)

If the percentage of pigs for which a bonus is paid is less than 100%, then the bonus per animal should be higher. At 85% bonus payment, for example, it increases by €2 (Farm type C) to over €5 (Farm type A) per pig to cover costs at the farm level.

2.5 Proposal for reimbursement: €28 to €31 per delivered pig

To arrive at a proposed reimbursement, the starting point was the desire of the client and several interviewees for a *uniform tail bonus* per animal, independent of initial situations at the pig farms. Based on experience from abroad and from organic pig farming, where no tail docking is used, it should not be assumed that tail-biting would be completely eliminated despite substantial modifications in farm facilities and farm management. CoViVa's 'curly tail routes' define an undocked tail in good condition for pig farms as follows: "An undocked tail that has no visible wounds/crusts/swelling and is curled." This definition is a guide for pig farmers to determine whether they can take the next step in the route, e.g. from 4 litters with undocked tails to 8 litters.

It is assumed that buyers/slaughterhouses work out a system in which the reimbursement to be paid depends on the condition of the tails, e.g. length of the tail or occurrence of wounds. Thus, we assume a *proportion of animals without a tail bonus* because the tails of these animals do not meet the criteria.

There is inadequate information on the extent to which pig farmers manage to deliver animals with tails that meet criteria for payment of a tail bonus; this is because criteria are not yet known; because experience with uncut tails is limited to a small number of farms; and because farms need to gain experience.

To address this uncertainty, a range is given for a proposed reimbursement. Based on the assumption that a substantial proportion of farms are similar to Farm type A and Farm type B, the reimbursement should reflect this. Here we assume additional costs (rounded) of €29 per delivered pig from a farming system with

undocked tails in which many modifications are still needed (Farm type A), and €19 per pig from Farm type B. Also assumed is that 85% to 95% of the tails are in good condition.

To cover the additional costs of raising pigs with undocked tails, reimbursement from the buyer is needed in the range of €28 to €31 per delivered pig with a tail in good condition. In the learning phase, around €3 per delivered pig should be added to this.

Of the required reimbursement of €28 to €31 per animal, €11 to €12 is attributable to the 25 kg piglet. For pigs that are produced under the Beter Leven hallmark (1 star), €8 should be deducted per animal from the aforementioned reimbursement to avoid double reimbursement. This amount of €8 per pig delivered is the order of magnitude of additional fixed costs on a Beter Leven farm compared to a conventional farm. This is due to lower pen stocking rates.

To encourage participation by pig farmers, a higher reimbursement could be considered as a reward for pioneering and because the risks of tail biting cannot yet be effectively assessed.

A correction should be made for possible double reimbursement, insofar as some measures are already compensated within market concepts (e.g. compensation for extra living space). Costs have been calculated based on a large number of assumptions and estimates. It is worth considering repeating and updating this cost calculation in a few years' time.

3 Preconditions for successful implementation of pig farming with undocked tails

For successful implementation of pig farming with undocked tails, several aspects are important. These are discussed in the following sections.

3.1 Method: Interviews and literature research

Ten semi-structured interviews were conducted for the study on preconditions for successful implementation of pig farming with undocked tails. These interviews addressed the following talking points: Ideas on system for pioneering with undocked tails; amount of reimbursement; duration of system; number of pig farmers in pioneering phase; who pays the reimbursement; enforcement; and how to deal with calamities?

Interviews were conducted with representatives of the meat industry, retail sector and the Animal Protection Society (see Appendix 2). The interviews were held in September and October 2022 and lasted 1 to 1.5 hours. In addition, information has been incorporated from the other sources (see Literature).

3.2 Gaining experience and sharing knowledge are essential

The interviewees were unanimously in favour of pioneering pig farming with undocked tails. Pig farmers need time to gain sufficient understanding of effective management, but also time to make modifications to farm facilities. The latter often requires investments, which must fit into the farm's investment strategy. Moreover, there must be financial room to make investments, and at the time of the interviews (autumn 2022), there had been a prolonged period of negative margins.

Interviewees from the meat industry and retail think pioneering is best started with existing retail chains. Here, slaughterhouses could each select, for example, 5 to 10 (especially closed cycle) pig farms to start raising pigs with undocked tails. However, given the end date (2030) and the learning time required, it is important to take a much broader approach and ensure that pig farmers start taking the first steps soon. Importantly, the farms are working together on a chain-by-chain basis as a group of pioneers, with intensive information exchange between them. Furthermore, it is important to set up a roadmap and to acquire guidance from an animal welfare specialist. For this pioneering phase, interviewees from the meat industry suggest a period of roughly five years, while retailers suggest a shorter period of two years.

Another idea could be to develop a benchmarking tool (as with antibiotic reduction) to increase understanding of the occurrence and prevention of tail-biting.

3.3 Cooperation in chains is needed, as well as linkage to existing market concepts

The parties interviewed were all of the opinion that in the pioneering phase a link with the Beter Leven hallmark is desirable. Most of the production chains for Dutch supermarkets that use the Beter Leven hallmark already have cooperation between farmer and processor, and offer a premium price for the additional production costs. In these cases, it is easier to realise a premium price for undocked tails than in a non-contracted market in the Netherlands or abroad. This does require commitment from the retail sector, as well as from the Animal Protection Society and the Beter Leven hallmark Foundation (SBLk).

According to retailers, it is not possible to work with a growth model on the shelf: an increasing share of pork from animals raised with uncut tails. In any case, it cannot be communicated to consumers in this way, as there could be confusion similar to the situation with 'green' electricity. Therefore communication to consumers can take place only after the whole chain has switched to the new approach. It is important to have a good communication strategy in place to tell consumers why tail docking is no longer necessary now and was necessary before.

Especially for pig farmers who work outside the Dutch retail concepts, attention is needed on how to implement the new approach. This will certainly not happen automatically, according to interviewees, until adequate reimbursement is provided. On the question of who should pay the reimbursement for pigs that are raised outside Dutch retail chains, reference was made to the need for equal legislation within Europe (see 3.7).

