



GEroNIMO project

*Genome and Epigenome eNabled
breedIng in MOnogastrics*

Grant Agreement n°101000236

Deliverable D3.1

Report on the surveys assessing management schemes of local breeds over Europe in monogastric

Due date of deliverable: M9 – February 2022

Actual submission date: M11 – 29 April 2022 (accepted) / V2 on 14 February 2023

Workpackage concerned	WP3
Deliverable leader / Main author	Marie-José Mercat (IFIP)
Additional author(s)	Andreia Amaral (FMV), Danijel Karolyi (UNIZG), Dubravko Škorput (UNIZG), Jetsabell Gutierrez Vallejos (IFIP), Denis Laloë (INRAE), Herveline Lenoir (IFIP), Marjeta Čandek Potokar (KIS), Martin Škrlep (KIS), Gwendal Restoux (INRAE), Riccardo Bozzi (UNIFI), Romuald Rouger (SYSAAF), Tamara Rodríguez (FEUGA), Zoran Luković (UNIZG)
Version	2
Type	<input checked="" type="checkbox"/> R Document, report <input type="checkbox"/> ORDP Open Research Data Pilot <input type="checkbox"/> ETHICS Ethics requirements <input type="checkbox"/> OTHER
Dissemination level	<input checked="" type="checkbox"/> PU Public <input type="checkbox"/> CO Confidential (only for members of the consortium (including the Commission Services))



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 101000236.



Abstract

Two very similar broad surveys were conducted with stakeholders (breeders, managers, advisers and processors) involved in preserving local breeds of chickens and pigs. The aim was to have them describe their farms, their activities and the conservation programs. The purpose was also to collect their perceptions on the possibilities of implementing selection schemes, on the impact of health crises or on the sustainability of the breeds in the future. The surveys were carried out online and were designed in seven languages: Croatian, English, French, Italian, Portuguese, Slovenian and Spanish. They contained over 300 questions each, displayed according to responses to previous questions.

More than 550 participants answered the surveys and, after data cleaning, the responses of 542 of them were included in the analyses: 203 participants for the chicken survey and 339 for the pig one. An overall descriptive analysis of the responses is presented; some results by country or breed are also mentioned. Overall, the data collected covers 12 countries, 31 local pig breeds and 94 chicken breeds, with unequal representation by breed and country.

In both surveys, preserving genetic diversity is the main motivation stated by the stakeholders surveyed. Leisure activity is the second most important motivation for the chicken breeders for whose economic activities related to these breeds seem marginal. In contrast, economic activities associated with local pig breeds is significant (42% of the income in median value) and constitute the second motivation of the pig stakeholders. However, health crises seem to have deteriorated the profitability of the pig farms.

The animals are mostly raised purebred, outdoor, in small and fairly recent farms; their selection is based mainly on phenotypic features like compliance with breed standards. Nevertheless, most participants show interest in selection, particularly for reproductive (pigs) or productive (chicken) traits, but there are many obstacles to the implementation of breeding programs. Most stakeholders express concern about the sustainability of the local breeds, especially for economic reasons and for compliance with the regulations like health regulations. Stakeholders expect more support from public authorities: more specifically, support for improving productivity and protecting the use of the names of the pig breeds or, for chicken breeds, subsidies for research programs and for human resources to manage conservation programs.

Table of content

ABSTRACT	2
TABLE OF CONTENT	3
1 INTRODUCTION	4
2 DESCRIPTION OF THE SURVEY	4
3 DESCRIPTION OF THE DATASETS	6
3.1 NUMBER OF RESPONDENTS	6
3.2 PROFILE OF RESPONDENTS	7
3.3 PROFILE OF THE M/OTH RESPONDENTS	13
3.4 PROFILE OF THE BREEDERS/FARMERS (B/F) RESPONDENTS	15
4 FARMS CHARACTERISTICS AND PRODUCTION PERFORMANCES	18
5 CURRENT PRESERVATION OR SELECTION MODE	21
5.1 REARING AND REPRODUCTION MODE	21
5.2 IDENTIFICATION AND MATING PLANS	23
5.3 CHOICE OF FUTURE BREEDING ANIMALS	26
5.4 SELECTED TRAITS	28
6 STAKEHOLDERS' INTEREST AND CONCERNS	30
6.1 MOTIVATIONS OF THE STAKEHOLDERS (B/F AND M/OTH)	30
6.2 INTEREST FOR SELECTION	32
6.3 EXPECTATION AND PERCEPTION OF THE FUTURE OF THE LOCAL BREEDS STAKEHOLDERS	35
6.4 ADDITIONAL INFORMATION ON THE STAKEHOLDERS	41
7 IMPACT OF SANITARY CRISES	42
7.1 COVID CRISIS	42
7.2 IMPACT OF THE AFRICAN SWINE FEVER PANDEMIC ON PIG STAKEHOLDERS	43
7.3 OVERALL SANITARY CRISES IMPACT ON PIG STAKEHOLDERS	44
7.4 IMPACT OF THE AVIAN INFLUENZA PANDEMIC ON CHICKEN STAKEHOLDERS	45
7.5 OVERALL SANITARY CRISES IMPACT ON CHICKEN STAKEHOLDERS	45
7.6 SANITARY FOLLOW-UP OF THE LOCAL BREED FARMS	45
8 CONCLUSION	47
9 ACKNOWLEDGEMENT	49
10 ABBREVIATIONS	50
11 ADDITIONAL FIGURES	51

1 Introduction

As part of the GERONIMO (Genome and Epigenome eNabled breedIng in MONogastrics) project funded by the European Union's Horizon 2020 research and innovation program (grant agreement N° 101000236), two broad surveys were conducted addressing stakeholders involved in the conservation of pig and chicken local breeds (breeders, advisers...). The goal of these surveys was to assess the ongoing management programs for local breeds and to collect information regarding the guidelines currently implemented.

The surveys were based primarily on questionnaires available online in seven languages including English. Six European countries were more specifically targeted (Croatia, Italy, France, Portugal, Slovenia, Spain) but responses from other countries were also welcomed. The aim was to describe the conservation programs of local breeds of pigs and chicken, the rearing and breeding conditions, the way the breeding animals are usually chosen, and practices of genetic diversity management. It also aimed to evaluate the possibilities to implement selection schemes in local breeds: the perception of the stakeholders on selection, the traits of interest and the obstacles. Finally, the purpose was to collect the feelings expressed by the stakeholders on the impact of sanitary crisis, their fears, their needs to preserve local breeds in the future. This report synthesizes data collected and presents a global descriptive analysis of the collected responses. Only few results by country or by breed are mentioned. The report shows the similarities and differences between the two species and emphasizes how local breeds are managed very differently from conventional livestock production.

2 Description of the survey

Both surveys have the same structure with very similar questions adapted to the species. They contained very few species-specific questions (e.g., issues related to viruses affecting only one species or impacting it more significantly, e.g., litter size).

Questions were organized in several clusters to gather them by topic: rearing mode, reproduction, productivity, income, selection, health considerations, future perception... The main objectives of the first groups of questions (preliminary questions) were to define the country, the role of stakeholders related to local breeds (i.e., distinguish in particular breeding/farming from other activities), the number of breeds with which respondents are involved in and to specify these breeds. These questions were mandatory.

Several categories of questions were defined:

- General: not associated to a breed
- Breed related questions (i.e., similar questions applied to one or several breeds) with three indexes:
 - o B1: questions associated to the first selected breed
 - o B2: questions associated to the second selected breed
 - o MB: questions associated to several breeds for stakeholders involved in more than two breeds.

Respondents had to define their role in the conservation of local breeds with one mandatory multichoice question per breed index defined above. The following definitions were proposed. **Breeder**: In charge of reproduction and/or selection for a local breed. **Farmer**: Who rears animals of local breeds without reproduction (professional or non-professional activity). **Manager**: Involved in a breed management or conservation activity (facilitator, technical advisor, expert, management board...). **Processor**: Processor of meat or seller of products from local breeds or person with responsibilities in a value chain for local breed products. **Other**.

Questions were displayed according to responses to previous questions and, above all, to the number of breeds, the role and the question index as described in the Table 1. Breed specific questions were displayed only when B1 or B2 breeds were defined. Stakeholders involved in more than two breeds were free to answer B1, B2 and MB questions or only part of them. In overall analyses (i.e., not related to specific breeds) presented in this report, only one response per question and per participant was considered when responses to B1, B2 and MB questions were identical, otherwise, up to three responses as described in Table 1.

Table 1: Description of how breed-specific questions were displayed and included in the analysis according to the number of breeds and to the breeds defined

NbBreed	Defined Breeds			Displayed questions ¹			
	B1	B2	General	B1	B2	MB	Data analyses ²
1	Y		Y	Y			1
2	Y	Y	Y	Y	Y		1 to 2
2	Y		Y	Y			1
n>2	Y	Y	Y	Y	Y	Y	1 to 3
n>2	Y		Y	Y		Y	1 to 2
n>2		Y	Y		Y	Y	1 to 2
n>2			Y			Y	1

Y means yes, empty cells mean no. ¹ Index of breed related questions. ² Maximum number of responses per respondent included in the analyses (knowing only questions with answers were considered).

Similar questions were formulated in a way that was appropriate to the situation: mentioning “in your farm” for breeders/farmers or “considering the breed as a whole” for other actors with advisor or management board activities for example. Stakeholders combining B/F and other actors’ activities were invited to answer both questions about their farm and questions about the whole breed.

Almost all questions were optional. Thus, the number of responses (**NR**) differs from one question to another according to the number of participants answering each question and of distinct responses per breed they gave; it includes answers like “no opinion”. Part of the questions contained sub questions (e.g., number of females, of males and of juveniles were defined within a single question) with sometimes incomplete answers.

Various formats of questions were used. In order to standardize the presentation of results across question types, a **SCORE** between 0 and 100 was calculated as follows:

- i) For single choice (SC) questions and multiple-choice questions, percentage of relevant responses assigned to each response option;
- ii) For multiple digital input questions used to assign grades of increasing interest or impact (from 0 to 3 or from -3 to +3):

$$Score = \frac{(100 * \sum_{i=1}^3 i * Number\ of\ Grades_i)}{3 * NR}$$

With i the grade given by the participants and NR the number of responses analysed for the question.

- iii) For ranking questions:

$$Score = \frac{(100 * \sum_{i=1}^3 p_i * Number\ of\ ranks_i)}{3 * NR}$$

With a p_i weight per rank i equal to 3 for ranks 1, to 2 for ranks 2 and to 1 for ranks 3

However, not all scores are comparable since, by construction, the scores of the ranking questions are lower than those of the multiple numeric questions, especially as the number of answer options offered is greater.

For numerical questions with free response input, medians and not means are discussed to reduce the impact of very heterogeneous or inconsistent responses; it is often not possible to define a threshold value common to all breeds between normal or atypical.

Data were collected between 2/10/21 and 31/12/21 with, for the chicken survey, few additional responses until 14/01/22. Most responses were collected online. Some face-to-face interviews and phone calls were also performed, many in Portugal and Croatia, less in Slovenia and France.

3 Description of the datasets

3.1 Number of respondents

Some participants did not complete the survey until the submission stage. Given the fact that the survey was very long and that some of the respondents who did not reach the submission stage answered many questions (up to 67), it was decided to include most of the incomplete questionnaires in the analyses: all respondents providing their email address were included, the others were included only if they answered more than 20 questions, considering that they were unlikely to be duplicated in the analysis. Furthermore, questionnaires with an email address already provided in another more comprehensive questionnaire were also excluded from the analysis (except for participants involved in more than two breeds when they had selected different B1 and B2 breeds in the different questionnaires). This led to first validate 554 participants (351 in the pig survey and 203 participants in the chicken one). A final data cleaning was performed to exclude from the rest of the analysis 12 participants from the pig survey (with 5 to 19 responses), although they submitted their questionnaires or gave their email addresses, due to the lack of breed or role information. These questions on the breeds and roles of the participants were mandatory to access the following questions but could be deleted later by the participants. By the end, in total 542 distinct identifiers (**id**) recorded in LimeSurvey were considered in the analyses: 339 pig questionnaires and 203 chicken questionnaires. On average, participants answered 58 (pig survey) and 65 (chicken survey) questions (Table 2 and 3). Among them, respectively, 272 and 177 completed the survey and submitted the questionnaire with 65 and 70 responses on average. The others one didn't submit the survey and answered 27 (pig survey) or 24 (chicken survey) questions on average with a large variability.

Table 2: Number of distinct identifiers (**id**) included in the analyses for the pig survey and statistics of their answers

Response type	Number of id ¹	Number of responses ²	Standard deviation	Minimum number of responses	Maximum number of responses
Total	339	57.7	22.6	8	118
Complete	272	65.3	17.0	8	118
Incomplete	76	26.8	15.3	8	67

¹ distinct identifiers recorded in LimeSurvey. ² Average number of responses collected.

Table 3: Number of distinct identifiers (**id**) included in the analyses for the chicken survey and statistics of their answers

Response type	Number of id ¹	Number of responses ²	Standard deviation	Minimum number of responses	Maximum number of responses
Total	203	64.7	29.5	11	150
Complete	177	69.7	27.8	18	150
Incomplete	26	31.0	14.7	11	57

¹ distinct identifiers recorded in LimeSurvey. ² Average number of responses collected.

3.2 Profile of respondents

In total, respondents are living in 12 European countries, with only few of them (10) from countries other than those of the partners involved in the task (Table 4). The lack of local contact fully involved in the survey and of translation of the survey in all European languages certainly explains this low participation outside the consortium despite efforts to promote the survey through social media.

In addition, the number of respondents varies greatly between the countries involved in the task with an overrepresentation of Portugal and France. Several considerations explain these differences between countries: the number of local breeds and breeders in each country, the email address book of the partners and their already existing links with local breed stakeholders but also the possibility to organise direct contacts (phone calls, face to face interviews, promotion of the survey during meetings...) had probably much more impact compared to social media or professional press poorly targeting many local breed stakeholders. For example, most of the Banija spotted and Turopolje pig breeds and about half of the Nuštrale and Black Slavonian pigs' responses were collected through direct interviews (face to face or phone). In Portugal, all the answers to the chicken survey were resulted from direct interviews and Bisaro stakeholders were sometimes assisted by technicians. The previous relationships certainly facilitated data collection and resulted in a greater number of responses on pigs, the field of activity of most of the task partners, than in chicken. However, some of the stakeholders spontaneously showed enthusiasm to be, for the first time, solicited by the research field: this was particularly the case on poultry breeds in Portugal (Amarela, Branca, Pedrês Portuguese, Preta Lusitânica). In other cases, in the absence of previous links, some stakeholders first expressed their surprise at being questioned and, initially, some reluctance to respond. It is thus important to emphasize the positive impact of this survey work beyond the counting of responses: indeed, fruitful contacts have been made with some of the stakeholders (e.g., with the French Poultry Federation or with the Portuguese chicken associations) during this survey and will be extended beyond the survey, creating potential bridges between research performed in GERO NIMO and local breed stakeholders. It is also worth mentioning that for some breeds, such as Banija spotted and Turopolje pigs, almost all existing breeders and farmers were interviewed, which gives an almost complete insight into the current situation of breeding these local breeds. However, the relatively small number of farms and the size of the breeding area of these local breeds certainly contributed to this.

Figures 1 and 2 synthesis the roles of the respondents. For both species, respondents are mainly breeders or farmers ($\geq 85\%$), most of them with reproduction or selection activities. However, stakeholders involved in breed management or conservation activities are well represented too (27 and 20% of the pig and chicken respondents, respectively). In pig species, stakeholders often have several roles (37%), which is much less frequent for the chicken species stakeholders (18%). Respondents with processing activities represent 22% of the participants of the pig survey (of which 54% in France) but only 3% of the participants of the chicken survey. For most of pork processors (NR=77), it is a self-employed activity and collective approaches organised in a chain only represent 16% of the collected responses. In both species, some respondents are both breeders and managers reflecting the involvement of the breeders in the management of the breeds.

In the remainder of the report, the following abbreviations will be used to summarize the respondents' roles: **B/F** for breeders or farmers, **M/Oth** for other roles (manager, processor or other).