3.4 Fixed reimbursement per pig is preferred

According to interviewees, the undocked tail reimbursement per delivered animal should cover the additional costs incurred. Consideration is currently being given in the pig sector to link reimbursement to tail length. This could conceivably include the tail reimbursement only for tails above a certain length, but differentiation by tail length, and/or by the percentage of animals with sufficiently long tails per supplier could also be considered. The issue here is the balance between sufficient incentive via a positive bonus for farmers, and sufficient demotivation via a costly penalty for animals with unsuitable tails. It can be assumed that the chain as a whole will have no direct economic benefit from tail docking, and so a negative incentive is not economically driven. A combination of positive and negative incentives is worth considering.

Given experience with existing market concepts, there is a need for the reimbursement (tail bonus) to be fixed for several years; there is concern among pig farmers that the fee will be scaled back after reaching an initial break-even level. Most interviewees believe that supermarkets should pioneer the payment of reimbursements, as consumers should ultimately pay the additional costs. Interviewees expressed a preference for a fixed reimbursement per pig delivered with an undocked tail in good condition. Opinions differ on whether this should be a uniform reimbursement applying to all slaughterhouses/chains, and whether it is permissible under antitrust law. It is therefore advisable to check with the Netherlands Authority for Consumers and Markets (ACM) about whether a uniform nationwide reimbursement is permissible under antitrust law. In any case, CoViVa can provide advice on reimbursement. This should then be differentiated according to reimbursement per piglet and reimbursement per finishing pig.

For the pioneering phase, it is advisable to explore opportunities to join the Marktprogramma Verduurzaming Dierlijke Producten (market programme for making animal products more sustainable). We also recommend finding out whether there is room for compensation for raising pigs with undocked tails within the ECO scheme, which is currently being developed by the Ministry of Agriculture, Nature and Food Quality.

3.5 Professional skills are essential

For raising pigs with undocked tails, professional skills are crucially important. According to expert pig farmer Martin van de Peut: "Animal-centred management is the crucial factor for successfully raising pigs with undocked tails." Another interviewee stated: "Are you willing to read the pig?" i.e. to base farm management on the needs and behaviours of the animal. This should be the starting point in pig farming operations. For some of the farmers, this will require a major shift in thinking.

According to interviewees, the piglet rearing phase in particular is crucial to the biting behaviour in the life of a finishing pig. Jurgen Hijink explains: "By investing in trouble-free piglet rearing, you avoid problems at the pig finishing stage." This is linked to the correct management of post-weaning dip and a well-functioning gut flora. Intensive cooperation and information exchange between the sow farmer and finishing pig farmer is

therefore of extra importance for pig farming with undocked tails. This is irrespective of a fair distribution of the reimbursement between sow farmer and finishing pig farmer, which is related.

This *fingerspitzengefühl* for animal behaviour could well become decisive for determining whether a pig farmer or his/her staff is able to keep animals with undocked tails without major outbreaks of tail biting, with the resulting disadvantages for animal welfare and farm economics.

The extra labour requirement for this on pig farms cannot always be filled and certainly not easily. The labour market has been tight for years. On top of that, this approach requires employees with the skills to recognise abnormal animal behaviour and act appropriately. Employing workers from abroad without language proficiency can be problematic in this regard because of the need for intensive communication and supervision.

However, huge strides have been made in recent years with other complex animal welfare improvements in pig farming, such as free-range farrowing, non-castration and reduction in the use of antibiotics, which require more skills to implement. This provides hope that such strides can also be taken in pig farming with undocked tails. It is advisable to offer courses in animal-centred management and to train additional animal welfare specialists. In addition, extra attention should be paid to animal-oriented management in practical education (*Pig Signals* is a good example of this approach). We also recommend the development of technological solutions for real-time recognition of abnormal behaviour of pigs (hanging tails, tail biting) to complement the professionalism of pig farmers and employees.

3.6 Preference for enforcement at slaughter

Interviewees have a clear preference for enforcement of undocked tails through inspection at the slaughterhouse. The reimbursement can also be based on that final inspection. Enforcement on farms, e.g. as part of the annual inspections for Integrated Chain Management (IKB) or the Beter Leven hallmark, would then be unnecessary.

Except in the case of live exports, no further enforcement is needed, unless a joint calamity fund is established (see 3.7 and Chapter 4), and pig farmers want to submit a claim.

3.7 Calamities will continue to occur

The expectation of interviewees, as well as pig farmers who currently have no experience of raising pigs with undocked tails, is that calamities will occasionally occur. A calamity would be an outbreak of tail-biting. According to pig farmers who do have experience with this problem, an outbreak can happen in the event of a weather change, feeding newly-harvested grain, abnormal feed quality if there are, for example, mycotoxins in the grains, or – more generally – animal distress. Such a calamity cannot always be prevented, but it can be stopped with acute intervention. During such an intervention, biting pigs (or only the bitten ones) are isolated, and many and varied additional pen enrichment materials are immediately given. Through active observation and swift action, an outbreak can be dealt with immediately to prevent escalation.

Nevertheless, it is not always possible to prevent animals from being bitten and severely affected. This occasionally results in the need to euthanise some animals. According to interviewees, it is important to have a ready solution (i.e. suitable intervention) at the farm in case of such calamities. One interviewee suggested euthanising animals on the farm, and then taking them to an emergency slaughterhouse for further processing for consumption.

Transporting animals with injured tails is a problem and is not always straightforward, especially when the animals are assumed to be suffering. It is recommended that the industry reach clear agreements with the NVWA for unambiguous guidelines on transporting animals with injured tails ('orange pigs'), on when on-

farm euthanasia is necessary, and on what is possible with a view to further processing. It is also advisable to coordinate with the Beter Leven hallmark Foundation on how to deal with animals with injured tails.

Besides focusing on legal and technical aspects, calamities – especially unexpected outbreaks of biting – also need to be addressed financially. According to some interviewees, a calamity fund is urgently needed, as its absence would hinder pig farmers' transition to raising pigs with undocked tails. Incidentally, this approach was not supported by the majority of pig farmers in both study clubs; they would rather have a larger reimbursement, from which they can meet the costs of an outbreak themselves. One suggestion from the field is to make it fiscally possible to reserve money for outbreak costs, similar to the fiscal arrangement for asbestos remediation. It has not been investigated whether the government is open to this suggested solution.

3.8 Level playing field in the EU is essential

A level playing field indicates an equal approach to pig farmers within the EU, where national legislation does not lead to competitive disadvantages compared to pig farmers in other EU countries. If the pig industry in the Netherlands unilaterally switches completely to rearing animals with undocked tails, a majority of pig farmers will suffer major economic disadvantages. Production costs would rise substantially, but buyers at home and abroad would have no corresponding incentive to pay a premium price. Indeed, piglets with undocked tails could fetch a lower price in some markets than those with docked tails, as buyers are apprehensive about the increased risk of tail biting. On top of this, buyers in domestic retail chains could start eliminating reimbursements for the extra costs of undocked tails, since requirements on producers would become legally mandatory.

We recommend that the Dutch government commit to a level playing field in the European Union, whereby all European pig farmers are required to switch to raising pigs with undocked tails. Experience shows that the market price, which is mainly determined in Northwest Europe, will rise along with the increased costs associated with undocked tails. Focusing on a level playing field will ensure the competitive balance within the EU. A point of attention is therefore the simultaneous implementation and realisation of this level playing field in the EU, as well as the corresponding enforcement. Given the experience already gained, EU-wide implementation is a long-term affair. Therefore, attention is needed for a realistic timeframe for pig farmers who are currently not producing in domestic value-added concepts.

If there is a complete legal ban on tail docking in the Netherlands, we recommend that legislators also impose requirements on the production conditions of pork products sold to consumers here. It is to be expected that the retail sector would otherwise source products abroad, at relatively lower prices, and domestic producers would suffer.

3.9 Retail chains are already pioneering on a small scale

Several retail chains are pioneering on the theme of undocked tails. Some retailers were willing to cooperate with an interview, some others were not. It seems these retailers are also working on the issue, and did not want to share information about it. The Animal Protection Society is also positive about the transition to raising pigs with undocked tails, and its inclusion in the Beter Leven hallmark.

Where several pioneering projects run in parallel, the challenge is to seek coherence and sectoral appeal.

3.10 Transition period is needed for learning

An ample transition period is needed not only for pig farmers and buyers, but also for farm advisers and suppliers and the industry as a whole. This includes enabling farms to invest in modified housing, gaining broad experience with suitable animal farming and with adequate measures in case of outbreaks of biting, and avoiding unfair competition due to unequal regulations within the EU.

Jeroen Neimeijer, organic pig farmer and expert by experience, put it this way: "The industry should not move too quickly to raising pigs with undocked tails; take sufficient time for learning."

As an indication, we estimate a required transition period for individual farms of two to five years. This concerns pig farming only, and is separate from marketing the animals at an adequate premium price.

3.11 Professional satisfaction is a concern

For farmers, problems with tail-biting are not only a cost, but it can also be detrimental to professional satisfaction. If raising pigs with undocked tails is successful, it could enhance the attractiveness of pig farming as a profession, provided the compensation is adequate. However, in interviews with pig farmers, a deeply felt concern was whether stopping tail docking would actually improve animal welfare. Some of the interviewed pig farmers expect regular outbreaks of tail biting. As a result, some farmers are sceptical about the net result of switching to undocked tails: the one-off procedure of tail docking is less far-reaching than the problems of tail biting, especially in the case of 'a bloodbath', with wounds, abscesses, possible hindquarters paralysis and the necessity to euthanise the affected animals. It has been argued that this can lead to high levels of stress for farmers and even to mental health problems. Incidentally, pig farmers with experience in raising pigs with undocked tails seem to be less sceptical. So some farmers seem to be worried about the unknown. What is important is a careful path, with a combination of sufficient transition time, sharing of learning experiences, guidance and adequate reimbursement for the necessary additional costs. We recommend that sufficient time be provided for pig farmers to make the transition, with a supportive guidance and learning process and suitable reimbursement of additional costs.

3.12 Appropriate genetics

Pig farmers also mentioned the need to pay attention to the right genetics. Above all, there is a need for 'more social' animals, which are less prone to tail-biting.

4 Options for a calamity fund

For the transition to pig farming without tail docking, the possibility and feasibility of a calamity fund has been investigated. The essence of a such a fund is that pig farmers are compensated in case of damage due to tail biting. Pig farmers are expected to be more likely to stop tail docking if their financial risks can be covered. Various solutions for risk financing were examined.

4.1 Opportunities for covering financial risks

The concept of risk is defined by two elements: the probability and magnitude of a potential hazard. The probability is the likelihood of the hazard occurring. Magnitude or severity is the consequence in case of exposure to the hazard. The experiences of several pig farmers with undocked tails show that occasional outbreaks of tail biting are to be expected. Given the severe financial damage that can result from tail-biting outbreaks, this can have implications for farm continuity. Risks of low frequency and high magnitude will usually be insured by the farmer to avoid jeopardising continuity.

4.1.1 Five principles are important in risk coverage

This section will outline the possibilities for covering the costs of tail-biting outbreaks with livestock insurance. In particular, the changing factors that are important in an insurance policy or other form of risk hedging are addressed. The fundamentals of insurance can be divided into a number of principles (Ray, 1967; Rejda, 1998), with five being particularly important in tail biting. These are:

1) Sufficient statistical data on occurrence and extent of damage.

The insurer must have sufficient statistical data on the occurrence and extent of claims to be able to determine the risk premium, based on a large number of claims and preferably on a time series of assessed claims.

2) No influencing of claims by the policyholder (other than in the context of prevention; related to moral hazard).

Insurable risks are those that are beyond a policyholder's control (management risks need to be excluded). The peril should be such that it cannot be intentionally caused by the policyholder without a sacrifice: insurability should not result in a profit for the policyholder. This is the moral hazard aspect of the risk that a policyholder intentionally or unintentionally adjusts their risk behaviour by taking – or refraining from taking – certain actions after being insured.

3) No anti-selection of potential policyholders.

Anti-selection is likely to take place. Only those who are actually at risk (or more at risk) will more likely insure themselves. Avoidable self-selection is where the selection is a consequence of the insurer's lenient underwriting policy and/or low differentiation of its premiums, and the prospective policyholder takes advantage of this leniency or low differentiation. The individual premium should therefore be in line with the individual risk. Unavoidable self-selection results from asymmetric information. It occurs when the prospective policyholder has an information advantage over the insurer; they know their own situation fairly accurately, while the insurer does not know about certain risk-increasing factors that are present (because the insurer does not know about specific farm practices or is not allowed to request certain data).

4) *Damage must not be ambiguous to assess.*

The loss must be determinable and measurable. It should not be ambiguous whether the claim is covered in the policy or not, and how the amount assessed.