Table 4: Origin of the respondents considered in the analyses of the two surveys

Country	Number of id ¹	
	For the pig stakeholders	For the chicken stakeholders
Austria	2	1
Belgium	1	
Croatia	48	3
Czech Republic	1	
Finland		2
France	113	47
Germany	1	1
Italy	31	37
Netherlands	2	
Portugal	100	92
Slovenia	31	4
Spain	10	16

¹ distinct identifiers recorded in LimeSurvey

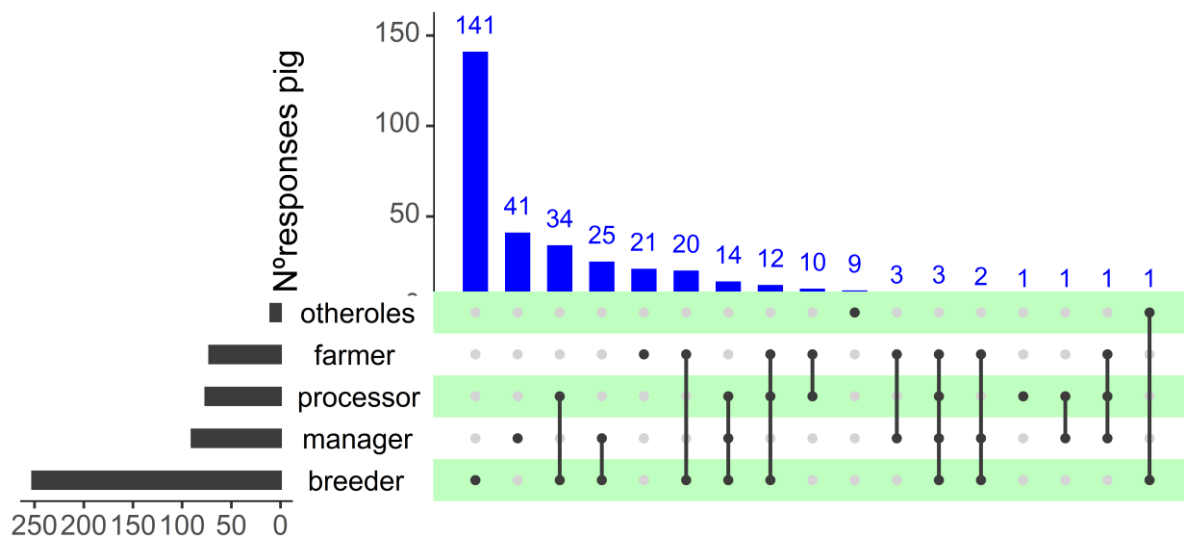


Figure 1: Roles of the respondents to the pig survey
NR=339

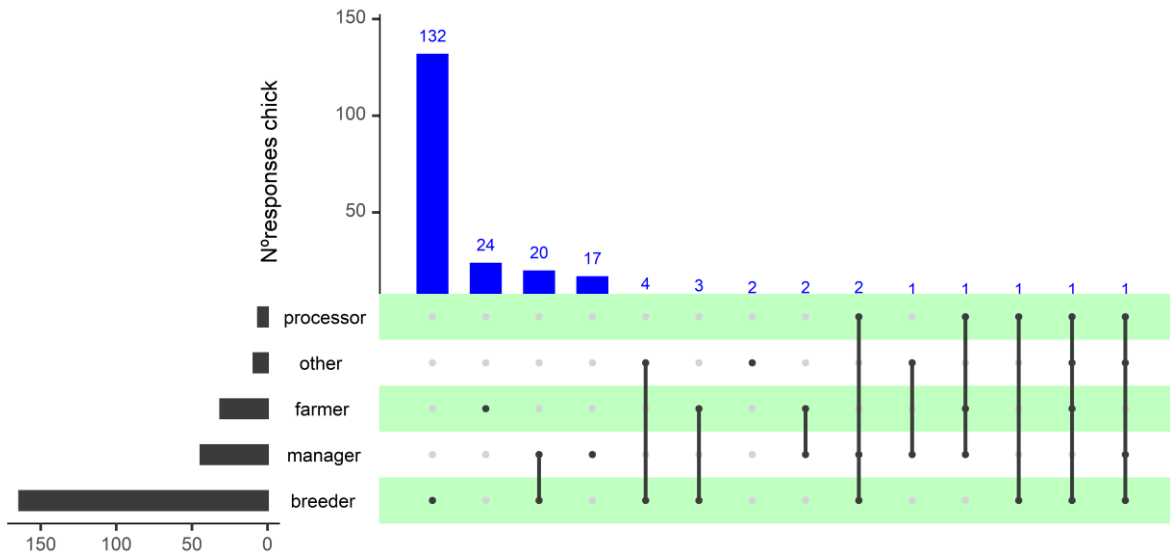


Figure 2: Roles of the respondents to the chicken survey

NR=203

9 respondents having different roles by breed are counted twice

The stakeholders who answered the survey are on average involved in 1.1 pig (median=1) and 2.8 chicken local breeds (median=2). The distribution is illustrated in Figure 3 showing few atypical respondents and slighter higher number of breeds per respondent in Portugal and Italy compared to other countries. In addition, 56% of the chicken surveys B/F (NR=171) said they have several varieties of the same chicken breed.; the percentage is even higher in Portugal (72%, NR=78).

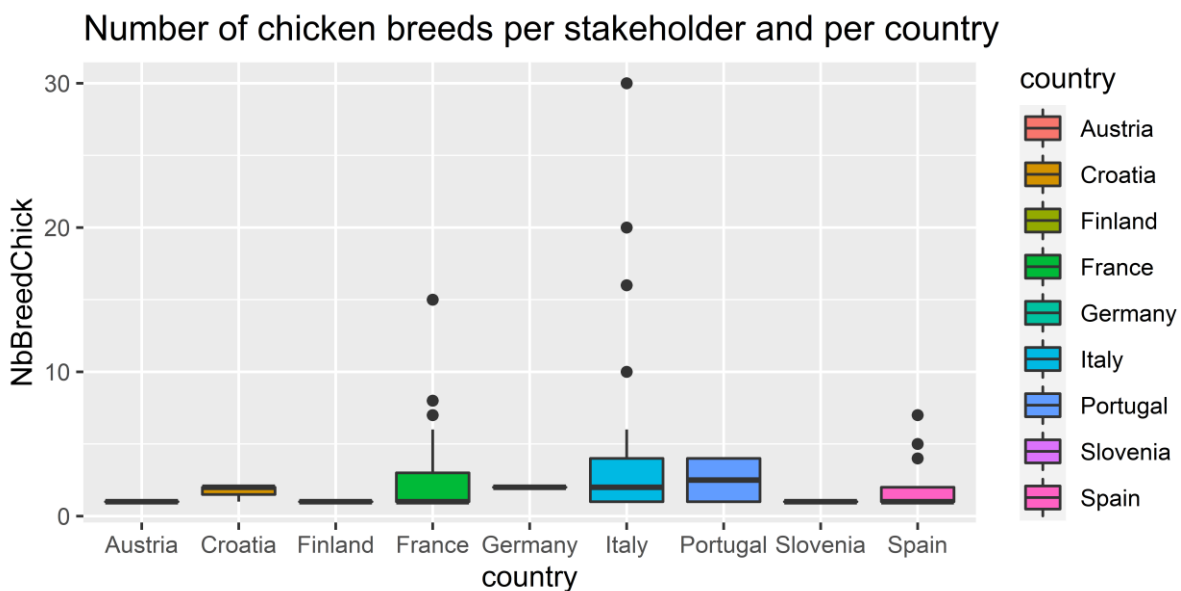


Figure 3: Number of local breeds in which chicken stakeholders are involved in, per country

NR=203

In total, stakeholders who answered the surveys are involved in 31 local pig breeds (gathering Euskal Txerria with the Basque breed) and 94 chicken breeds with very unbalanced contributions amongst them (Figures 4 and 5). The breakdown of surveys by country and breed is shown in Tables 5 and 6.

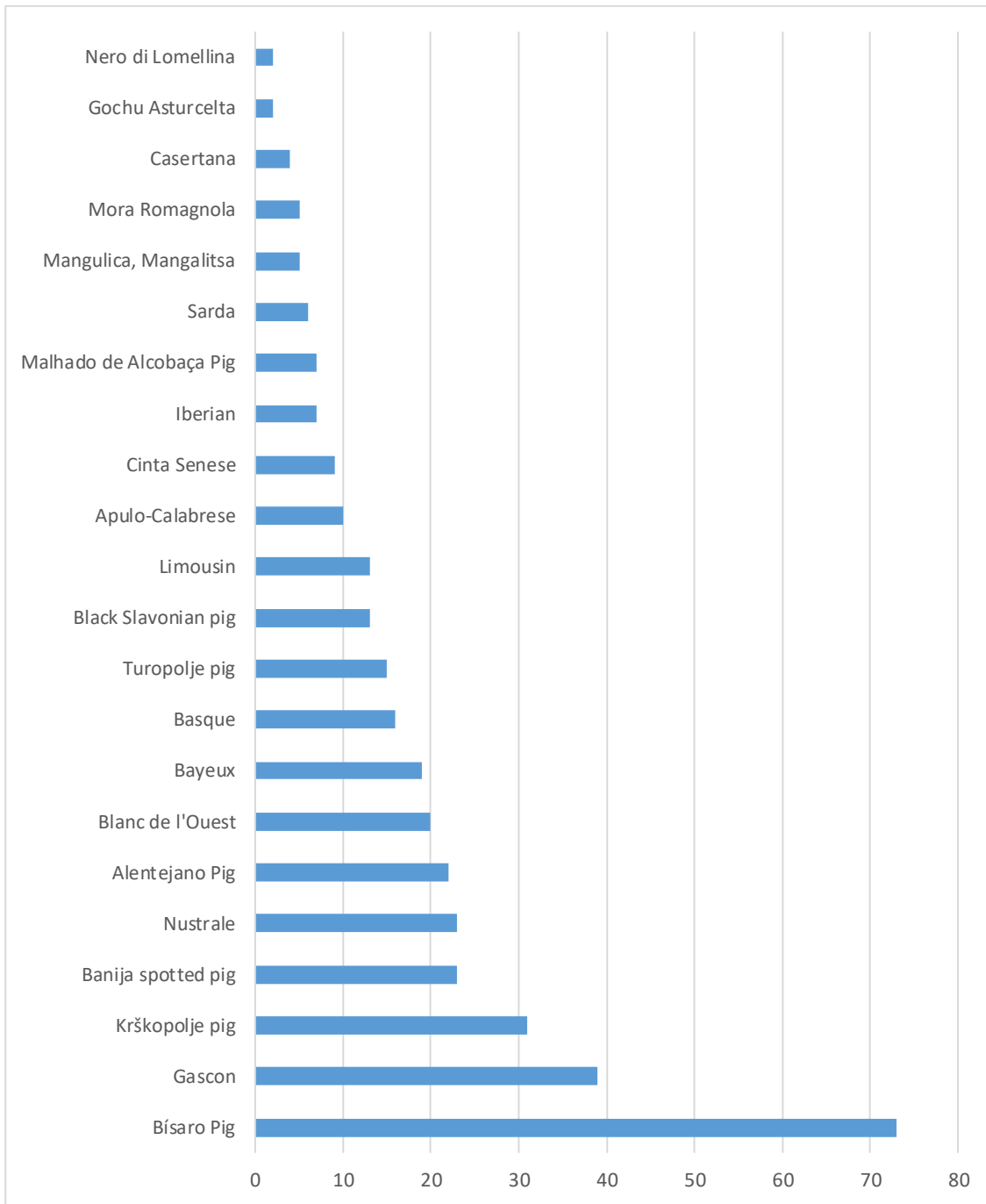


Figure 4: Number of respondents per pig local breed

Breeds with only one response are not included on the figure: Black Alpine pig, Bunte Bentheimer, Celtic pig, Meticcio, Negra Canaria, Nero di Parma, Nero Siciliano, Presticke cernostrakate, Schwäbisch Hällisches Schwein

Table 5: Number of questionnaires included in the analyses per pig breed and per country

Country (number of breeds)	Breeds (number of questionnaires per breed and country)
Austria (2)	Black Alpine pig (1), Turopolje pig (1)
Belgium (1)	Bayeux (1)
Croatia (4)	Banija spotted pig (23), Black Slavonian pig (13), Mangulica (4), Turopolje pig (14)
Czech Republic (1)	Presticke cernostrakate (1)
France (7)	Basque (16), Bayeux (18), Blanc de l'Ouest (20), Gascon (39), Limousin (13), Mangulica (1), Nustrale (23)
Germany (1)	Schwäbisch Hällisches Schwein (1)
Italy (9)	Apulo-Calabrese (10), Casertana (4), Cinta Senese (9), Meticcio (1), Mora Romagnola (5), Nero di Lomellina (2), Nero di Parma (1), Nero Siciliano (1), Sarda (6)
Netherlands (1)	Bunte Bentheimer (1)
Portugal (4)	Alentejano Pig (22), Bísaro Pig (73), Iberian (1), Malhado de Alcobaça Pig (7)
Slovenia (1)	Krškopolje pig (31)
Spain (4)	Celtic pig (1), Gochu Asturcelta (2), Iberian (6), Negra Canaria (1)

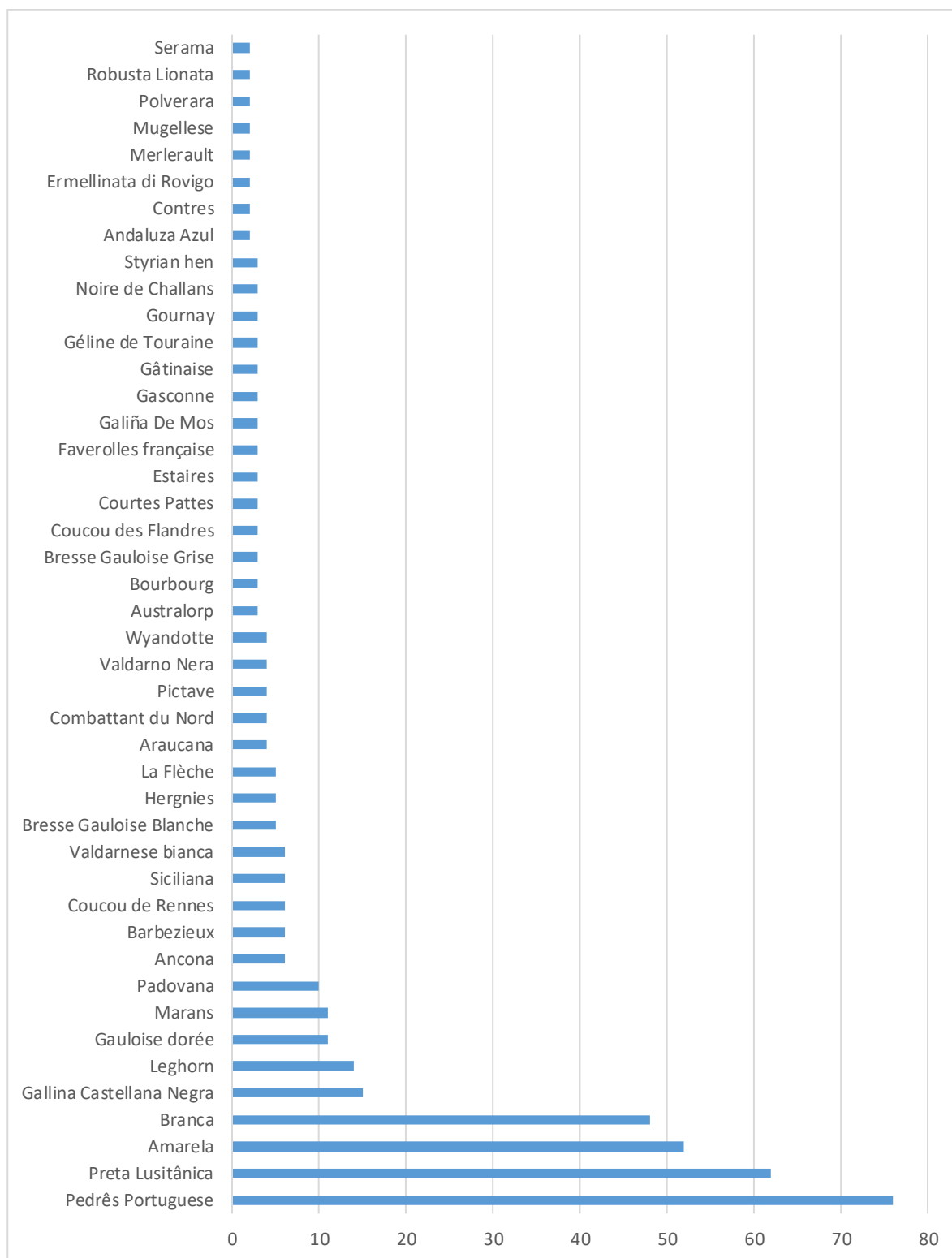


Figure 5: Number of respondents per chicken local breed

Breeds with only one response are not included on the figure: Alsacienne, Amrocks , Appenzelloise huppée, Barbuta d’Uccle, Bionda piemontese, Bourbonnaise, Bresse Gauloise Noire, Caumont, Charollaise, Cornuta di Sicilia, Cotentine, Cou nu du Forez, Coucou de France, Crèvecoeur, Denizli, Euskal Oiloa, Finnish Landrace, Flor de ametller, Gallina Del Prat, Gallina Extremeña Azul, Hämeenkanta, Houdan , Hrvatica hen, Hrvatska patuljasta kokoš-HPK, Indio De León, Italian, Janzé, Križevci crested hen, Le Mans, Malines, Mantes, Millefiori Lonigo, Moroseta, Mouette de Frise Orientale, Naine Allemande, New Hampshire, Noirans-Marans, Noire du Berry, Padovana nana, Pardo De León, Pavilly, Pepoi, Pita Pinta, Posavina crested hen, Poule soie, Robusta Maculata, Sussex, Tirolerhuhn , Valplatani, Veneto.