5) *An insurance premium must be economically feasible.*

The loss caused by the risk must be large enough to mean a significant reduction in income or assets. Minor damage is not insured: the benefits from indemnity usually do not outweigh the associated transaction costs and risk premiums.

4.1.2 Deductible excess and underwriting conditions of the insurer are important

In the case of tail-biting risk, not all insurability requirements are met without question. The aspects mentioned below should be taken into account when formulating an insurance policy.

1) *Sufficient statistical data on occurrence and extent of damage.*

There is little or no experience with non-docking of tails. Reliable information on frequency and level of damage from tail biting is lacking in conventional pig farming. In organic pig farming, docking is banned, but tail biting is known to occur. In general, it can be said that an outbreak of tail-biting can occur relatively frequently (per farm, for example, once every three years, but also more than once a year). The extent of damage can range from low (in case of timely intervention – only a few animals may be affected) to high in case euthanasia is necessary. Because tail-biting is a multifactorial problem, the risks are higher in certain seasons (spring and autumn when there are high temperature variations within a 24-hour period) than in the rest of the year.

2) *Moral hazard can be reduced by introducing a deductible excess per policyholder and by setting underwriting conditions.*

The policyholder can reduce risk by optimising conditions and using good management practices. In addition, early detection of the onset of tail-biting and effective curative measures can greatly reduce the extent of damage. It is almost impossible for the insurer to retrospectively determine whether the right measures were implemented at the right time by the policyholder.

Moral hazard can be limited by introducing a substantial deductible excess per policyholder and by drafting underwriting conditions (via an article on general exclusions). For example, pig farmers would qualify for insurance only if they can prove that they have been claim-free for several production rounds and thus have mastered the management of pigs with undocked tails. Consideration could also be given to a bonus-malus system to deal with management risk. The bonus-malus system works with a 'bonus-malus ladder' consisting of a number of steps. Linked to each step is a certain discount or surcharge on the premium. The bonus-malus system rewards pig farmers with claim-free rounds/years with a lower premium. Pig farmers with claims face higher premiums.

3) *A differentiated premium is important to prevent anti-selection.*

The occurrence of the risk is in all likelihood not homogeneously distributed because it is a multifactorial problem. Farmers who have mastered pig farming with undocked tails will not be willing to pay the average premium and will prefer to bear the entire risk themselves. Experience shows that anti-selection will take place to some extent, especially at insurance start-up. A differentiated premium is important to prevent anti-selection and to increase demand, so that risk is spread more widely.

4) *Damage must not be ambiguous to assess.*

Damage due to tail-biting is difficult to determine and includes the costs of treating animals (labour and medication), isolating animals (housing costs), reduced yields due to lower growth rates and total or partial rejection of animals by slaughterhouses. Determining the damages objectively is therefore difficult or impossible. Insurance based on indemnification will involve significant assessment costs. An alternative option to reduce transaction costs is to pay out a pre-agreed amount.

5) *An insurance premium must be economically feasible.*

The incidence and extent of damages from outbreaks of tail-biting are largely unknown. Due to premium differentiation, farmers who do not master raising pigs with undocked tails will face relatively high premiums (frequent and costly damage claims make future damage difficult or impossible to insure) or they will start docking the pigs again.

In summary, the aforementioned aspects are not an insurmountable problem, but it does mean that premium differentiation, the deductible excess and the conditions of acceptance by the insurance company are particularly important when developing insurance.

4.2 Case studies on risk financing in pig farming

4.2.1 Only with a large group of potential participants is there possible interest from insurance companies

Livestock insurance in the Netherlands

A number of insurance companies offer livestock insurance in the Netherlands, notably Achmea (Interpolis and Topland), Nationale Nederlanden, Klaverblad and Univé. LTO Verzekeringen is not a risk carrier itself but it is possible to insure risks through livestock insurance with LTO Verzekeringen as intermediary.

In pig farming, livestock insurance with coverage for animal diseases is not common. Coverage for damage due to causes such as fire, storm and suffocation is more common. There is no insurance to cover damage due to tail biting.

In dairy farming, cattle accident insurance is available, but only a minority of dairy farmers have this coverage. The available policies differ with regard to the risks that are covered (and especially the risks that are excluded), the insured value and the deductible excess (per year/per event). Covered events usually include mortality and culling due to sickness and acute poisoning, as well as accidents and theft. Besides coverage for livestock damage, in many cases additional costs such as transport for animal disposal, extra veterinary fees and examination costs are also covered, but this varies between insurers. The insurance excludes damage due to farm-related animal diseases and specific udder and leg disorders. An even smaller group of dairy farmers has taken out supplementary calamity insurance. Compensated damages as a result of culling due to foot and mouth disease, for example, are based on the replacement value (pre-agreed insured value per head of cattle). This additional consequential loss insurance reimburses 10% to 15% of the insured amount.

In summary, it can be concluded that the livestock insurance market in the Netherlands is a niche market of relatively limited size. Insurance against tail biting is currently not possible due to the aforementioned bottlenecks. The market will possibly be of interest to insurers only when a large group of pig farmers voluntarily stop docking tails or are legally obliged to stop. Such insurance takes several years to develop due to the current lack of claims statistics, among other reasons.

Livestock insurance in Germany

The limited coverage combined with limited demand in the Netherlands as well as in many other European countries shows that livestock insurance is struggling to get off the ground. A positive exception is the yield loss insurance (*Ertragsschadenversicherung*) offered by the Vereinigte Tierversicherung, a special insurer for animal production within the R+V insurance group, which is the market leader of speciality insurers in animal production in Germany. R+V was the first to develop this *Ertragsschadenversicherung* in 1993. There are currently two main insurance formulas. On the one hand, there is basic coverage, which offers protection against the greatest possible perils. It is a kind of minimum insurance, limited to notifiable animal diseases and accidents in livestock. There is also premium coverage, which is the most comprehensive. The actual damage suffered based on the insurer's own data will be compensated, minus the pre-agreed deductible excess. Therefore the reimbursement is not on a flat-rate basis. Compensation is paid for some additional costs (such as animal replacement, destruction of milk, disinfection costs, safety measures) and some loss of revenue (such as reduction or loss of revenue due to location in an area with transport restrictions, and

temporarily lower production in the reconstruction phase). Around 50% of cattle farms and 30% of sow farms in Germany have taken out livestock insurance.