Table 6: Number of questionnaires included in the analyses per chicken breed and per country

Country (number of breeds)	Breeds (number of questionnaires per breed and country)
Austria (1)	Tirolerhuhn (1)
Croatia (5)	Australorp (1), Hrvatica hen (1), Hrvatska patuljasta kokoš-HPK (1), Križevci crested hen (1), Posavina crested hen (1)
Finland (2)	Finnish Landrace (1), Hämeenkanta (1)
France (47)	Alsacienne (1), Appenzelloise huppée (1), Araucana (1), Australorp (1), Barbezieux (5), Bourbonnaise (1), Bourbourg (3), Bresse Gauloise Blanche (3), Bresse Gauloise Grise (3), Bresse Gauloise Noire (1), Caumont (1), Charollaise (1), Combattant du Nord (4), Contres (2), Cotentine (1), Cou nu du Forez (1), Coucou de France (1), Coucou de Rennes (6), Coucou des Flandres (3), Courtes Pattes (3), Crèvecoeur (1), Estaires (3), Faverolles française (2), Gasconne (3), Gâtinaise (3), Gauloise dorée (11), Géline de Touraine (3), Gournay (3), Hergnies (5), Houdan (1), Italienne (1), Janzé (1), La Flèche (4), Le Mans (1), Mantes (1), Marans (4), Merlerault (2), Mouette de Frise Orientale (1), Naine Allemande (1), Noirans-Marans (1), Noire de Challans (3), Noire du Berry (1), Pavilly (1), Pictave (4), Poule soie (1), Serama (1), Wyandotte (1)
Germany (2)	Bresse Gauloise Blanche (1), La Flèche (1)
Italy (34)	Amrocks (1), Ancona (6), Andaluza Azul (1), Araucana (2), Australorp (1), Barbuta d'Uccle (1), Bionda piemontese (1), Bresse Gauloise Blanche (1), Cornuta di Sicilia (1), Denizli (1), Ermellinata di Rovigo (2), Faverolles française (1), Gallina Del Prat (1), Leghorn (14), Malines (1), Marans (7), Millefiori Lonigo (1), Moroseta (1), Mugellese (2), New Hampshire (1), Padovana (10), Padovana nana (1), Pepoi (1), Polverara (2), Robusta Lionata (2), Robusta Maculata (1), Serama (1), Siciliana (6), Sussex (1), Valdarnese bianca (6), Valdarno Nera (4), Valplatani (1), Veneto (1), Wyandotte (3)
Portugal (4)	Amarela (52), Branca (48), Pedrês Portuguese (76), Preta Lusitânica (62)
Slovenia (2)	Barbezieux (1), Styrian hen (3)
Spain (10)	Andaluza Azul (1), Araucana (1), Euskal Oiloa (1), Flor de ametller (1), Galiña De Mos (3), Gallina Castellana Negra (15), Gallina Extremeña Azul (1), Indio De León (1), Pardo De León (1), Pita Pinta (1)

3.3 Profile of the M/Oth respondents

Figures 6 and 7 precise the role of M/Oth in the pig (NR=86) and chicken (NR=48) species: facilitator / technical advisory, registration in the zootechnical register or herd book, and members of management board of a breed association, or other. Very few M/Oth carry out several of these activities. In the pig survey, the first 3 activities are represented in a balanced way between them. The advisory activities are rather well represented for both species, but herd book management activity is less frequent in chicken answers. It should be noted that 50% (chicken survey) to 2/3 (pig survey) of the “herd book” answers are formulated by respondents who are not breeders, whereas breeders are significantly involved in management and advisory activities: **more than half of the participants with breed management or conservation activities also rear animals** (55% in the pig survey, 65% in the chicken survey, not shown). Finally, the answer “other” was frequently chosen in poultry (29%, NR=48) with various associated comments: veterinarian, university researcher, in charge of a conservation centre, national referent, president of a commercial structure, the rest of the comments indicating that respondents are breeders or amateurs.

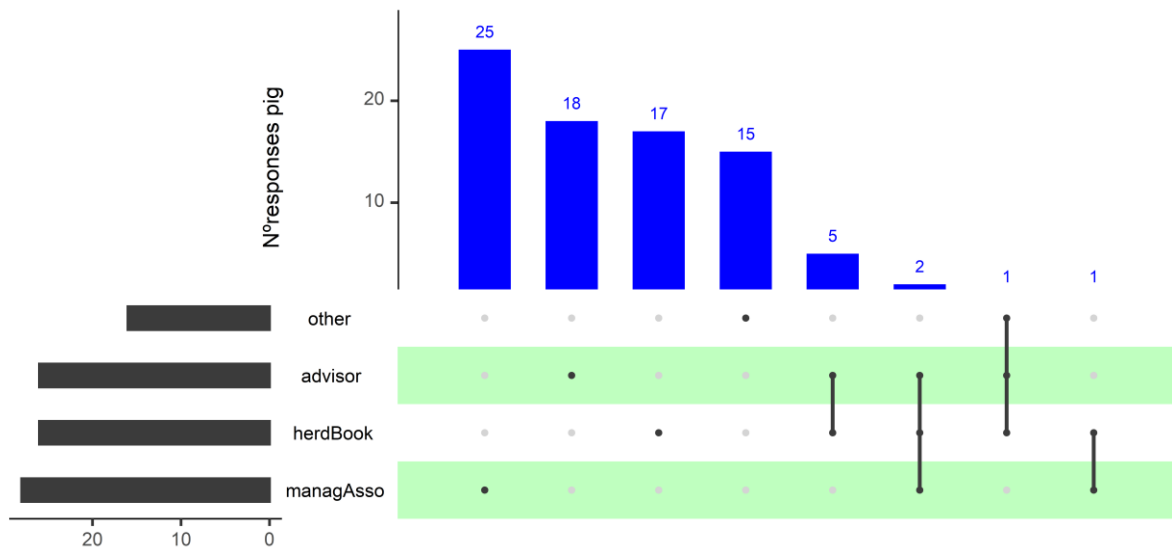


Figure 6: Precisions on the roles of pig M/Oth

From bottom to top: 1) Members of management board of a breed association (manageAsso), 2) Registration in the zootechnical register or herd book (herBook), 3) Facilitator/ technical advisory (advisor) 4) Other role (other).

NR=86 of which 2 with only “No” answers

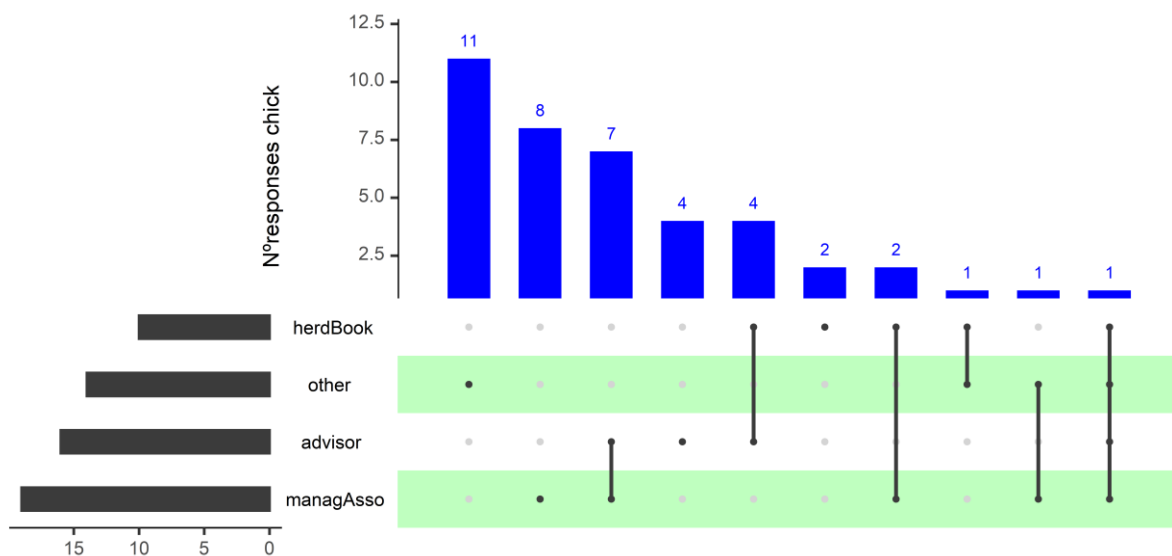


Figure 7: Precisions on the roles of chicken M/Oth

From bottom to top: 1) Members of management board of a breed association (manageAsso), 2) Facilitator/ technical advisory (advisor), 3) Other role (other) 4) registration in the zootechnical register or herd book (herBook).

NR=48 of which 7 with only “No” answers

The majority of stakeholders performs these M/Oth activities on a voluntary basis: 66% in the chicken survey (NR=35) and 51% in the pig one (NR=72). M/Oth voluntary activities seems less frequent in Portugal: 29% with NR=14 in pigs, and 1 response out of only 2 in the chicken survey. This may reflect more financial resources dedicated to management in Portugal. Most of the M/Oth participants (pig NR= 150, chicken NR=45) adhere to a breed association or equivalent structure for genetic conservation purpose (81% in pig species, 73% in chicken species) while few of them are linked to a structure with commercial purpose (15% and 13% in pig and chicken species, respectively) with some overlap between these two purposes. Respectively, 12% and 20% of the pig and chicken M/Oth stakeholders are not involved in any structure.

Most of the M/Oth involved in a structure with a genetic conservation purpose only dedicate a small part of their time to genetic technical work: median of 20% in pigs (NR=59) and 30% in chicken (NR=19). The proportion of technical work not related to genetics is more important: median of 50% for pig M/Oth and 70% for chicken ones.

Breeding pigs and chickens of local breeds is often a family activity: 45% of the chicken B/F (NR= 181) and 66% of the pig B/F (NR=274) carry out their activity with their relatives: people of their own generation, the previous one, or the next one (Figures 10 and 11). But 27% (pig) and 36% (chicken) of B/F always work alone. Professional partnerships and employees are relatively rare, especially in chicken (9% versus 22% in pig).

B/F producers who responded the survey started their activities 7 (pig median value, NR=258) and 6.5 (chicken median value, NR=128) years ago, with many of them much earlier (first quartile equal to 5 for pig B/F and to 3 for chicken B/F). Relying mostly on an online survey could have impacted these values; however, whether direct contact surveys were conducted in the country (face to face, phone) or not to circumvent possible obstacles to Internet use, does not seem to have had a strong impact on seniority. The longest median activity durations are seen in Italy for pigs (14 years, NR=16) and, for chicken, in France (14 years, NR=36) and Italy (10.5 years, NR=26). The shortest are observed in Croatia and Slovenia for the pig B/F (5.5 years with NR equal to 34 and 27 respectively) and in Portugal for the chicken B/F (3 years, NR=46). These recent installations therefore potentially reflect a good dynamic of local breeds' sector.

In addition, B/F planning to stop their activity within next 5 years are a minority (around 10% in both species with pig NR=264 and chicken NR=130). However, 27% and 35% of the pig and chicken B/F, respectively, don't know how long they expect to continue their activity (up to 54% of the Portuguese chicken B/F, NR=46). Finally, only 13 to 15% of the B/F planning to stop their activity within 10 years (chicken NR=108, pig NR=122) declare that they do not plan to pass their farm further to somebody else while 33% (chicken B/F) to 45% (pig B/F) don't know if they will pass or not. Fortunately, transmission to others (most often within family) are also frequently planned. Altogether, these answers do not raise any particular concern about the desire of the breeders to maintain their activity.

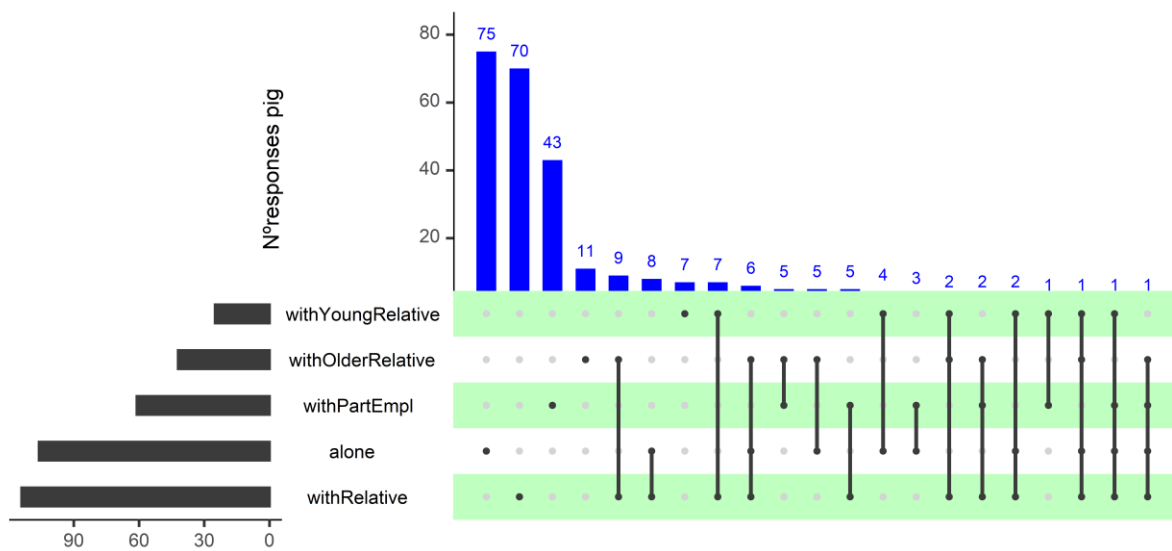


Figure 10: Activity mode (alone or not) of pig B/F producers

From bottom to top: 1) with relatives of the same generation (withRelative), 2) alone, 3) with partners or salaries (withPartEmpl), 4) with relatives of the previous generation (withOldRelative), 5) with relatives of the next generation (withYoungRelative).

NR=274

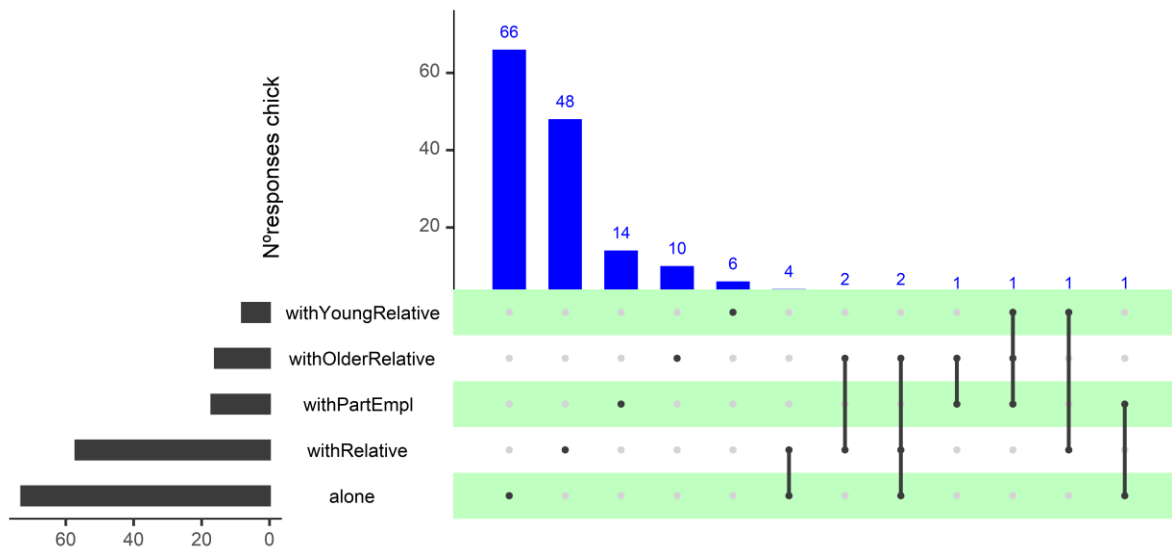


Figure 11: Activity mode (alone or not) of chicken B/F producers

From bottom to top: 1) alone, 2) with relatives of the same generation (withRelative), 3) with partners or salaries (withPartEmpl), 4) with relatives of the previous generation (withOldRelative), 5) with relatives of the next generation (withYoungRelative).

NR=181

Most of B/F adhere to a collective approach (association, trade union, or any type of breed organisation): 90% in the pig survey (NR=264) and 80% in the chicken one (NR=165).

Of the 215 answers given by the pig B/F on their economic activity (Table 7), Selling of live animal for slaughter is the most important, then Processing and sale of products, followed by Selling of fresh meat and Sale of breeding animals. While chicken B/F more frequent economic activities (Table 8) relies on Selling of eggs for human consumption, then Selling of chicks for breeding purposes and Selling of fertilized eggs. We can also underline that Processing and sale of products and Sale of carcasses received the least number of responses of chicken B/F.

Table 7: Kind of economic activity of pig B/F producers

Proposed activity	Percentages			
	Important	Few	None	NA
Sale of live animal for slaughter	51,6	23,3	8,8	16,3
Processing and sale of products	37,7	13,5	16,3	32,6
Sale of fresh meat	25,6	14,4	14	46
Sale of breeding animals	17,2	43,7	9,8	29,3
Sale of carcasses	12,6	21,4	15,3	50,7
Other	5,6	2,3	76,7	15,3

NR= 215. NA: no answer to the sub question

Table 8: Kind of economic activity of chicken B/F producers

Number of answers	Percentages			
	Important	Few	None	NA
Sale of eggs for human consumption	40.2	19.6	7.8	32.4
Sale of chicks for breeding purposes	35.3	40.2	4.9	19.6
Sale of fertilized eggs	31.4	43.1	4.9	20.6
Sale of live animal for ornamental purposes	24.5	34.3	9.8	31.4
Sale of breeding stock	22.5	36.3	33.3	7.8
Sale of chicks for rearing purposes	21.6	32.4	8.8	37.3
Sale of live animals for slaughter	17.6	28.4	5.9	48.0
Sale of mature laying hens	14.7	39.2	10.8	35.3
Sale of carcasses	10.8	24.5	5.9	58.8
Processing and sale of products	5.9	12.7	10.8	70.6

NR=102. NA: no answer to the sub question.

In addition, products from local pig breeds are more often valued under a quality sign (56%, NR=201) compared to the chicken products (overall 24%, NR=92, with quality signs only reported in Portugal, France and Spain). [PDO \(Protected Designation of Origin\) is the main quality label sign in pigs](#) (60%, NR=112) [while organic label is the main one in chicken](#) (40%, NR=25). Organic label still represents 20% of the responses in the pig species and out of the 22 pig B/F reporting organic label 12 are from France, and 3 to 4 from Portugal, Italy and Slovenia. Almost all the stakeholders consider that the quality sign constitutes a plus for the valorisation of products from the breeds: only 5% of negative answers (NR=123 gathering both species), 64% of considering that the sign constitutes a significant increase and a slight increase for the rest. This question was also displayed to processors.

4 Farms characteristics and production performances

[Pig and chicken local breeds are usually very small farms, with few exceptions](#) (e.g., one very large centre dedicated to chicken local breeds preservation and phenotyping in France or few Alentejano, Apulo-Calabrese or Bisaro large farms) explaining why means and median are so different (Tables 9 and 10a and 10b). Thus, [half of the farms have 9 or less sows for the pig farms](#) (NR=271) [and 15 or less hens for the chicken farms](#) (NR=263). Median number of male breeding animals per farm is lower: 2 boars and 3 cocks. Farms of the Krškopolje, Blanc de l'Ouest, Banijska šara, Bayeux and Malhado de Alcobaça pig breeds have the smallest median sizes: 2, 4 and, for the last three breeds, 5 sows, respectively (NR equal to 29, 16, 18, 16 and 4, respectively). At the opposite extreme are the Gascon, Basque, Alentejana and Iberian pig farms with 20, 30, 30 and 60 sows, respectively and NR of 32, 13, 17 and 2 (not shown). Amongst the chicken breeds with at least four questionnaires, farms of the Barbezieux and Coucou de Rennes stand out with median number of hens equal to 62.5 for the first one (NR=4 of which 2 farms ≥ 100 including the very large French farm previously mentioned which keeps 16 000 hens), to 60 for the second one (NR=6 of which 5 farms ≥ 100 including again the very large French farm which has 16 000 hens). The median numbers of hens per farm are very similar between countries (not shown).

These sizes of facilities have nothing in common with farms rearing cosmopolitan breeds. In addition, not all types of animals (male, female breeding stock, growing animals) can be found on all farms explaining 0 minimum values. Note that these statistics rely on a breed specific question (meaning on up to 3 responses per

farm with several breeds) as described in the description of the survey; analysis were also performed only considering the highest response per participant and led to a median chicken farm of 20 hens (without impact on pig statistics).

Table 9: Number of breeding animals and juveniles per farm or per farm and per breed

	Nb ¹	mean	median	Sd ²	minimum	maximum
boars	245	2.5	2	2.6	0	18
sows	253	22.3	9	49.8	0	650
pigs	209	100.0	44	238.9	0	2,478

¹Number of considered responses (one participant can have up to three answers per category of animals), ² standard deviation. After removal of few very doubtful data, defined breed by breed by expert opinion

In total NR= 274

Table 10a: Number of breeding animals and juveniles per farm or per farm and per breed

	Nb ¹	mean	median	Sd ²	minimum	maximum
cocks	263	37.4	3	231	0	2,450
hens	263	150.0	15	1,273	0	16,000
juveniles	196	140.7	12	976	0	12,000

¹Number of considered responses (one participant can have up to three answers per category of animals), ² standard deviation.

In total, NR=264

Table 10b: Number of breeding animals and juveniles per farm or per farm and per breed without the biggest farm dedicated to chicken local breeds preservation and phenotyping in France

	Nb ¹	mean	median	Sd ²	minimum	maximum
cocks	235	17.4	3	80.9	0	800
hens	2600	39.0	15	89.7	0	700
juveniles	195	46.5	12	122.5	0	1,150

¹ Number of considered responses, ² standard deviation (one participant can have up to three answers per category of animals)

In total NR=262

Consequently, the [production levels per farm and per year are low](#). The median number of slaughter pigs produced per farm by year is 25 (NR=195 B/F) with differences amongst breeds and countries (e.g. 6 in Croatia, NR=33 but 110 in Portugal, NR=58). In chicken farms, median annual production per farm declared (NR=118 to 155 B/F per sub question) are 123 eggs per hen, 1 500 eggs, 50 chickens born and 20 produced chickens. Median production levels vary a little from a country to another: for example, production reported in Portugal are 122 eggs per hen and 1 500 in total, 50 chicken born, 17 chicken produced (NR=up to 127); in Italy, 160 eggs per hen and 2 000 in total, 30 chicken born, 20 chicken produced (NR=up to 16) or in France, 150 eggs per hen and 1 500 in total, 72 chicken born, 64 chicken produced (NR=up to 31). Median annual productivity of the breeds declared by 31 M/Oth are 150 eggs per hen, 14 800 eggs, 401 chickens born and 150 produced chickens. Median egg weight is 58 (NR=95 B/F and M/Oth) and median hens' culling age is 31 months (NR=135 B/F and M/Oth).

Median sow productivity data show that sows first farrow at 13 months (NR=189), they have 2 litters per year (NR=124), wean 10 piglets per year (NR=79 only collected in Italy and Portugal) and are culled at 55 months

(NR=166). Rough estimation of prolificacy from class responses (NR=302) gives an approximate average litter size of 8.7 total born piglets, 8.1 piglets born alive and 7.2 weaned piglets with very low numbers in part of the answers. E.g., 21 stakeholders declare 4 or less weaned piglets per litter (9 in Croatia, 5 in Portugal), 9 of them also declaring 4 or less total born piglets per litter of which 4 in Croatia and less in other countries. Litter sizes lower than 4 total born piglets are usually considered as compromising the continuation of gestation to its end.

Furthermore, local breed animals are slow growing and slaughtered much older than crossbred animals produced with cosmopolitan breeds or lines. In pigs, median values recorded in the survey are 150 Kg slaughter liveweight (NR=284), 110 Kg carcass weight (NR=292) at 13 months old (NR=287). However, in Portugal, part of the pigs seem to be slaughtered very early (median liveweight=12 kg, i.e. piglets, median carcass often <10 kg), as visible on Figure 12 with a very low median value in Portugal and a high variability. This most probably reflects the fact that many breeders sell piglets which are fattened in Spain and respondents may have given the selling weight instead of the slaughter weight. Indeed, Portuguese pigs are usually slaughtered at about 100 Kg for meat consumption and 150-160Kg for dry ham and other derived products. Similarly, in chicken local breeds (Figure 13), median values recorded in the survey (NR=156) are 3Kg slaughter liveweight, 2.4Kg carcass weight at 28 weeks old, with some variations between countries.

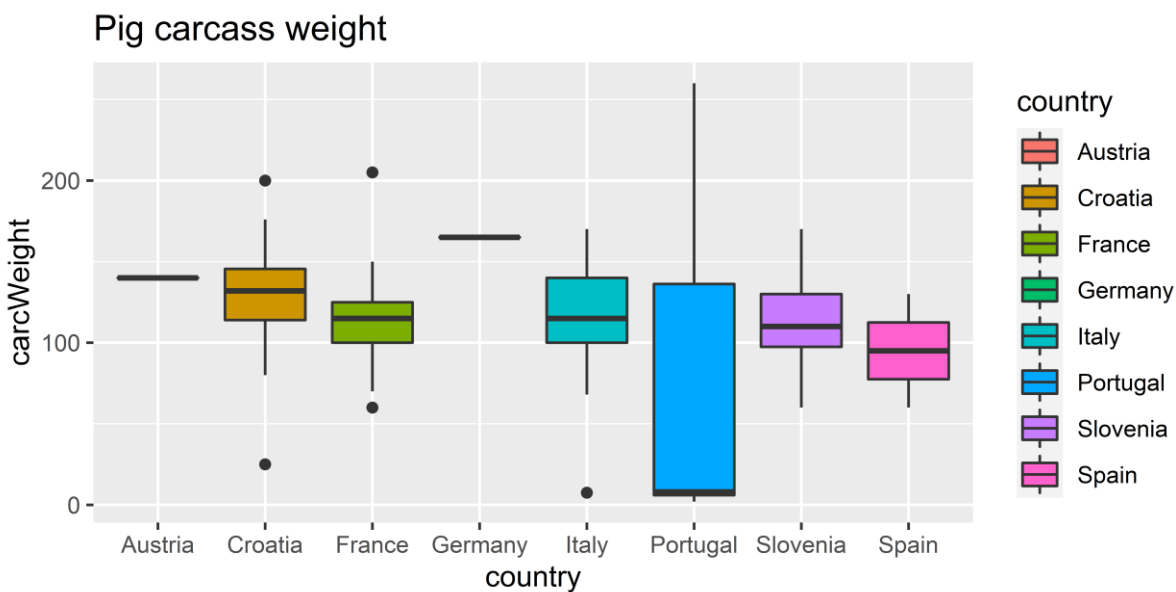


Figure 12: Carcass weight of pork (in Kg)

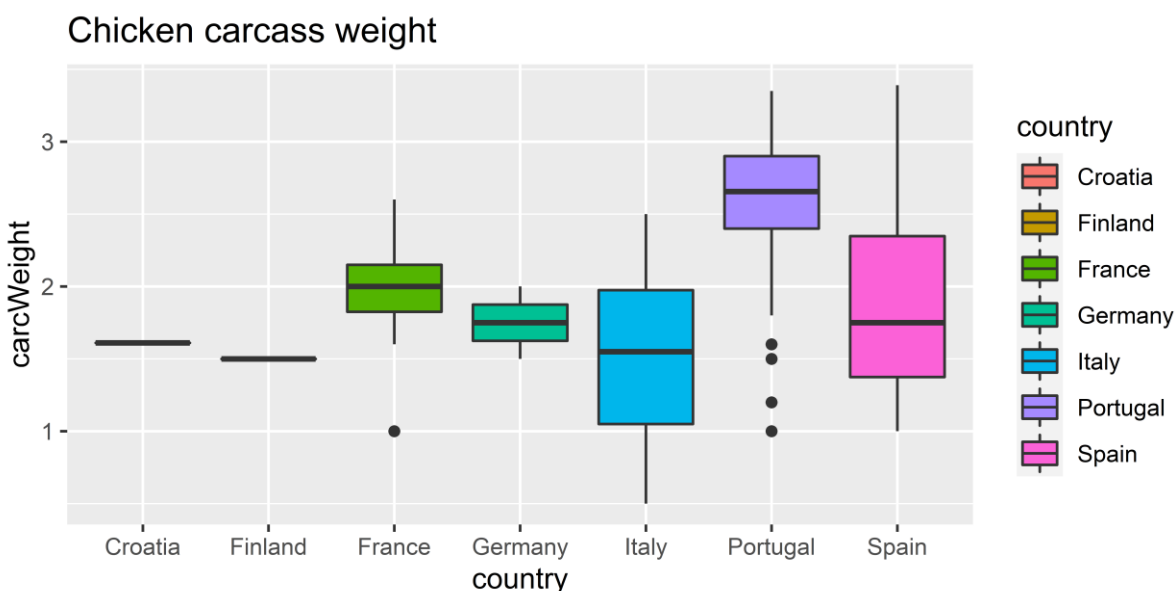


Figure 13: Carcass weight of chicken (in Kg) according to the country

In connection with heavy pig farming, pig male castration is quite common while immunocastration is marginal: the average percentage of immunocastrated males per farm is 1.1% versus 70% (even 100% considering the median percentage) surgically castrated (NR=235). The breeds Bisaro and, to a lesser extent, the Turopolje stand out with a much lower average percentage of castrated males per farm (8% and 52%, NR=43 and NR=12, respectively) without using immunocastration. The average percentage of ovariectomised females per farm is 19%, and of immunocastrated is 1.1% (NR=216 to 218). Ovariectomy is performed mainly in southwest of Europe (France mainly on Gascon and Nustrale pigs, Portugal on Alentejano but not on Bisaro pigs and Spain on Iberian); the main given reason (NR=54) is to reduce contact with wild boars and associated sanitary risks (76%), then for the quality of the meat (37%) and to a lesser extent, for ancestral practice reason (20% of the response). Ovariectomy is performed by a veterinarian (65%), by a technician (17%) or by the breeder (17%). Finally, the average percentages of tooth grinding is 7.7% and of tail docking 1.3% (NR=174 and 214, respectively).

In local chick farming, per farm, average percentages of beak bluntness, male castration and wing cut are very low: 1.9%, 1.4% and 6.5%, respectively (NR=143 to 148).

5 Current preservation or selection mode

5.1 Rearing and reproduction mode

Rearing conditions of pig and chicken local breeds vary amongst farms but are often characterised by outdoor or partly outdoor low-density (median values of 10 sows or finishing pigs, and 15 growing pigs per ha, NR=104 to 133; median values of 3 chicken and 27.5 hens per ha, NR=14 to 28) to 15rearing (Tables 11, 12, 13 and 14). Therefore, pigs valorise grazing and natural resources usually combined with raw fed and/or formulated feed (Figure 14, NR=299): 65% of the answers mention grazing and natural resources while formulated feed alone represents only 11% of the responses. Similarly, formulated feed alone represents only 8% of the responses collected in the chicken survey and 71% of the responses include raw feed, usually combined with other feeding like co-products and leftovers or formulated feed (Figure 15, NR=189).

Table 11: Percentage of responses per rearing mode from birth to finishing of slaughter pigs

Pigs	Indoor	Partly Outside	Outdoor	NA
At birth	46.4	20.1	25.5	7.9
After weaning	32.4	23.7	33.8	10.1
Beginning of growth	15.1	25.2	49.3	10.4
Finishing period	14.0	20.1	52.2	13.7

NR=278. NA no answer to the sub question.

Table 12: Percentage of responses per rearing mode of sows

	Indoor	Partly Outside	Outside	other
Sows	15.2	41.6	38.9	4.3

NR=257

Table 13: Percentage of responses per rearing mode of chicken

	Indoor	Partly Outside	Outside	other
Chickens	3.2	59.4	35.5	1.9

NR=155

Table 14: Percentage of responses per rearing mode of hens

	Cages	Indoor	Partly Outside	Outside	others
Hens	2.1	2.1	54.2	39.4	2.1

NR=142

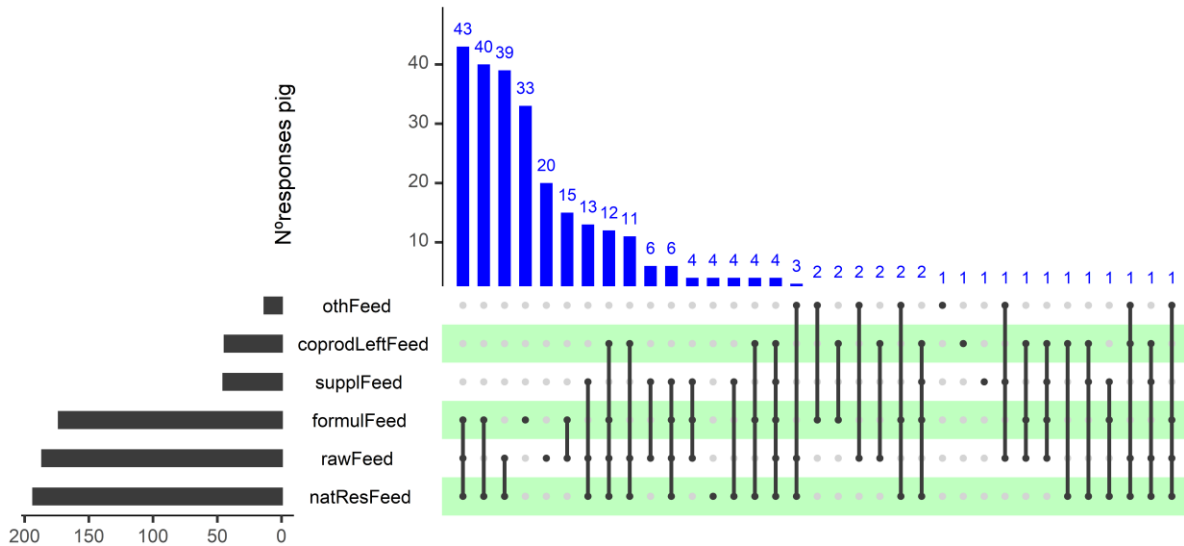


Figure 14: Feeding of the pigs

Grazing or natural resources (natResFeed), Raw feed (cereals...) (rawFeed), Formulated feed (formulFeed), Nutritional supplements (supplFeed), Co-products and leftovers (CoprodLeftFeed), other (othFeed)

NR=299

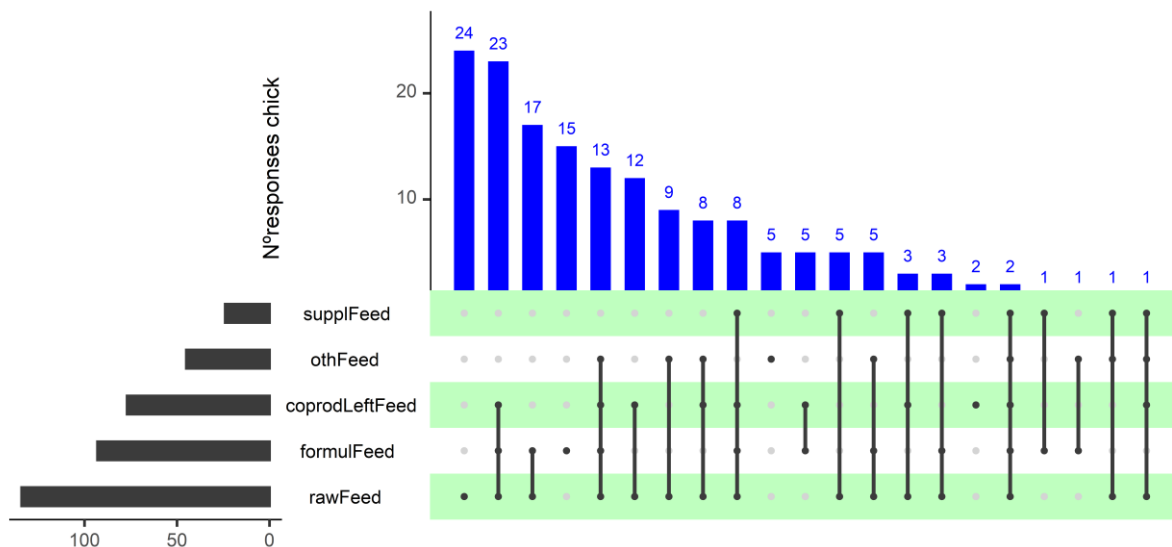


Figure 15: Feeding of the chickens

rawFeed: Raw feed (grains...), formulFeed (Formulated feed), CoprodLeftFeed (Co-products and leftovers), othFeed (other), supplFeed (Nutritional supplements),

NR=189

A large majority of pig and chicken local breeds reproduce in purebred: exclusive pure breeding represents 88% of the B/F responses of the pig survey (NR=224) and 92% of the B/F responses of the chicken one (NR=128), while exclusive crossbreeding is almost not performed (0.4% in the pig survey with only one Bisaro breeder and 0% in the chicken survey). When both pure breeding and crossbreeding is performed, the median

percentage of animals reproducing in purebred is high: 70% (NR=35) and 50% (NR=9) in the pig and chicken surveys, respectively. M/Oth participants give quite similar answers.