As in the Netherlands, the current practice in Germany is to dock the tails of almost all piglets. The *Ertragsschadenversicherung* does not provide coverage for tail-biting (for the time being) because it does not currently cause problems with insurmountable economic damage. In the future, coverage might be expanded, should there be a case for it (along the lines of the current coverage in Germany of feather pecking and cannibalism in poultry).

4.2.2 Experience has shown that support for insurance among pig farmers is low

A mutual insurance company is governed and managed by the policyholders themselves. The board sets the level of premiums and determines which claims will be reimbursed.

The Porcopol mutual insurance company, which had covered consequential losses in its policy for pigs, was liquidated in 2013 due to lack of interest. Porcopol did not have to pay any damages during its existence. At Porcopol, the financial consequences of an outbreak of Aujeszky's disease were insurable. Over time, insurance for idle production after culling for classical swine fever and foot and mouth disease was added. At its peak in 2006, Porcopol had 119 members, insuring a total of nearly 74,000 sows.

Historically, there has been little support for insurance among pig farmers. In addition, the requirements have been tightened by the regulator. The development of a mutual insurance company takes several years because, among other things, claims statistics are lacking.

In contrast to pig farming, a mutual insurance company has proved viable in poultry farming. In fact, this insurer (Onderlinge Waarborgmaatschappij Avipol B.A.) has existed for 25 years after being founded on the initiative of a group of poultry breeders. The aim is to offer poultry farms with broiler parent stock the option of insurance against the risks of Salmonella. The policy was later extended to include coverage against damage caused by *Mycoplasma gallisepticum* (Mg) and the conditions hysteria and false layer syndrome. Mutual insurance is possible for breeding and rearing farms in the poultry sector and if the farm has a valid IKB-KIP certificate (Avipol website).

4.2.3 Considering livestock slaughter insurance as an option

In the past, the Centraal Bureau Slachtveeverzekeringen (CBS) N.V. (bureau for livestock slaughter insurance) has insured animals against processing risk. This is the risk of financial damage resulting from full or partial rejection or conditional approval of an animal by the official inspection body, the NVWA. Using the information available to CBS N.V., advice was given on damage control measures. This promoted quality in terms of animal health, animal welfare and food safety, thus encouraging sustainable development of the sector. For participation in the Kwaliteitsregeling (quality scheme), the participant paid a contribution per slaughtered animal. The participant was periodically monitored for compliance. After monitoring and assessment, it was known whether the participant complied with the scheme or whether remedial measures needed to be taken. If the scheme was complied with, in case of an unfit for human consumption declaration after slaughter by the competent authority NVWA, the participant could apply for compensation. The compensation request was checked substantively and administratively by auditors and assessed by reviewers. Certain cases, for example, were not eligible for any compensation. Compensation could also be reduced if any non-compliance with the scheme was ascertained. The inspectors conducted an administrative review and/or visited the farm (Bondt et al., 2004; Wagenberg et al., 2010). From July 2004, rejected livers were no longer covered by livestock slaughter insurance. The main reason was that liver abnormalities are largely caused by farm management problems. The percentage of rejected livers in the Netherlands in 2004 doubled compared to 1990 (10% in 2004 and 5% in 1990 (Bondt et al., 2004). After coverage was curtailed, the prevalence dropped again to 5% (Wagenberg et al., 2010).

From 1 July 2013, services to slaughterhouses (and livestock farmers) were provided under the name Kwaliteitsregeling (quality scheme). However, in 2017 the Supreme Court of the Netherlands ruled that the

Kwaliteitsregeling for slaughtered livestock with compensation option in case of meat rejection is actually an insurance policy (Hoge Raad, 2017). Soon after, this type of insurance was terminated.

By analogy with the former livestock slaughter insurance, it might be interesting for slaughterhouses to work out a compensation system, whereby the compensation to be paid out depends on the degree of intact tails. Depending on the expected damage burden, part of this tail bonus could be used to compensate for fully or partially rejected animals. This would involve limited coverage because it is not obvious to compensate damage on pig farms (including growth retardation and breakdown) through livestock slaughter insurance. We recommend checking with the Netherlands Authority for Consumers and Markets (ACM) about whether a uniform nationwide reimbursement is permissible under antitrust law, and with the Dutch Central Bank (DNB) and the Financial Markets Authority (AFM) that supervise insurers about whether a supplementation to a livestock slaughter insurance policy is permissible (given previous case law).

4.2.4 Guarantee can reduce obstacles

One way to reduce investment or innovation risks is to offer a guarantee. These are national measures to accommodate farmers who invest or innovate, so that they run less risk and banks are more likely to finance the farms/innovation.

The SME Agricultural Loans Guarantee Scheme in the Netherlands is designed for agricultural enterprises that cannot offer the bank enough security (collateral such as land, buildings or machinery) when taking out a loan. Experience shows that this instrument is effective because banks are more likely to give a loan if the government is a partial guarantor (Meurs et al., 2019).

To successfully raise animals with undocked tails, pig farms need to be able to invest in appropriate housing. In case of insufficient collateral, the SME Agricultural Loans Guarantee Scheme can offer a solution (if investments are so high that a guarantee is needed). However, guarantees are limited to investment risks and do not address production risks such as tail biting. We recommended finding out whether there is room for compensation for pig farms with undocked tails (including coverage of risks) within the ECO scheme, which is currently being developed by the Ministry of Agriculture, Nature and Food Quality.

4.3 Support among pig farmers for a calamity fund appears to be marginal

In discussions with pig farmers, as part of this study, our impression was that only a small minority are interested in a calamity fund. Pig farmers with experience in raising pigs with undocked tails are overwhelmingly negative about the need or requirement for such a fund (in any form). Even most pig farmers without experience are a priori opposed to some form of calamity fund, especially if the costs ultimately have to be borne by themselves.

However, these interviews are not representative of the entire sector, but they do provide an indication of the likely participation in such a fund in any form. Farmers are more interested in sufficient reimbursement, which can also be used to compensate damages (Section 3.7) and in fiscal reserve accounts. Should there be a possibility of calamity costs being borne by other parties, such as the government, interest would presumably be higher.