Furthermore, **natural mating is the most common reproduction mode in both species: exclusive natural mating represents 97% of the chicken B/F responses (NR=127) and 88% of the pig ones (NR=224)**. Nevertheless, some artificial inseminations exist in Alentejano, Basque, Bisaro, Krškopolje, Iberian, and Malhado de Alcobaça Schwäbisch Hällisches pigs and more than half of the Basque, Krškopolje and Malhado report buying semen. Depending on the farm, it can be performed on all or part of the sows, with a median percentage of 50% of the sows inseminated for the farms using artificial insemination (NR=35, of which 16 of the Bisaro breed). However, the number of boars per breed in artificial insemination centres seems very limited (median=2, NR=8 M/Oth) except for the Iberian breed (50 boars). In addition, 9% of the pig B/F report sometime using the boar of another farm (NR=221). Artificial insemination is also mentioned but scarce (3%, NR=127 B/F) in chicken in Amarela, Branca, Pedrês Portuguese, Preta Lusitânica in Portugal and, in France in Barbezieux, Gournay, Alsacienne, Bresse Gauloise or Australorp with 70 to 80 cocks in AI centre for the three first breeds (NR=3) and up to 600 for the Bresse Gauloise (NR=1). M/Oth participants report far more use of artificial insemination at the level of breeds (81%, NR=37) than B/F. In addition, chicken B/F are not aware of the availability of semen. They do not collect semen either but 20% of them report sometimes using a neighbour's cock and 9% using cock semen from another farm (NR=127). The gene exchange between breeders is therefore based on other practices than artificial insemination. Thus, **with natural mating, local breeds clearly contrast with the usual pyramidal schemes producing crossbred pigs and chicken which rely heavily on artificial insemination.**

5.2 Identification and mating plans

Most B/F and M/Oth declare that animals are individually identified: 93% of the stakeholders involved in pigs (NR=256) and 81% in chickens (NR=143). They are also registered within databases (zootechnical register, herd book) with a higher percentage of positive responses in pigs (95%, NR=256) compared to chicken (66%, NR=143). The genealogies of some or all the animals are recorded: 97% (NR=225) of the pig stakeholders both B/F and M/Oth give a positive answer and 69% of the chicken ones (NR=127). This average rate hides important differences between countries in the chicken survey: 90% in Portugal (NR=58) versus 44% to 58% in the other countries with NR \geq 12. This coincides well with the creation of herd books between 2003 and 2007 for the Portuguese chicken breeds. More details on the routinely recorded information (routinely meaning on more than 90% of the animals) are given in Table 15 for pigs showing that data related to mating and litter size are quite well recorded but mating and weaning dates and individual data (ID, sex) are less; this is more pronounced in Italy and Portugal. Recording of equivalent information is much lower in poultry farms (Table 16) with higher routine parents recording percentages in Spain (91% for the father, 73% for the mother, NR=11) compared to other countries with NR \geq 11.

Table 15: Percentage of the responses of the pig survey stating that more than 90% of the following information are routinely recorded

	No	Yes
Mating / AI Date	25.5	74.5
Mother ID	13	87
Father ID	16.5	83.5
Farrowing Date	6	94
Total Born Piglets per litter	11	89
Born Alive Piglets per litter	13	87
Weaned piglets per litter	16.5	83.5
Weaning Date	22.5	77.5
Sex of the Pigs	23	77
Piglet ID	35	65
No Recording	99	1

NR=231 B/F

Table 16: Percentage of the responses of the chicken survey stating that more than 90% of the following information are routinely recorded

	No	Yes
Father ID	52	48
Mother ID	70	30
Laying Date	52	48
Hatching Date	38	62
Sex Chick	59	41
Chick ID	54	46
No Recording	89	11

NR=151 B/F

In addition, some pedigree controls are performed in pig farms (NR=264) but are overall rare: 44% of the responses indicate no control, 25% rare control, 11% occasional or regular control, 9% frequent control and 11% don't know. In the chicken survey (NR=141), the absence of control collects 85% of the responses, rare or occasional control 9% and systematic control 2%. In both species, pedigree controls are performed randomly or in case of doubt (NR=88 pig survey, NR=3 chicken survey). These control policies can be related to the answers on mating plans which are often fully controlled in pigs (79%, NR=218 B/F answers) or partly controlled (2 males with a group of females, 14%) leaving 7% for uncontrolled mating plans (males and females mixed). In the chicken species (NR=127), fully controlled mating plans only concerns 61% of the responses (most often with a configuration one accurate male with a group of females); partly controlled mating plans (2 males with a group of females) such as uncontrolled mating are quite common (20% and 19%, respectively). *Altogether, without surprise these responses suggest that collect of basic information used in genetic evaluation might be incomplete in local breeds, especially in chickens.*

Criteria that are considered when defining the mating plans are illustrated in Figures 16 and 17 for responses given by B/F and their counterpart for M/Oth in supplementary document (Figures S1 and S2 at the end of the document). Overall, all other proposed criteria have been widely chosen by the respondents and discrimination among them is limited. In pigs, relatedness between males and females (i.e., inbreeding of the offspring) estimated with pedigrees is the most cited criterion (by 61% of the B/F, NR=232). It is often the only mentioned criterion but is also frequently associated with considerations on group of animals (i.e., families, lines) constituting the second most frequent modality. Qualities and performances of the breeding animals and phenotype of the breeding animals only come next. In contrast, chicken B/F first mentioned the phenotype of the breeding animals and qualities and performances of the breeding animals (respectively cited by 61% and 49% of the B/F, NR=151); considerations on group of animals and relatedness between males and females coming only after. The difficulty to follow the pedigree of animals with hens raised (and laying) outdoor and in groups certainly explains the fact that this criterion is little taken into account. In both species, molecular relatedness is scarcely used to define mating plans and part of these answers might be questionable.

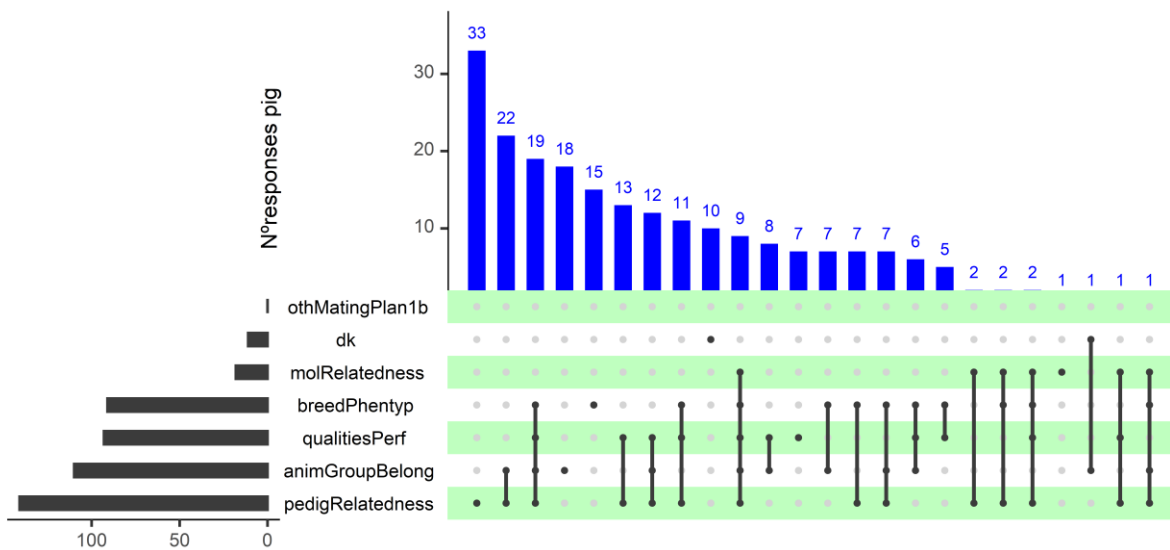


Figure 16: Criteria taken into account when defining mating plans in pigs

From bottom to top: 1) Relatedness male-female (inbreeding of the offspring) estimated with pedigrees (pedigRelatedness); 2) Belonging to a group of animals (family, lineage) (animGroupBelong); 3) Qualities & performances of the breeding animals (qualitiesPerf); 4) Phenotype of the breeding animals (breedPhentyp); 5) Molecular relatedness male female (molRelatednes); 6) don't know (dk).

NR=232 B/F

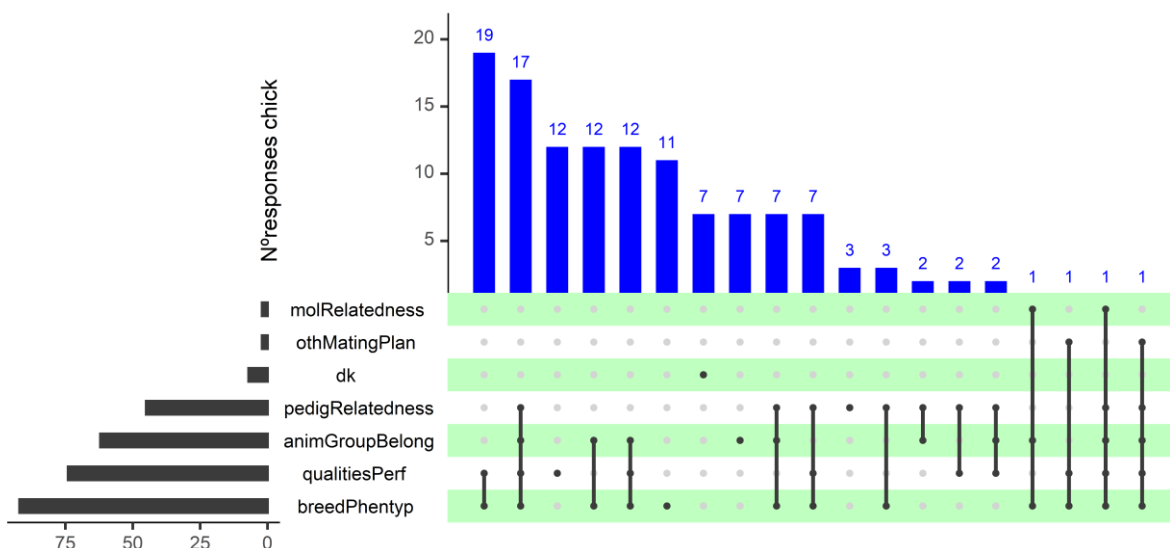


Figure 17: Criteria taken into account when defining mating plans in chicken (responses of B/F)

From bottom to top: 1) Phenotype of the breeding animals (breedPhentyp); 2) Qualities & performances of the breeding animals (qualitiesPerf); 3) Belonging to a group of animals (family, lineage) (animGroupBelong); 4) Relatedness male-

female (inbreeding of the offspring) estimated with pedigrees (pedigRelatedness); 5) don't know (dk); 6) other mating plan (othMatingPlan); 7) Molecular relatedness male female (molRelatedness).

NR=151

5.3 Choice of future breeding animals

In pigs, future breeding animals are most often chosen by B/F themselves (49% of NR=290 B/F and M/Oth) but also frequently by B/F with a person outside the farm (i.e. 37% with a M/Oth) with some discrepancies amongst countries: Portuguese B/F most often choose future breeding animals alone (78%, NR=85), Croatian respondents (NR=44) gave balance answers between choice done by the breeder alone or by the breeder with a person outside the farm (48% and 52%, respectively with NR=44) and French answers are more variable (24% breeder alone, 45% breeder with a person outside the farm and 24% a person outside the farm alone, NR=101). Similar answers are given by the chicken stakeholders: on average the choice of future chicken breeding animals is also done by the breeder alone (50%, NR=161), or by the breeder with a person outside the farm (34%) or only by a person outside the farm (12%). Discrepancies are also seen amongst countries: 23% of Portuguese answers (NR=64) are “person outside the farm alone” and 64% “breeder with a person outside the farm”. In France (NR=44), $\frac{3}{4}$ of the answers indicate that the farmer chooses the breeding animals alone. [The quite frequent involvement of people from outside the farms to choose future breeding stock is evidence of frequent external monitoring of the farms.](#)

[The criteria for choosing future breeding animals clearly emphasize the importance, for the stakeholders, of respecting the breed standard and the general appearance](#) (see Figures 18 and 19). These two criteria are more cited than others (71% and 68% of the responses, respectively NR=278) although belonging to a group of animals and pedigree are also frequently mentioned by pig stakeholders. This is also pronounced in chicken answers (72% and 56% respectively for breed standard and general appearance, NR=187) and pedigree are far less mentioned. Unexpectedly, breeding value is quite often chosen (31% in the pig survey, 26% in the chicken one), and in a large part of these answers, can't for sure be related to true genetic evaluation relying on pedigree and performance recording since no breeding values are calculated in the corresponding breeds. The term "genetic value" has probably been interpreted as the genetic merit of the breed. Response to associated questions must therefore be considered with caution: “what type of evaluation is carried out (genomic/genetic), “with which frequency, by who and which trait are evaluated”. However, with their expertise, partners involved in the task could confirm or infirm part of these responses. In practice, genetic evaluation is only performed in very few local pig breeds: Alentejano, Bísaro, Iberian pig breeds, and is being under study in Krškopolje and Nustrale. It is also performed in Bourbonnaise and Alsacienne chicken breeds. Overall, [selection of most of the local breeds only relies on external features once mating plan have been defined.](#)

Regarding criteria for not choosing an animal as a future breeding animal, stakeholders were asked to rank up to 3 criteria amongst a list (see tables 17 and 18. In the pig survey (NR=230), Number and quality (morphology and functionality) of teats gets the highest number of responses and the highest SCORE (SCORE=30) with high scores for Basque (74, NR=9), Gascon (60, NR=24), Bayeux (53, NR=12) and Bísara (43, NR=50) breeds. It is followed by Anomaly and defect and General condition and health (SCORE=28 for both options of response with health being chosen a bit more often), and Colour or pattern of the coat or the hair (SCORE=25). In the chicken survey (NR=157), Anomaly and defect gets the highest SCORE (SCORE=44) followed by Colour or pattern of the coat or the feathers (SCORE=39) then General shape or body form (SCORE=30) and Shape of the head including crest (SCORE=25). The overriding elimination criteria vary from country to country: mostly anomalies and defects in Portugal and Spain (SCORE=51, NR=65 and 13, respectively), the general shape in France (SCORE=43, NR=42) and both criteria in Italy (SCORE=44 and 42, respectively, NR=32).

[Overall, the choice or elimination of breeding animal have few in common criteria with conventional selection schemes. The main focus is on the visual phenotype](#) and for example, elimination of animals because of fat has one of the lowest SCORE in both species (SCORE \leq 4).

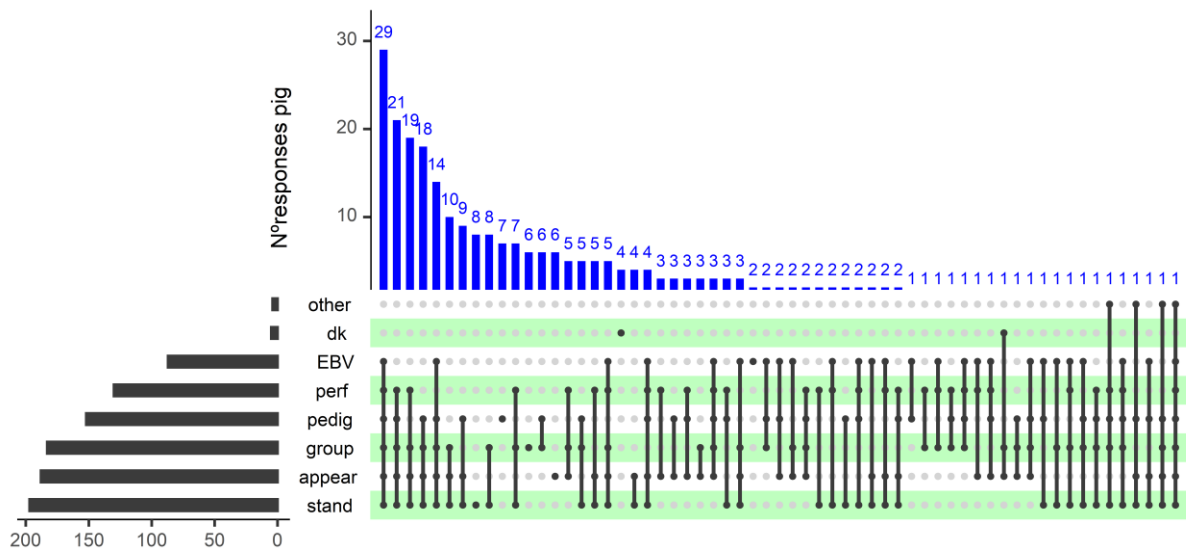


Figure 18: Criteria taken into account when choosing the pig breeding animals

From bottom to top: Breed standard (stand), General appearance (appear); Belonging to a group of animals (group); Pedigree (pedig), Performances (perf); Breeding value (EBV), dont know (dk), other choice (other)

NR=278 B/F and M/Oth

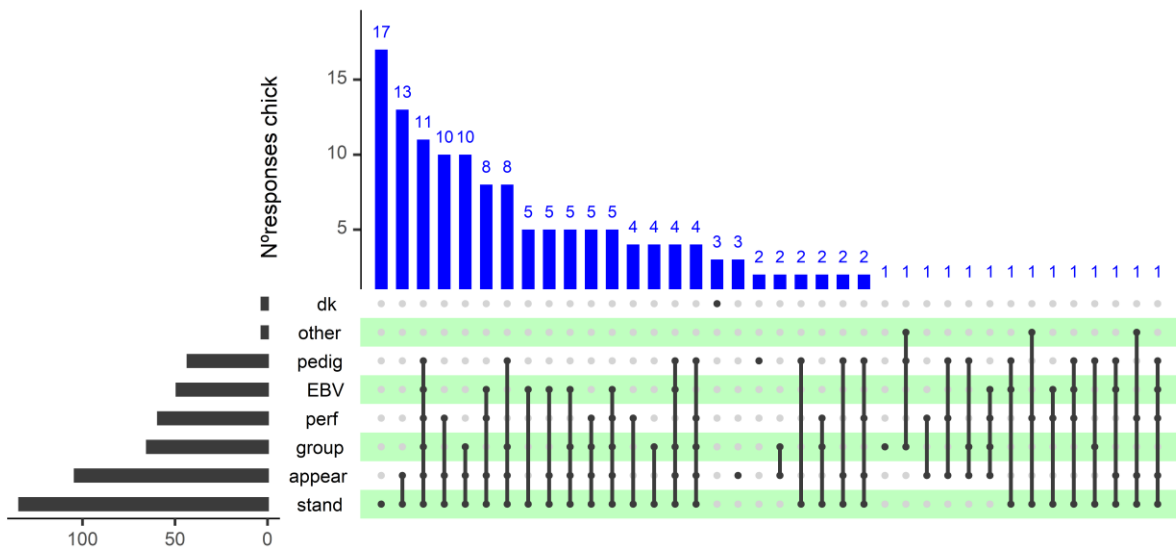


Figure 19: Criteria taken into account when choosing the chicken breeding animals

From bottom to top: Breed standard (stand), General appearance (appear); Belonging to a group of animals (group); Performances (perf); EBV (Breeding value), pedig (Pedigree), Dont know (dk), Other (other choice)

NR= 187 B/F and M/Oth

Table 17: Scores obtained from ranking of the most common elimination criteria on local pig breeds when choosing future breeding animals.

Proposed answers	SCORE	Total ranked
Number and quality (morphology/functionality) of teats	30	98
Anomaly (defect)	28	86
General condition (health)	28	90
Colour or pattern of the coat or the hair	25	82
General shape or body form	19	77
Shape of the head or ears	17	60
Size in relation to the age	16	55
Quality of the legs	11	38
Type or pattern of hair (spike)	8	30
Don't know	4	9
Visual fat cover	4	14
Other	1	4

NR=230 B/F and M/Oth

Total ranked: Number of times each proposed answered has been chosen.

Table 18: Scores obtained from ranking of the most common elimination criteria on chicken breeds when choosing future breeding animals.

Proposed answers	SCORE	Total ranked
Anomaly (defect)	44	87
Color or pattern of the coat or the feathers	39	95
General shape or body form	30	72
Shape of the head (including crest)	25	59
General condition (health)	21	48
Size in relation to age	17	39
Quality of the legs	10	24
Other	6	14
Visual fat cover	2	7

NR=157 B/F and M/Oth

Total ranked: Number of times each proposed answered has been chosen.

5.4 Selected traits

Figures 20 and 21 illustrate traits that are supposed to be evaluated, keeping in mind that part of them are not truly evaluated due to the previously mentioned misunderstanding of the meaning of breeding value by some of the participants. This impacted the displaying (or not) of related questions. Question “Which traits are evaluated/selected?” was displayed only when estimated breeding value had been previously ticked by respondents as criteria taken into account choosing future breeding animals. When not appropriately chosen by few respondents, this question was displayed instead of “Would you like to select your local pig breed? And if yes, which traits would you like to select?”. Part of answers to the first question might somehow be

interpreted, with caution, as answers to the last one. In the pig survey (NR=84), with 70% of positive responses, Reproduction clearly outstands other proposed criteria while Defects (discarding congenital disorder, colour of feathers...) and Production traits (production or weight of eggs, fat thickness, muscle content) come out on top (79% and 68% of positive responses, respectively) in the chicken survey (NR=57).

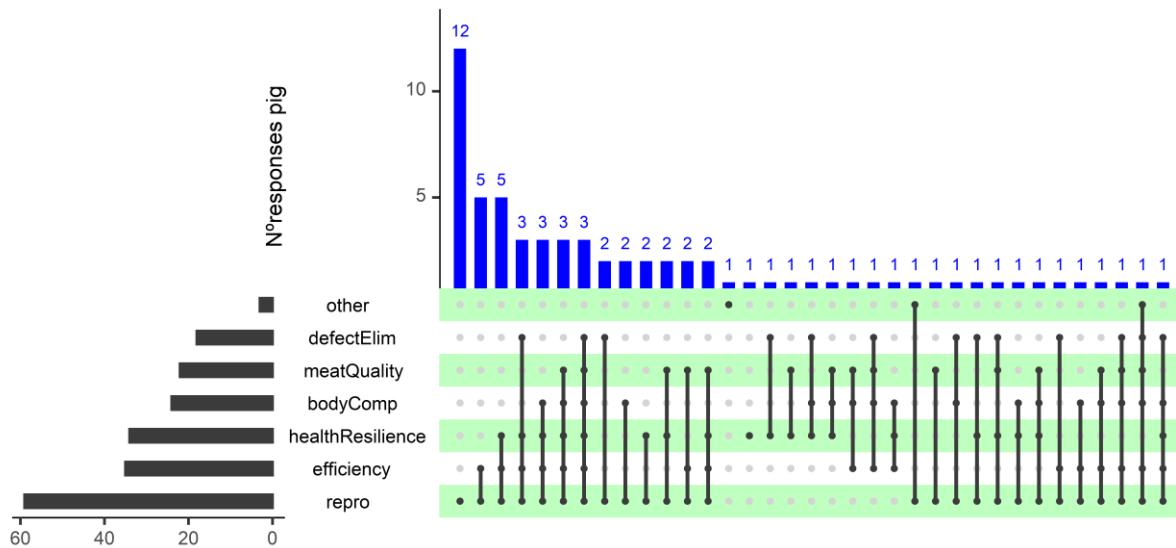


Figure 20: Traits defined as being evaluated/selected by pig B/F and M/Oth stakeholders (knowing that part of these traits are not truly selected relying on estimated breeding values)

From bottom to top: Reproduction: fertility, litter size, teats (repro); Efficiency: growth, feed conversion (efficiency); Health, resilience (healthResilience); Body composition: fat thickness, Muscle content (bodyComp); Meat quality: pH, intramuscular fat, color... (meatQuality); Defect elimination: halothane/RYR1, spot... (defectElim), Other

NR=84 B/F and M/Oth

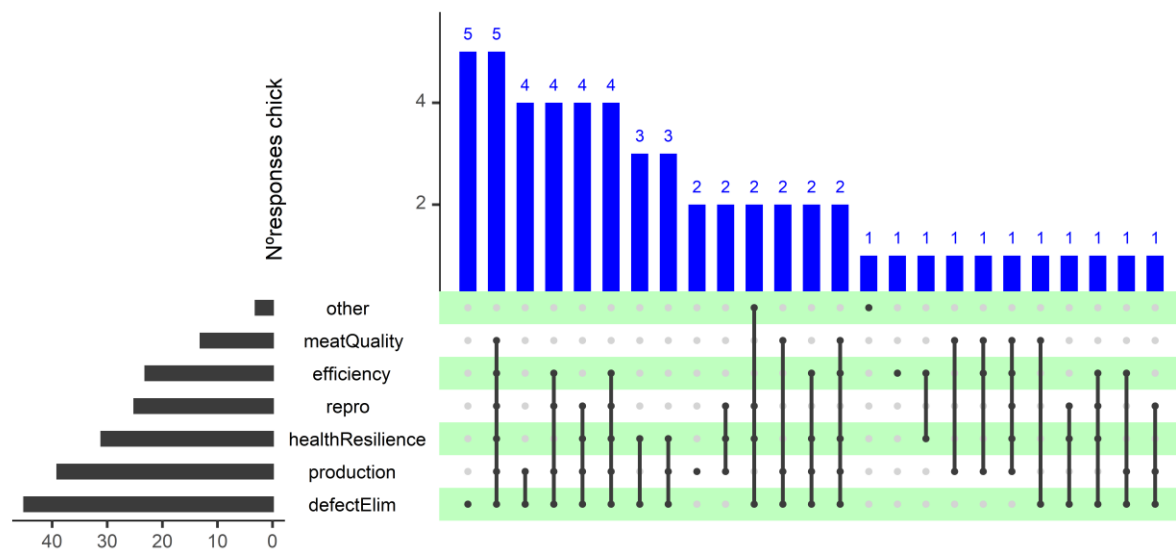


Figure 21: Traits defined as being selected by 52 chicken B/F and M/Oth stakeholders (knowing that part of these traits are not truly selected relying on estimated breeding values)

From bottom to top: Defect discarding: congenital disorder, color of feathers... (defectElim); Production traits: production or weight of eggs, fat thickness, Muscle content (production); Health, resilience (healthResilience); Reproduction: (male or female fertility) (repro); Efficiency: growth, feed conversion (efficiency) ; Meat quality: pH, intramuscular fat, color... (meatQuality); Other

NR=57 B/F and M/Oth

6 Stakeholders' interest and concerns

6.1 Motivations of the stakeholders (B/F and M/Oth)

Pig and chicken stakeholders' motivations with regard to their local breeds (NR=303 and NR=192, respectively) are shown in Tables 19 and 20 summarising marks (from 0 when no interest to 3 for major interest) given to five criteria: 1) Household consumption, 2) Desire to work with a non-cosmopolitan breed to stand out, 3) Economic activity, 4) Genetic conservation and 5) Leisure aesthetics or originality. Stakeholders selected many of these criteria and often gave high marks. However, **in both species, Genetic conservation outstands other motivation criteria both SCORE (76 in pigs, 78 in chicken). In pigs, other proposed criteria are then ranked in the following descending order: Economic activity (SCORE=68) then Desire to work with a non-cosmopolitan breed to stand out (SCORE=58). Apart from the genetic motivation, differences between the next three criteria are less pronounced in chicken. Chicken stakeholders rank other criteria as followed: Leisure aesthetics or originality (SCORE=64), Household consumption (SCORE=58), Desire to work with a non-cosmopolitan breed to stand out (SCORE=47) and Economic activity (SCORE=34) comes only after.**

Table 19: Motivation of the pig stakeholders with regard to their local breed(s)

Proposed answers	Score	Total Marked
Genetic conservation	76	286
Economic activity	68	270
Desire to work with a non-cosmopolitan breed to stand out	58	226
Household consumption (consumption)	44	215
Leisure aesthetics or originality	34	173

Total Marked: Number of times each proposed answered has been marked
NR=303

Table 20: Motivation of the chicken stakeholders with regard to their local breed(s)

Proposed answers	Score	Total Marked
Genetic conservation	78	189
Leisure aesthetics or originality	64	170
Household consumption (consumption)	58	156
Desire to work with a non-cosmopolitan breed to stand out	47	140
Economic activity	34	152

Total Marked: Number of times each proposed answered has been marked
NR=192

The differences in motivation according to the species result in very different proportions of income related to local breeds over the last 3 years with a median percentage of 42% of the income for the pig stakeholders (NR=211) and 0% of the income for the chicken ones (NR=133). Indeed, 53% of the chicken stakeholders answered zero (versus 13% of the pig stakeholders) and only 10% report that 50 to 100% of their income is related to local breeds. The near absence of income from local chicken breeds is found in all countries surveyed while large differences amongst countries are seen in the pig survey with much lower income percentage linked to local pig breeds in Croatia (10%, NR=35), Italy (12%, NR=20) or Slovenia (15%, NR=15) than in Portugal (45%, NR=50), Spain (55%, NR=7) or France (60%, NR=82). Furthermore, activities related to the conservation of local breed(s) can even represent a cost for 81% (NR=16, pig survey) to 93% (NR=28, chicken survey) of the stakeholders who answered that 0% of their income was linked to local breeds. The median approximate annual budget spent by the surveyed stakeholders on local breed(s) without compensation by sale

or consumption is estimated to 1 000 € in the chicken survey (NR=19) and 2 150 € in the pig survey (NR=6 only).

Tables 21 and 22 indicate the main cost categories given by pig (NR=217) and chicken (NR=136) B/F. Not surprisingly, **feeding costs score the highest** (SCORE=86 in both species). **The second cost item is related to installations for the sanitary protection of the herd like fences or locks** (SCORES =51 in the pig survey and SCORE=47 in the chicken survey). In the chicken survey, housing/building has also a high SCORE=46. Other proposed items have SCORES ≤ 37 .

Table 21: Most significant cost categories over the last 3 years marked by the pig stakeholders
1 minor cost, 2 a significant cost, 3 the most important cost

Proposed answers	Score	Total Marked
Feeding	86	212
Installations for the sanitary protection of the herd (fences, locks...).	51	172
Land / outdoor maintenance	37	154
Labour force	36	150
Slaughtering and transport from farm to slaughterhouse	35	140
Housing / building	34	148
Prophylaxis / sanitary treatments	34	157
Compliance with animal welfare regulations.	30	133
Compliance with environmental standards	26	117
Taxes, duties	22	104
Travel (meetings, farm visits, etc.)	16	89
Other	4	27

NR=217

Table 22: Most significant cost categories over the last 3 years marked by the chicken stakeholders
1 minor cost, 2 a significant cost, 3 the most important cost

Proposed answers	Score	Total Marked
Feeding	86	136
Installations for the sanitary protection of the herd (fences, locks...).	47	111
Housing / building	46	111
Prophylaxis / sanitary treatments	37	116
Land / outdoor maintenance	30	102
Compliance with animal welfare regulations.	29	98
Labour force	25	98
Compliance with environmental standards	23	93
Taxes, duties	18	85
Travel (meetings, farm visits, etc.)	15	89
Slaughtering and transport from farm to slaughterhouse	12	81
Other	6	59

NR=136

6.2 Interest for selection

Stakeholders seems to be clearly in favour of selection: 80% of the 183 pig B/F and M/Oth and 84% of the 98 chicken ones. Very few of them being against (5% in pig species and 2% in chicken one), the remaining ones having no opinion. However, caution should be used in interpreting this result, as not all stakeholders necessarily have the same definition of the term selection. Furthermore, for both species, the percentage of favourable responses seems slightly lower in France (68% in the chicken survey, NR=25, 77% in the pig survey, NR=70) than in other countries (83%-100%).

As shown on figures 22 and 23, all proposed traits are quite commonly selected by stakeholders as potential selection traits (NR=183 and NR=98 for the pig and chicken survey, respectively). The modality gathering all of them arrives even first in the two species. Nevertheless, quite consistently with the traits supposed to be selected described in the previous part, reproduction collects the most votes of the pig stakeholders and production traits in the chicken survey.

Stakeholders in favour of selection were then asked to rank the three main obstacles to implementing a breeding scheme for their local breed (Tables 23 and 24). In both species (NR=121 in the pig survey and NR=92 in the chicken one), those in favour of selection primarily identified the lack of resources as the main limit, both in terms of number of times the item was selected and its SCORE (56 in the pig survey and 57 In the chicken one). Too variable rearing conditions and lack of motivations arrive later in the pig survey (SCORES of 31). In the chicken survey, the lack of affordable measurement methods for the traits of interest (SCORE=39) then the too variable rearing conditions (SCORE=30) have the second and third highest SCORES.

Along the same lines, stakeholders against selection were asked to rank the main obstacles that prevent them from setting a proper selection (Table 25): this time again, in the pig survey, the lack of human or financial resources stands out (SCORE=38, NR=31), followed focusing only on the preservation of genetic diversity and inbreeding (SCORE=31) and commitment to the traditional way of farming (SCORE=26). There was only one response in the chicken survey (not shown)

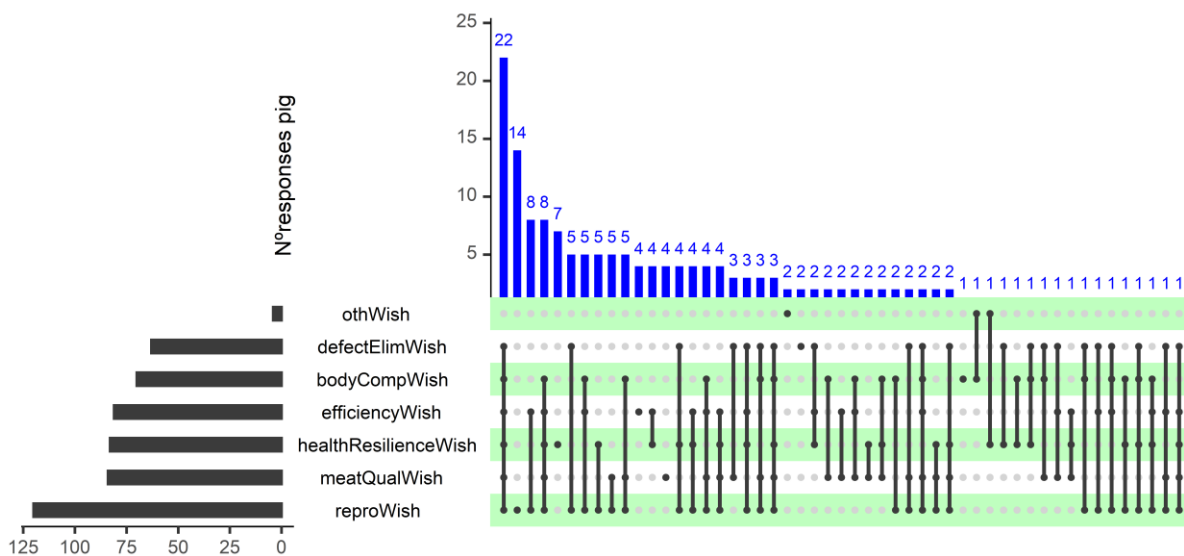


Figure 22: Traits that the pig stakeholders would like to select
 From bottom to top: 1) Reproduction (reproWish), 2) Meat quality (meatQualWish), 3) Health and resilience (healthResilienceWish), 4) Efficiency: growth, feed conversion (efficiencyWish), 5) Body composition: fat thickness, muscle content (bodyCompWish), 6) Defect elimination: halothane/RYR1, spot... (defectElimWish), Other (othWish)
 NR=183 B/F and M/Oth

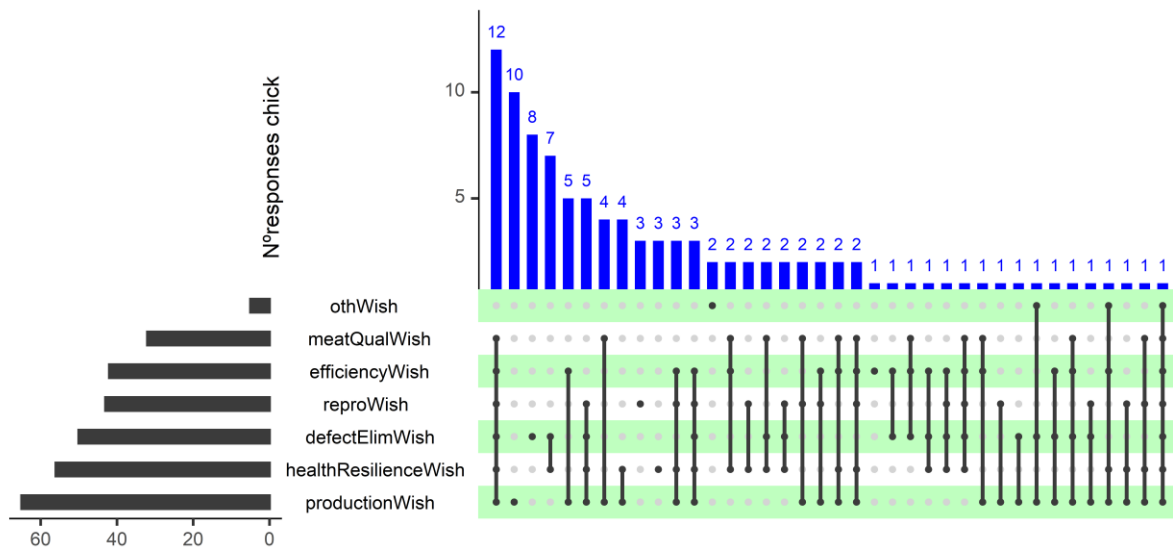


Figure 23: Traits that the chicken stakeholders would like to select

From bottom to top: 1) Production (productionWish), 2) Health and resilience (healthResilienceWish), 3) Defect elimination: discarding congenital disorder, color of feathers... (defectElimWish), 4) Reproduction (reproWish), 5) Efficiency: growth, feed conversion (efficiencyWish), 6) Meat quality: pH, intramuscular fat, color... (meatQualWish), 7) other (otherWish)

NR=98 B/F and M/Oth

Table 23: Ranking of the main obstacles to implementing a breeding scheme on local pig breeds by B/F and M/Oth *in favour* of selection

Proposed answers	Score	Total ranked
Lack of human or financial resources	56	88
Lack of motivation of farmers	31	51
Rearing conditions too variable (between farms, season...)	31	53
Lack of consensus or organisation at breed level	22	38
Lack of affordable measurement methods for the traits of interest	18	38
Difficulty to get pedigree/genealogy	17	28
Other	5	9

NR=121

Total ranked: Number of times each proposed answered has been chosen.