Provided that such an opportunity presents itself, we recommend that a larger group of pig farmers, for example from the members of the de Producentenorganisatie Varkenshouderij (Pig Production Organisation – POV), be asked about their interest in participating in a possible calamity fund (in whatever form).

We also recommend consulting with slaughterhouses on setting up a joint livestock slaughter insurance scheme in some form, from which limited coverage can be offered for severe damage. This can also be set up individually by slaughterhouses for their own suppliers. The cost of this scheme should not come at the expense of the reimbursable tail bonus.

5 Discussion and recommendations

5.1 Discussion

Situations from practice show large differences in the modifications required at the farm level to enable pig farming with undocked tails. This is evident from interviews with several experts by experience. Animal-centred management plays an important role in this. Outcomes of this analysis are thus only indicative of the additional costs required. Situations from farming practice are more diverse than the three Farm types defined in this study. Although no quantitative information is available on the proportion of farms classified as Type A, B or C, farms that fit Farm type A seem to be particularly common.

For finishing pig farms that use liquid feed, modifications may be needed for extra trough length (so the animals can feed simultaneously). This can be difficult to achieve in practice. The assumption is that a solution can be found with management measures (e.g. feeding twice in quick succession each time).

Building modifications (living space, flooring and so on) are limited in this analysis to modifications for the purpose of raising pigs with undocked tails; in practice, a redesign will have to be compatible with the farm's investment strategy and with an overall package for a future-proof farm (such as free-range farrowing or increased weaning age).

Financing the necessary modifications may become a bottleneck, especially given the economic situation in recent years. No account has been taken of the consequences of farm modifications on compliance with existing permits and/or emission requirements; in practice, this can be prohibitive.

The cost calculations were based on housing investment amounts from the most recent *Kwantitatieve Informatie Veehouderij* (KWIN). However, the prices in this budgeting annual handbook are based on the cost situation before the start of the war in Ukraine. As a result, the calculated additional housing costs are currently expected to be underestimated. The costs for a pig farmer depend on the market situation of building materials and labour, among other things, and these may be different in the future.

Also because of the aforementioned uncertainties, we recommend repeating the cost calculation of raising pigs with intact tails in a few years, so that a correction of the cost increase can be included. The experience gained with this form of pig farming on a wider range of farms will provide more information for more accurate analysis.

Possibilities and feasibility of a calamity fund in the form of livestock insurance or mutual fund are limited in the short term. Only when a large group of pig farms stop docking tails voluntarily, or are required to do so by law, might there be sufficient market potential for insurers. By analogy with the former livestock slaughter insurance, it might be interesting for slaughterhouses to work out a compensation system to compensate farmers for fully or partially rejected animals. The development of a form of risk hedging will take several years because, among other things, claims statistics are lacking.

5.2 Recommendations

1. Switching to pig farming with intact tails requires all links in the production chain to take responsibility (action by the whole chain).
2. Reimburse pig farmers an amount of €28 to €31 per animal with an intact tail in good condition (action by meat industry and retail sector). During the first years, an amount of €3 per animal should be added here for additional costs during the learning phase. For farms already producing under the Beter Leven hallmark (1 star), this fee should be reduced by €8 per animal delivered, to avoid double reimbursement.
3. Offer more animal-centred management courses (action by Pig Production Organisation – POV).
4. Train additional animal welfare specialists to guide farmers (action by POV).
5. In vocational education, pay extra attention to animal-centred management (action by education).
6. Develop technology solutions for real-time recognition of abnormal pig behaviour such as hanging tails and tail biting (action by technology companies).
7. Make clear and unambiguous guidelines with the NVWA on transporting animals with injured tails ('orange pigs'), and on on-farm euthanasia. Also discuss with NVWA options for further processing of animals that are euthanised on the farm (action by CoViVa).
8. Make clear agreements with Beter Leven hallmark Foundation on how to deal with animals with slightly damaged tails (action by CoViVa).
9. Enquire with the Ministry of Agriculture, Nature and Food Quality about what scope there is for reimbursement for raising animals with undocked tails, and for covering risks in case of outbreaks of tail biting, within the ECO scheme. This is especially important for the transition phase and for possible calamity insurance (action by CoViVa).
10. For the pioneering phase, explore opportunities to join the market programme for making animal products more sustainable (action by CoViVa).
11. Lobby for a level playing field in the European Union for undocked tails (action by LNV). Without adequate reimbursement for additional costs, pig farmers will be unable to make the transition in farming systems.
12. If there is a complete legal ban on tail docking in the Netherlands, politicians should impose requirements on production conditions of products sold to consumers here (action by LNV).
13. Offer sufficient time for pig farmers to make the transition (action by LNV and CoViVa).
14. Subject to the possibility of external funding of calamity insurance, conduct a broad poll among POV members on their interest in participating in some form of calamity fund (action by POV).
15. Consult with slaughterhouses on setting up joint livestock slaughter insurance in some form, for limited coverage for major claims. For this purpose, consult with the Netherlands Authority for Consumers and Markets (ACM) on whether a uniform nationwide fee is permissible under antitrust law, and with the Dutch Central Bank (DNB) and the Financial Markets Authority (AFM) on whether supplemental livestock slaughter insurance is permissible. Action by CoViVa.
16. Repeat the cost analysis for raising pigs with undocked tails in a few years' time, as more information will then be available, and a correction due to the cost increase can also be included (action by CoViVa).