Table 24: Ranking of the main obstacles to implementing a breeding scheme on local chicken breeds by B/F and M/Oth *in favour* of selection

Proposed answers	Score	Total ranked
Lack of human or financial resources	57	62
Lack of affordable measurement methods for the traits of interest	39	54
Rearing conditions too variable (between farms, season...)	30	46
Difficulty to get pedigree/genealogy	29	38
Lack of motivation of farmers	20	32
Lack of consensus or organisation at breed level	12	16
Other	4	7

NR=92

Total ranked: Number of times each proposed answered has been chosen.

Table 25: Ranking of the main obstacles to implementing a breeding scheme on local pig breeds by B/F and M/Oth *against* selection

Proposed answers	Score	Total ranked
Lack of human or financial resources	38	17
Only the preservation of genetic diversity (limiting inbreeding) matters	31	12
You are committed to the traditional way of farming	26	11
Lack of motivation of farmers	23	8
Rearing conditions too variable (between farms, season...)	17	9
Fear that consumers are not in favour of selection	9	4
Difficulty to get pedigree/genealogy	9	3
Desire to stand out from cosmopolitan breeds that are selected	6	4
Lack of consensus or organisation at breed level	6	2
Other	6	2
Lack of affordable measurement methods for the traits of interest	3	3

NR=31

Total ranked: Number of times each proposed answered has been chosen.

6.3 Expectation and perception of the future of the local breeds stakeholders

More than half of the stakeholders have concerns about the sustainability of their breed in the longer or shorter term: 65% in the pig survey (NR=255) and 71% in the chicken one (NR=150). In the pig survey, this concern is particularly important in Croatia (84%, NR=44) but less strongly expressed in Slovenia (26%, NR=19) and France (52%, NR=90). Conversely, in the chicken survey, fears are much higher in France, Spain and Portugal (76-83%) than in Italy or Croatia (49-50% with NR=23 or only 2, respectively).

More details were then requested from those who have concerns: first to identify the main families of risks (Table 26 and 27), and then to try to describe each of them in more details. Further questions were only displayed to people having identified a risk in the previous question, number of potential respondents thus varies a lot from one question to the other and not all those who had the question answered. The number of respondents per question is specified in the text and the legend of the tables.

In both species, the two main risk families are **economical risks** (both with SCORE=53, ranked first in the pig survey with NR=150 and second in the chicken one with NR=79) and **risks linked to regulation** (ranked first in the chicken survey with a SCORE=54 and two in the pig one with a SCORE=45). In the two species, sanitary risks are ranked 3 (SCORE=37 in the pig survey and SCORE=40 in the chicken one); it was often marked (68 times) by the chicken stakeholders but collected few high marks. The economic risks stand out, particularly in relation to the Bísara pig breed (SCORE=82, NR=29), those linked to regulations are particularly perceived for the Blanc de l'Ouest pig breed (SCORE=88, NR=8 only). The economic risk SCORES on chicken breeds differ greatly between the countries with the highest number of responses: SCORE only equal to 24 in France (NR=24) versus 67 in Portugal (NR=35).

Table 26: Marks attributed to different risk categories by pig stakeholders having concerns about the sustainability of their breed in the future

Proposed risks:	Score	Total Marked
Linked to economical reason	53	115
Linked to legal regulation	45	102
Linked to sanitary causes	37	90
Linked to the breed	34	93
Linked to rearing conditions	32	88
Linked to human	30	84
Linked to consumers	27	84
Other	18	55

Total Marked: Number of times each proposed answered has been marked
NR=150

Table 27: Marks attributed to different risk categories attributed by chicken stakeholders having concerns about the susceptibility of their breed in the future

Proposed risks:	Score	Total Marked
Linked to legal regulation	54	69
Linked to economical reason	53	59
Linked to sanitary causes	40	68
Linked to the breed	33	63
Linked to consumers	31	53
Linked to rearing conditions	29	54
Linked to human	28	52
Other	28	47

Total Marked: Number of times each proposed answered has been marked
NR=79

Stakeholders having ranked the **economic risk** in the previous questions were invited to provide further detail on these economic risks (Tables 28 and 29): 97 pig stakeholders answered out of 115 invited to do so compared to only 20 out of 49 chicken stakeholders. *Amongst the economic risk family, risks associated with profitability are the most cited in both species. It has the highest SCORE in the chicken survey (SCORE=55) but not in the pig one. Indeed, competition with breeders who use the name of the breeds without assuming the constraints of a specific specification is the first economic risk perceived by the pig stakeholders (SCORE=43 compared to 40 for the profitability) which is the risk with the lowest SCORE in the chicken survey (SCORE=10). The unfair use of pig breed names is particularly marked in France (SCORE=43, NR=56), in Italy (SCORE=71, NR=8), and for the Alentejano breed (SCORE=58, NR=8). Concerns about the fragility of the chain scored slightly lower in both species (38 in the pig survey and 37 in the chicken one).*

Table 28: Ranking of the risks associated to economy by the pig stakeholders

Proposed risks:	Score	Total Ranked
Competition with breeders who use the breed’s name without assuming the constraints of a particular specification	43	53
Profitability of the activity	40	57
Fragility of the chain	38	53
Competition with other products from more profitable breeds or crosses	30	46
Competition with cross-breeders	27	39
Insufficient market size	15	22

Total Ranked: Number of times each proposed answered has been chosen
NR=97

Table 29: Ranking of the risks associated to economy by the chicken stakeholders

Proposed risks:	Score	Total Ranked
Profitability of the activity	55	13
Fragility of the chain	37	12
Competition with other products from more profitable breeds or crosses	33	10
Insufficient market size	23	7
Competition with cross breeders	17	4
Competition with breeders who use the breed’s name without assuming the constraints of a particular specification	10	3

Total Ranked: Number of times each proposed answered has been chosen

NR=20

Amongst risks associated with **regulation**, rules related to sanitary topic got the highest marks and SCORES than those related to welfare or environment: SCORES equal to 67, 48 and 43, respectively (NR=86 pig stakeholders, not shown).

In regard to **sanitary risks** (NR=79), African Swine Fever (SCORE=69) followed by the presence of wildlife infected with a pathogen (SCORE=63) are the main risk factors identified by the pig stakeholders (Table 30). Brucellosis and Aujeszky come later (SCORE=32 for both), collecting less and lower marks. Answers of the chicken stakeholders (NR=36) on health risks are not very discriminating with SCORES equal to 48 for Avian influenza, to 47 for the presence of wildlife infected with a pathogen and 40 for other pandemic or health risk (not shown). Neither are responses to the **risk related to Human** (not shown) with the following SCORES into brackets listed in descending order: i) in the pig survey (NR=68), Organisation of the actors involved (60), Motivation of farmers (55), Attractiveness of the farming profession (53), Lack of local breed specific know-how (47) and, ii) in the chicken survey (NR=26), Attractiveness of the farming profession (64), Lack of local breed specific know-how (63), Motivation of farmers (56) and Organisation of the actors involved (51).

Table 30: Marks given to different sanitary risks attributed by pig stakeholders having mentioned sanitary risk

Proposed risks:	Score	Total Marked
African Swine Fever	69	71
Presence of wildlife infected with a pathogen	63	63
Brucellosis	32	52
Classical swine fever	32	48
Aujeszky	30	49
Other pandemic or health risk	29	50

Total Marked: Number of times each proposed answered has been marked.

NR=79

Regarding **risks linked with consumers** (NR=66 in the pig survey and NR=30 in the chicken one), stakeholders, to a greater extent those involved in local pig breeds, highlight the limited purchasing power as the main risk link to consumers (Tables 31 and 32).

Table 31: Marks given to different consumer risks attributed by pig stakeholders having mentioned consumer risk

Proposed risks:	Score	Total Marked
Limited purchasing power	82	65
Decrease in meat consumption	51	55
Vegan trend	37	45
Religious restrictions	15	33

Total Marked: Number of times each proposed answered has been marked.

NR=66

Table 32: Marks given to different consumer risks attributed by chicken stakeholders having mentioned consumer risk

Proposed risks:	Score	Total Marked
Limited purchasing power	69	29
Decrease in meat consumption	40	25
Vegan trend	29	25

Total Marked: Number of times each proposed answered has been marked

NR=66

Finally, stakeholders (NR=75 in the pig survey and NR=44 in the chicken survey) ranked the intrinsic **risks inherent to their local breeds** (Table 33 and 34. [In the pig survey, inbreeding is the main concern](#) (SCORE=44), followed by poor productive performance (SCORE=42) and the lack of available boars (SCORE=33). [Chicken stakeholders](#) do not highlight any inbreeding risk (SCORE=12) but [rather class first the lack of available cocks](#) (SCORE=44), then poor reproductive performance (SCORE=41) and the lack of available hens (SCORE=37).

Table 33: Ranking of the risks associated to the local pig breed by pig stakeholders having mentioned breed risks

Proposed risks:	Score	Total Ranked
Inbreeding	44	45
Poor productive performance	42	38
Difficulty in finding male breeding animals	33	37
Difficulty in finding female breeding animals	20	22
Presence of genetic defects	19	20
Product quality	8	10
Poor reproductive performance	6	6

Total Ranked: Number of times each proposed answered has been chosen

NR=75

Table 34: Ranking of the risks associated to the local chicken breed by pig stakeholders having mentioned breed risks

Proposed risks:	Score	Total Ranked
Difficulty in finding male breeding animals	44	31
Poor reproductive performance	41	24
Difficulty in finding female breeding animals	37	22
Product quality	24	18
Inbreeding	12	7
Presence of genetic defects	10	6

Total Ranked: Number of times each proposed answered has been chosen

NR=75

There is little financial support for local chicken farming activities (only 16% of positive answers, NR=153), while local pig breeding benefit from subsidies (61% of positive answers, NR=231). Support seems less known in Spain (29%, NR=7) and Slovenia (44%, NR=18) and more in Croatia (80%, NR=39) where people were surveyed face-to-face. Endangered premium (55%), European (22%) and National (34%) aids are more cited (NR=141) than Regional (14%) or Local (10%) or association (5%) aids. National aids are less cited in France (12%, NR=52) and much more mentioned in Croatia (84%, NR=31). In contrast, local and regional aids are more specifically cited by the French (25%, NR=51), Croatian (45%, NR=31) and Italian (50%, NR=10) stakeholders. About half of the participants knowing subsidies for local breed farming are also aware of financial support for analyses like parentage control or kinship assignment, health prophylaxis analyses, RYR1 genotyping or support for breeding animal renewal (NR=76 in the pig survey, NR=15 in the chicken survey).

Most of the stakeholders expect more public support for the preservation of their local breeds: 68% in the chicken survey (NR=132) to 71% in the pig one (NR=231). Support to fight against competition with breeders who use the breed's name without assuming the constraints of a particular specification is the most ranked proposal in the pig survey (SCORE=30, Table 35). This expectation is particularly noticeable in France (SCORE=43, NR=56) and Italy (SCORE=44, NR=15), the Gascon breed being particularly concerned. However, Incentives to productivity received an even higher SCORE (33, thanks to more top 1 ranking) with high scores in Portugal (SCORE=60, NR=39) and in Slovenia (SCORE=50, NR=14). Then come Support for access to slaughterhouses (SCORE=23) and Subsidies to protect farms against pathogens introduced by wildlife (SCORE=20). In the chicken survey (NR=83), subsidies for research programs on local breeds (SCORE=31) exceeds other proposals (Table 36), before Subsidies for human resources to manage conservation programs and Subsidies to start a selection program (phenotyping...), both with a SCORE of 26, and Incentives to productivity (SCORE=24).

Table 35: Ranking of the expectations toward public support of the pig stakeholders hoping for more public policy support for the preservation of the local pig breed(s)

Proposed risks:	Score	Total Ranked
Incentives to productivity	33	62
Support to fight against competition with breeders who use the breed's name without assuming the constraints of a particular specification	30	66
Support for access to slaughterhouses close to the farms	23	46
Subsidies to protect farms against pathogens introduced by wide life	20	47
Policies for improving access to market of large retailers	15	29
Subsidies for research programs on local breeds	14	37
Subsidies for human resources to manage conservation programs	13	32
Subsidies to start a selection program (phenotyping...)	10	21
Subsidies to comply with welfare regulations	9	26
Subsidies to comply with environmental regulations	8	22
Subsidies for parentage testing	8	14
Advise on matings and management of biodiversity	5	11
Advise to start a selection program (phenotyping...)	3	11

Total Ranked: Number of times each proposed answered has been chosen.

NR=155

Table 36: Ranking of the expectations toward public support of the chicken stakeholders hoping for more public policy support for the preservation of the local chicken breed(s)

Proposed risks:	Score	Total Ranked
Subsidies for research programs on local breeds	31	40
Subsidies for human resources to manage conservation programs	26	30
Subsidies to start a selection program (phenotyping...)	26	28
Incentives to productivity	24	27
Support to fight against competition with breeders who use the breed's name without assuming the constraints of a particular specification	14	19
Subsidies for parentage testing	13	16
Support for access to slaughterhouses close to the farms	12	16
Advise to start a selection program (phenotyping...)	11	14
Subsidies to protect farms against pathogens introduced by wide life	10	12
Advise on matings and management of biodiversity	9	13
Subsidies to comply with welfare regulations	8	9
Policies for improving access to market of large retailers	6	9
Subsidies to comply with environmental regulations	5	7

Total Ranked: Number of times each proposed answered has been chosen. NR=83

6.4 Additional information on the stakeholders

Although four email addresses are common to the pig and chicken surveys, none of the participants ticked the two species (pig and chicken) at the beginning of each survey. However last questions indicate that B/F participants have quite often animals of local breeds for other species than pigs and hens/chickens: 33% of the pig B/F (NR=218) and 48% of the chicken on (NR=118). Most cited are cattle (55%), sheep (46%) goat (28%) and equine species (21%) in the pig survey and sheep (37%), cattle (23%), equine (23%), duck (18%), goose (16%) and rabbit species (16%) in the chicken survey (NR=57).

Participants described their knowledge in different topics related to breeding (Tables 37 and 38). Overall, although not ranked in the same order in both species, the three topics Selection implementation, Management of genetic variability and Phenotype (measurement) get much higher scores than Epigenetics and to a much lesser extent than Data base knowledge. Scores are a bit higher in the pig survey compared to the chicken one. Furthermore, participants are interested in increasing their knowledge in all these topics with high scores for all the proposed topics. In addition, most of them (79%, NR=248 in the pig survey and 74%, NR=143 in the chicken one) want to be part of the GeroNIMO’s communities to be involved or stayed tuned about the project activities (training activities, discussion groups, and events).

Table 37: Evaluation of the knowledge of the pig stakeholders in different topics related to breeding and their interest in increasing it

Topics	Knowledge rating (NR=225)		Interest in increasing knowledge (NR=210)	
	Score	Total Marked ¹	Score	Total Marked ²
Selection implementation	53	207	75	197
Management of genetic variability	50	209	70	191
Phenotype (measurement)	46	184	66	180
Data storage (genealogies, phenotypes, genotypes...)	45	189	62	175
Epigenetics	22	148	66	181

Total Marked: Number of times each proposed answered has been marked.