Sources and literature

- Avipol. Website: <https://www.avipol.nl>.
- Bondt, N., D. van den Elzen, R. Hoste, C. van Wagenberg, I. Vermeij, en B. van de Fels, 2004. *Terugdringen van slachtafwijkingen in de varkensvleesketen*. Rapport 5.04.04, LEI, Den Haag.
- Biggenprijzenschema, 2022. Uitgave van Wageningen Livestock Research. Versie 4 juli 2022.
- Brocke, A.L. vom Brocke, C. Karnholz, D. Madey-Rindermann, M. Gauly, C. Leeb, C. Winckler, L. Schrader, en S. Dippel, 2019. *Tail lesions in fattening pigs: relationships with postmortem meat inspection and influence of a tail biting management tool*. *Animal* (2019), 13:4, pp 835–844.
- Boyle, L.A., S.A. Edwards, J.E. Bolhuis, F. Pol, M.Z. Šemrov, S. Schütze, J. Nordgreen, N. Bozakova, E.N. Sossidou, en A. Valros, 2022. *The Evidence for a Causal Link Between Disease and Damaging Behavior in Pigs*. *Front. Vet. Sci.* 8:771682.
- Daugaard Larsen, H., en H. Spoolder, 2019. *TailCam; Automated detection of tail length and tail lesions on the slaughter line*.
- Dooren, K. van, 2019. Stress en krulstaarten gaan niet samen. <https://www.foodagribusiness.nl/stress-en-krulstaarten-gaan-niet-samen/>.
- Hoge Raad, 2017. *Kwaliteitsregeling voor slachtvee met compensatiemogelijkheid bij afkeuring vlees is een Verzekering*. Documentselectie 23-04-2020 (houthoff.com).
- Kluyvers-Poodt, M., H.M. Vermeer, A.I.J. Hoofs, en G.F.V. van der Peet, 2018. *Hokverrijking*. Wageningen University & Research. <https://edepot.wur.nl/465079>.
- KWIN 2022-23. *Kwantitatieve Informatie Veehouderij 2022-2023*. Wageningen Livestock Research, Handboek 46.
- Meurs, E., B. Witmond, G-J Wilbers, H van der Meulen, M. van Asseldonk, D. van Wonderen, en H. Pamuk, 2019. *Beleidsevaluatie Garanstelling Landbouw*. Ecorys, Rotterdam.
- Ministerie LNV, 2019. *Toekomst veehouderij*. Brief aan de Tweede Kamer, Kamerstuk 28973.
- Niemi, J.K., S.A. Edwards, D.K. Papanastasiou, D. Piette, A.H. Stygar, A. Wallenbeck, en A. Valros, 2021. *Cost-Effectiveness Analysis of Seven Measures to Reduce Tail Biting Lesions in Fattening Pigs*. *Front. Vet. Sci.* 8:682330.
- Peet, G. van der, M. Kluyvers-Poodt, N. Dirx, A. Hoofs, C. van der Peet-Schwering, G. Binnendijk, N. Ursinus, en L. Bolhuis, 2016. *Houden van varkens met een intacte staart; Invulling van stap 1 van de Verklaring van Dalfsen: demonstratieproject, praktijknetwerk en internationale samenwerking*. Wageningen, Wageningen Livestock Research, Rapport 939.
- POV, 2021. *Welzijnscheck 2.0*. <https://www.vitalevarkenshouderij.nl/ambities/ambitie-robuuste-en-gezonde-varkens-in-een-diervriendelijke-houderij/welzijnscheck-varkens/over-welzijnscheck>.
- Sinisalo, A., J.K. Niemi, M. Heinonen, en A. Valros, 2012. *Tail biting and production performance in fattening pigs*. *Livestock Science* 143 (2012) 220–225.
- Valros, A., E. Välimäki, H. Nordgren, J. Vugts, E. Fàbrega, en M. Heinonen, 2020. *Intact Tails as a Welfare Indicator in Finishing Pigs? Scoring of Tail Lesions and Defining Intact Tails in Undocked Pigs at the Abattoir*. *Front. Vet. Sci.* 7:405.
- Peet-Schwering, C. van der, N. Dirx, M. Kluyvers-Poodt, G. Binnendijk, L. Bolhuis, en G. van der Peet, 2017. *Effect van voersamenstelling op bijtgedrag bij varkens*. Wageningen Livestock Research, Rapport 1008.
- Peet, G.F.V. van der, A.I.J. Hoofs, K.G.H. Kreuger-Stolk, C.M.C. van der Peet-Schwering, H.M. Vermeer, T.J. Tobias, 2021. *Houden van varkens met een intacte staart; Eindrapportage 'Stappenplan krulstaarten 2017-2020'*. Wageningen Livestock Research, Rapport 1311.
- Ray, P.K., 1967. *Agricultural insurance, principles and organization and application to developing countries*. Pergamon Press Ltd, Oxford.
- Rejda, G.E., 1995. *Principles of risk management and insurance*. Addison-Wesley, Reading.
- Valros A., E. Välimäki, H. Nordgren, J. Vugts, E. Fàbrega, en M. Heinonen, 2020. *Intact Tails as a Welfare Indicator in Finishing Pigs? Scoring of Tail Lesions and Defining Intact Tails in Undocked Pigs at the Abattoir*. *Front. Vet. Sci.* 7:405. doi: 10.3389/fvets.2020.00405
- Vermeer, H.M., I. Vermeij, K. Blanken, en R. Verheijen, 2012. *Evaluatie plateaustal vleesvarkens*. Wageningen Livestock Research, Livestock Research Rapport 555.

-
- Wagenberg, C.P.A. van, G.B.C. Backus, W.E. Kuiper, J.G.A.J. van der Vorst, en H.A.P. Urlings, 2010. *Incentive mechanisms for liver lesion control in finishing pigs in the Netherlands*. Preventive Veterinary Medicine 93 (2010) p 19-24.
- Walker, P.K., en G. Bilkei, 2004. *Tail-biting in outdoor pig production*. The Veterinary Journal 171 (2006) 367–369. Short communication.
- Wallgren, P., en E. Lindahl, 1996. *The influence of tail biting on performance of fattening pigs*. Acta Vet. Scand. 37, 453–460.
- Werkgroep Krulstaart, 2013. *Varkens houden met een krul; Zoektocht naar het voorkomen en bestrijden van staartbijten*. Eindrapport van de werkgroep.
- Zonderland, J.J., 2010. *Talking Tails; Quantifying the development of tail biting in pigs*. PhD Thesis Wageningen University.
- Zonderland, J.J., B. Bosma, en R. Hoste, 2011. *Financiële consequenties van staartbijten bij varkens*. Wageningen Livestock Research, Rapport 543.

Verder is gebruikgemaakt van informatie uit volgende bronnen:

Bedrijveninformatienet, Wageningen Economic Research.

<http://www.agrimatie.nl/binternet.aspx?ID=4&bedrijfstype=5>.

InterPIG. Niet openbaar.

Diverse websites voor prijzen van materialen.

Appendix 1 Assumptions for the calculations

Assumptions on the frequency and price effect of damaged tails in rearing piglets and finishing pigs are given in Table B1.1. These assumptions have been used in the calculations in Chapter 2.

Table B1.1 Frequency (% per year) and price effect (euro/animal) of various categories of animals

	Piglet rearing		Finishing pigs	
	Frequency	Price effect (in euros)	Frequency	Price effect (in euros)
With damage, euthanised	1% (2.5%)	40	1% (2.5%)	100
Delivered with damage as a slaughter piglet	2% (5%)	40		
Delivered with damage, with penalty	5%	5	0%	0
With damage, healed	6%	0	15%	0

Note:

Numbers in brackets apply during the learning period.

Price effect of euthanised animals refers to the estimated average loss of value.

Slaughter piglet: concerns additional slaughter piglets.

Healed: no visible bite wounds, scabs or swellings. Yield price effect of healed animals has been assumed as nil; however, growth retardation has been factored in.

Price effect: depreciation from the market (piglet) or partial rejection at the slaughterhouse (finished pig), respectively.

Source: own assumptions, based on literature and experiences of pig farmers.

Table B1.2 Farrowing house modifications, by focus area, for the various farm types

Theme	Modification	Farm type A	Farm type B	Farm type C
Feed and water	Modify drinking bowls	x	x	-
Space	Area in existing farrowing pen (m ²)	4.3	5.4	5.4
Space	Number of sows	-20%	same	same
Space	Piglet nest expansion and isolation	x	x	-
Thermal comfort and air quality	Covering piglet nest	x	-	-
Pen enrichment	Efficient and adequate continuous pen enrichment + 2x daily rooting feed	x	x	-
Animal health	Optimal cleaning	x	x	-
Labour	Extra time in barn due to extra space and animal attention	x	x	x
	Additional minutes per sow place/year	39	29	18
Learning phase	Labour, enrichment materials, guidance	x	x	x

Explanation: x:modify; -:already in order.

For labour input, the basic assumption is 7.73 hours per sow place/year for sows and piglet rearing combined.

Table B1.3 Piglet rearing modifications, by focus area, in various farm situations

Theme	Modification	Farm type A	Farm type B	Farm type C
Feed and water	Modify drinking bowls	x	x	-
Feed and water	Eating places dry feeder	x	x	-
Feed and water	Modified feed composition	x	x	x
Space	Number of piglets reared	-20%	same	same
Space	Area enlargement	x	x	-
Space	Redesigning floor	x	-	-
Thermal comfort and air quality	Optimisation of ventilation system	x	x	-
Pen enrichment	Efficient and adequate continuous pen enrichment + 2x daily rooting feed	x	x	-
Animal health	Optimal cleaning	x	x	-
Labour	Extra time in barn due to extra space and animal attention	x	x	x
Labour	Course on human-animal interaction	x	x	-
	Additional minutes per sow place/year	90	90	65
Contingency plan	Labour and material	x	x	x
Learning phase	Labour, enrichment materials, guidance	x	x	x

Note:

Explanation: x:modify; -:already in order.

Area enlargement can be in the form of a rental barn, for example.

For labour input, the basic assumption is 7.73 hours per sow place/year for sows and piglet rearing combined.

Table B1.4 Finishing pig housing modifications, by focus area, in various farming situations

Theme	Modification	Farm type A	Farm type B	Farm type C
Feed and water	Number of drinking bowls	x	x	x
Feed and water	Eating places dry feeder	x	x	-
Feed and water	Modified feed composition	x	x	x
Space	Rent barn to increase space to 1.0m ²	-	x	-
Space	Number of finishing pigs	-20%	same	same
Thermal comfort and air quality	Optimisation of ventilation system	x	x	-
Pen enrichment	Efficient and adequate continuous pen enrichment + 2x daily rooting feed	x	x	-
Animal health	Optimal cleaning	x	x	-
Labour	Extra time in barn due to extra space and animal attention	x	x	x
Contingency plan	Labour and material	x	x	x
Labour	Course on human-animal interaction	x	x	-
Additional labour	Additional minutes per finishing pig place/year	20	20	15
Learning phase	Labour, enrichment materials, guidance	x	x	x

Explanation: x:modify; -:already in order.

For labour input, the basic assumption is 0.57 hours (34 minutes) per finishing pig place/year.

Appendix 2 Interviewees

For sub-question 1 (Chapter 2) and General:

Geert van der Peet, Theme leader Sustainable Livestock Farming, Wageningen Livestock Research

Valentijn Thuring, Pig veterinarian, Coöperatie Varkensartsen (pig veterinarians cooperative)

Eelco van de Hoef, Head of pig innovation team, AgruniekRijnvallei

Mark van den Eijnden, De Hoeve Innovatie

Jan Leeijen, Supply manager for pigs and cattle, De Groene Weg (organic meat processor)

Jeroen Nijmeier, chairman, Association of Organic Pig Farmers

Martin van de Peut, pig farmer, former Norvida programme participant

Cars Huisman, pig farmer, former Norvida programme participant

Brummelhuis family, Brummelhuis breeding farm

Jurgen Hijink, Hijdeporc Advies

Pig farmers in Didam study club (also for sub-questions 2 and 3)

Pig farmers in Wanroij study club (also for sub-questions 2 and 3)

Fleur Bartels, animal health/animal welfare policy officer, POV

Niina Immonen, Development Manager, Atria Plc, Finland

For sub-question 2 (Chapter 3):

Derk Oorburg, Director Quality Assurance, Vion Food Group (also for sub-question 3)

Jaap de Wit jr., Supply chain director, Westfort Vleesproducten (meat products)

Addy van Rooi, Co-owner Van Rooi Meat

Stan Quinten, Managing Director, Meat Friends

Menno Wigtman, Buying Manager Protein, and Wim van Willigenburg, senior buyer fresh produce, Jumbo Food Group

Rob de Bruijn, Senior Category Manager, Jan Linders Supermarkets

Marc Janssen, Director, and Jennifer Muller, sustainability manager, Centraal Bureau Levensmiddelenhandel

Bert van den Berg, livestock programme manager, Dierenbescherming (animal protection society)

Maurits Steverink, Sustainable Animal Products Market Programme, True Food Projects

For sub-question 3 (Chapter 4):

Melissa van de Kam-Jacobs, sector manager, Achmea Agro

Benjamin Overkleeft, account manager, LTO Verzekeringen

Twan Claessens, former board member, Porcopol Mutual Insurance Company

Jan Stevens, Firmenkundenberater Agrar, R+V Versicherung, Germany



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