¹ Mark: 0 (no knowledge or interest), 1 (basic knowledge), 2 (good knowledge), 3 very good knowledge

² Marks: 0 (no interest), 1 (some interest), 2 (great interest)

Table 38: Evaluation of the knowledge of the chick stakeholders in different topics related to breeding and their interest in increasing it

Topics	Knowledge rating (NR=137)		Interest in increasing knowledge (NR=133)	
	Score	Total Marked ¹	Score	Total Marked ²
Phenotype (measurement)	47	124	67	118
Selection implementation	47	133	70	124
Management of genetic variability	40	132	74	127
Data storage (genealogies, phenotypes, genotypes...)	36	124	64	119
Epigenetics	23	113	69	119

Total Marked: Number of times each proposed answered has been marked.

¹ Mark: 0 (no knowledge or interest), 1 (basic knowledge), 2 (good knowledge), 3 very good knowledge

² Marks: 0 (no interest), 1 (some interest), 2 (great interest)

7 Impact of sanitary crises

A group of questions was dedicated to the impact of sanitary crises with sub-groups of questions per virus: Covid-19 for both species, African Swine Fever (ASF) in the pig survey and Avian Influenza in the chicken one. Each sub-group started with a general question (Level 1) "Did the pandemic significantly affect your activity linked to local pig breeds, in terms of number of animals, rearing conditions or income (costs/products)?" Next questions were displayed only to those who reported an impact: Level 2 "what has been impacted, the number of animals, the rearing or production conditions, the income (costs/products)?" then Level 3) more detailed questions were again displayed only to those who reported an impact on the Level 2 items. The number of collected responses thus decreases from Level 1 to Level 3 and can be very limited at the last two levels (especially for the chicken species). The results should therefore be interpreted with caution.

7.1 Covid crisis

About half of the pig stakeholders (52%, NR=234) and one third of the chicken stakeholders (36%, NR=146) consider that the COVID-19 crisis (2020-2021) significantly affected their activity linked to local breeds compared to the previous period.

Stakeholders further think that it is mainly their income that has been impacted (86%, NR=122 in the pig survey, and 55%, NR=53 in the chicken survey) through an impact on the production costs (78% and 81%, NR=97 but only NR=21 in the pig and chicken surveys, respectively), and even more on sales (92% and 91%, NR=97 and NR=21 in the pig and chicken surveys, respectively). However, in both species (NR=76 in the pig survey but only NR=16 in the chicken one), no clear general trend on sales emerges, the impact being sometimes weak, sometimes strong, sometimes positive, sometimes negative ; this resulted in low scores in absolute terms (not shown), the most important being, i) in the pig survey, a positive overall impact on sales (SCORE=+25) but much lower when sales of slaughter pigs (SCORE=+15), breeding animals (SCORE=+1), carcasses or fresh meat (SCORE=+9) and process products (SCORE=14) are distinguished, ii) in the chicken survey, a negative impact on the sale of live chickens for slaughter (SCORE=-11). On the other hand, in both species, stakeholders report that the disease crisis appears to have increased feed costs (pig SCORE=44, NR=68, chicken SCORE=62, NR=15 only) and, to a much lesser extent, other costs like infrastructure, labour or slaughter costs (Table 39 and 40).

Table 39: Impact of the COVID19 crisis perceived by pig stakeholders on the production costs linked to local breeds compared to the previous period

Proposed cost impacted:	Score	Total Marked
Feeding in connection with a possible change in rearing methods	44	56
Infrastructures (housing, building, land, outdoor maintenance)	21	29
Labour force in connection with a possible change in rearing/processing methods	20	37
Slaughtering and transport from farm to slaughterhouse	19	29
Taxes, duties	14	19
Other costs	12	13
Travel (meetings, farm visits, etc.)	9	20

Total Marked: Number of times each proposed answered has been marked. Marks attributed to seven criteria from -3 (more than 75% decreasing impact on costs) to +3 (more than 75% increasing impact on costs).

NR=68

Table 40: Impact of the COVID19 crisis perceived by chicken stakeholders on the production costs linked to local breeds compared to the previous period

Proposed cost impacted:	Score	Total Marked
Feeding in connection with a possible change in rearing methods	62	14
Infrastructures (housing, building, land, outdoor maintenance)	20	10
Slaughtering and transport from farm to slaughterhouse	16	4
Taxes, duties	16	4
Labour force in connection with a possible change in rearing/processing methods	13	7
Travel (meetings, farm visits, etc.)	4	6
Other costs	0	2

Marks from -3 (more than 75% decreasing impact on costs) to +3 (more than 75% increasing impact on costs). Total Marked: Number of times each proposed answer has been marked.

NR=15

Few stakeholders report an impact of the Covid-19 crisis on the rearing conditions: 15% for the chicken survey (NR=53) and 9% in the pig survey (NR=122). In the pig survey (NR=11 only), a change in the process of products duration (73%), a modification of the specifications to produce animals or of products (64%) but few (27%) changes in the average slaughter age and weight are later reported. In the chicken survey (NR=8), only one stakeholder mentions changes on process of products duration, specifications or slaughter age and weight.

On the other hand, a more pronounced impact is described on the number of animals by 55% (chicken survey, NR=53) and 32% (pig survey, NR=122) of the stakeholders. The more detailed question per category of animals was designed in such a way as to encompass Covid-19 and ASF (see section 7.1.3).

7.2 Impact of the African Swine Fever pandemic on pig stakeholders

Only 19% (NR=233) of the pig B/F and M/Oth say that the recent African Swine Fever pandemic significantly affected their activity linked to local pig breeds. Croatian and French stakeholders being overrepresented amongst them (SCORE=28% in Croatia, NR=39, SCORE=27% in France, NR=81). This can be related to the presence of the virus in neighbouring countries and to the obligation to protect farms from wildlife contacts with heavy investments.

Most stakeholders do not report an impact of the ASF sanitary crises on the number of animals (88%, NR=43) but half of them do report an effect on the rearing or production conditions (54%) or on their income (54% too). In the next question on rearing conditions (NR=23), 26% mention the end of free-range rearing of breeding stock animals and 17% of growing animals but 40% choose the “other option”, all of them giving a free comment related to the fences. For those that are impacted on their income (NR=21), production costs seem to be much more impacted (91%) than sales (19%). Only four participants answered the question related to sales (not shown). Regarding the production costs, as visible in Table 41 (NR=only 19), installations for the sanitary protection of the herd (fences, locks etc) is the main selected item with a high SCORE of 61 (this is also the subject of several free text comments), then Land/outdoor maintenance (SCORE=42) and Labour force (SCORE=35). The limited number of answers is explained by the fact that questions were only displayed when a positive answer was given to the first question (thus maximum 43 respondents viewed these questions).

Table 41: Impact of the African Swine Fever crisis on the production costs compared to the previous period

Proposed cost impacted:	Score	Total Marked
Installations for the sanitary protection of the herd (fences, locks etc).	61	18
Land / outdoor maintenance	42	15
Labour force	35	11
Housing / building	16	8
Feeding	5	5
Compliance with environmental standards	5	4
Slaughtering and transport from farm to slaughterhouse	5	5
Taxes, duties	2	2
Travel (meetings, farm visits, etc.)	2	7
Compliance with animal welfare regulations.	2	3
Other	0	1
Prophylaxis / sanitary treatments	0	4

Total Marked: Number of times each proposed answered has been marked. Marks attributed to twelve criteria from -3 (more than 75% decreasing impact on costs) to +3 (more than 75% increasing impact on costs).

NR=19

7.3 Overall sanitary crises impact on pig stakeholders

In contrast to the previous sub-group of questions, 171 stakeholders involved with pig local breeds answered the question related to the profitability of their activity before and after the COVID-19 and ASF sanitary crises (Table 42). While the proportion of B/F having a balanced activity is unchanged (36%), the proportion of them having a cost-effective activity decreased (from 42% to 28%) and the proportion of them having a deficit increases to reach a third of the stakeholders. Moreover, 35% (NR=177) of the stakeholders consider that their income from local breeds decreased in 2020 (most often, a decrease estimated between 25% and 75%) while 22% say their income has increased (mostly lowly, by less than 25%).

Table 42: Profitability of the activities of pig B/F and processors (in %) before and after the sanitary crisis

	Balanced	Cost Effective	Deficit	NA
Previous Profit	35.7	42.2	18.7	3.5
Recent Profit	36.3	27.5	32.7	3.5

NR=171

NA: no answer to the sub question.

All virus combined (ASF and Covid-19), 10 pig B/F are reporting animal downsizing due to the health crisis. Growing pigs appear to be more affected than breeding animals. Concerning breeding animals, only one Alentejano farm seems to have been affected by a significant reduction in the number of animals (-40 boars and -80 sows). In terms of overall breed responses given by the M/Oth, only three describe significant decrease of the number of breeding animal attributed to the health crisis: the first one concerns the Alentejano breed (-500 sows, -50 boars), the second one the Iberian breed (-40 boars, - 80 sows) and the last one the Gochu Asturcelta (-50 sows).

7.4 Impact of the avian influenza pandemic on chicken stakeholders

Most of the stakeholders (79%, NR=118) consider that the avian influenza pandemic had no impact on their activities linked to local breeds. Most of those who have been affected (NR=25) mention an impact on the number of animals (60%, see 7.1.5 section for more detail) while 36% of them observed an impact on the rearing or production conditions (mainly the end of free-range rearing of growing animal, 78% and of breeding animals, 67%, NR=9 only) and 28% on their income. Both production cost (100%) and sales (83%) are affected when income is impacted (NR=6 only). As regards to production costs (NR=5 only), Installations for the sanitary protection of the herd (fences, locks etc) gets the highest SCORE (80), followed by Compliance with animal welfare regulations (60) and Feeding (53). As far as sales are concerned (NR=5 only), Sale of live animals for slaughter gets the highest SCORE (SCORE=33). Several stakeholders add free text comments explaining that sales were reduced because of the ban of exhibitions.

7.5 Overall sanitary crises impact on chicken stakeholders

Overall, sanitary crisis (Covid and avian Influenza) seemed to have no impact on the number of animals with slightly positive median values for changes in the number of animals between 0.5 and 3 for cocks, hens and chickens (NR=53). However, it is important to remember that data were collected by the end of year 2021. Responses might have evolved in-between.

On the revenue side, 28% of the chicken stakeholders (NR=79) don't know how their income from local breed evolved in 2020, 37% say it was stable, 23% that it increased (mostly by 25% to 75%) and 13% that it decreased. In addition, if the comparison of the profitability of the stakeholder business (Table 44) before the health crises (2019) and after (2020) doesn't show major evolution (NR=79), the question highlights the fact that more than 40% of the chicken stakeholders are in deficit.

Table 44: Profitability of the activities of chicken B/F and processors (in %) before and after the sanitary crisis

	Balanced	Cost effective	Deficit	NA
Previous Profit	26.6	24.1	41.8	7.6
Recent Profit	32.9	21.5	43.0	2.5

NR=79

7.6 Sanitary follow-up of the local breed farms

Almost all of the local breed pig farms (98%, NR=211) seem to be followed by a veterinarian. This is in agreement with the question on the regular serological monitoring (221 B/F and 62 M/Oth) indicating that ¾ of farms have at least annual analysis (four times a year being quite rare, 14%). Only 10% of the pig B/F (NR=221) and 3% of the M/Oth (NR=59) report cases of unusual mortality over the last year, most often with marginal losses especially as far as breeding animals are concerned: median values of 1 breeder animal lost, 21 animals lost in total and 28 piglets lost for the B/F answers (NR=20) but one M/Oth answer mentioning 200 piglets and 220 total animals lost in the Banija spotted pig breed. The majority of pig B/F say their farm has never been affected by regulated diseases (90%, NR=236). Amongst the farms of B/F respondents, four were already affected by Aujeszky disease and four by Brucellosis (of which tree in France). A majority of the B/F (60%, NR=238) doesn't know if any farm of their breed has already been affected by major diseases (ASF, Brucellosis, Aujeszky, Classical swine fever) but 19% know Brucellosis cases and 11% Aujeszky cases. M/Oth (NR=77) mention previous diseases cases in farms of their local pig breeds: 21 for Brucellosis (of which 19 in France), 13 for Aujeszky, 3 for African Swine Fever cases (of which two in Portugal) and 2 for Classical Swine Fever in Croatia.

More than half of the chicken farms of local breeds are also followed by a veterinarian (56%, NR=133) but a regular serological follow-up concerns only 14% of them (NR=136 B/F, and 25% considering only 8 M/Oth answers) and 63% say they never do analysis (B/F and M/Oth responses). As a consequence, a large part of the chicken stakeholders don't know if their farm (52% of the B/F, NR=169) or their breed 65% of the M/Oth, NR=34) has already been affected by any serious disease. Most stakeholders report that there was no unusual mortality over the last year (93% of B/F, NR=136, 100% of the M/Oth, NR=25). Only 3 BF quantify unusual

mortalities: one with 20 chickens lost, one with 500 chicken and 10 hens lost and the last one with 20 chicken and 200 hens lost. Only few farms of chicken local breeds have already been affected by serious diseases: 1 case of avian influenza, 2 of Marek disease, 1 of Coryza, 1 of Salmonella and one “other” are described by the B/F (NR=16) and 3 avian influenza cases are described by the M/Oth (NR=34).

Overall, this suggests that a majority of local breed farms have no particular health problems.

8 Conclusion

The conducted surveys were overall a success: around 550 respondents in total took part and provided many responses reflecting their interest for their local breeds and for GeroNIMO's research program. This global success nevertheless hides differences between countries and species. The lack of a database or zootechnical register listing breeders of local breeds has certainly hindered data collection, at least in poultries outside Portugal. Such a database would be very valuable to make a comprehensive census of the farmers involved in the conservation of chicken local breeds, to estimate the population sizes and genetically manage them. In France, the SYSAAF and the French poultry federation (Fédération Française des Volailles) are currently studying the implementation of this type of coordinated initiative, as an extension of the GeroNIMO survey. They are in contact with the Portuguese associations to benefit from their experience.

Breeding of pigs and chickens of local breeds is very different from conventional livestock production: farms are usually very small, animals are generally reared at least partially outdoor, they value natural resources and/or raw feed, they are slow growing and late slaughtered. During the period in which the data were collected, monitoring of farm health seemed more pronounced in pig local breeds than in poultry. Although free-range rearing has a definite interest (valorisation of natural resources, maintenance of spaces, animal welfare, image, etc.), wild fauna nevertheless endangers local breeds. The participants are aware that they must install protection in their farms from health risks (fences...); in this regard, they express expectations of support for associated costs which is considered as the second highest cost item after feeding.

Pig and chicken local breeds reproduce in pure bred with natural mating and breeding animals' choice most often relies on external feature (breed standard and general appearance); with few exceptions, there are generally no selection schemes. However, a possible interest of the participants in selection emerges from this study despite a lack of means for its implementation. This interest needs to be explored further to avoid problems of mutual understanding of the word "selection". Furthermore, the survey highlights additional obstacles to the implementation of selection programs such as very small farms, poorly connected to each other, variable environment or incomplete collect of basic information. Lastly, pedigrees are taken into account in mating plans much more frequently in pigs than in poultry. The low-cost parentage assignment tool to access pedigree of birds that is developed in GeroNIMO could overcome the difficulty of tracing genealogies.

In both surveys, stakeholder's motivation is primarily genetic conservation. However, fancy activity represents an important motivation of breeders involved in chicken local breeds for whose economic activities associated with these breeds seems marginal. Conversely, economic activities relying on local pig breeds are significant. Nevertheless, activities related to local breeds are often unbalanced economically, especially in chicken farms, with a deterioration in profitability of pig farms associated with health crises. In addition, most of the consulted stakeholders have concerns about the sustainability of their breed in the longer or shorter term, mainly with respect to economic risks and risks linked to regulation. Most of them expect more public support for the preservation of their local breeds: incentives to productivity, support to fight against unfair use of breed's names are the main expectations highlighted in the pig survey. In the chicken survey, subsidies for research programs on local breeds exceeds other expectations, followed by support fort management conservation and selection programs.

These surveys have allowed to characterise the current local breed management programs overall and to describe the wishes, the fears and needs of the stakeholders involved in local breeds preservation. Further analyses are ongoing to refine the conclusions depending on the typology of the breeders (size, importance or not of the economic activity...). Mostly global results were presented and only a few analyses per breed or country were mentioned. If some breeds are under-represented, especially those from countries not specifically targeted, others are well represented in the study in view of the number of farms per breed. However, due to the very unbalanced representation of the different breeds, some breeds have a much greater weight than others in the overall results of the study. Caution should therefore be exercised before generalising the conclusions of this study to all local breeds. Similarly, some results are based on a small number of responses and should also be treated with caution

To conclude, the recent installation of breeders, their involvement in the management boards of the breeds, the commitment of people from outside the farm in the choice of breeding stock are evidence of a certain dynamism and organisation of the European local breeds' sector. Furthermore, stakeholders are interested in

increasing their knowledge on selection, genetic variability management and epigenetics topics. Some training activities will be proposed in GERO NIMO. Finally, bridges between stakeholders and research field have been built and will have to be consolidated in the future to facilitate the transfer to the field of the tools and knowledge developed in GERO NIMO.

9 Acknowledgement

To the stakeholders who have fill-in the survey, to all the involved breeding organisations (Društvo rejcev krškopoljskih prašičev i.e. the Society of Krškopolje pig breeders, Association of Banija Spotted Pig Breeders, Noble Municipality of Turopolje - Turopolje Pig Breeders Section and Association of Black Slavonian Pig Breeders of Slavonia, Baranja and Western Srijem "Fajferica", LIGERAL i.e. association of the herd books of French local pig breeds, Association Porcu Nustrale, AMIBA- Associação dos Criadores de Bovinos de Raça Barrosã - ckicken breeds, ANCSUB – Associação Nacional de Criadores de Suínos de Raça Bísara - Bisaro pigs, Federação Portuguesa das Associações de Suinicultores – FPAS -Malhado de Alcobaça pig , ANCPA – Associação Nacional de Criadores de Porco Alentejano – Alentejano pigs, ACPA – Associação de Criadores de Porco Alentejano - Alentejano pigs), to IDELE for the LimeSurvey softway support and for data hosting and to all those contributed to the promotion of the survey (EFFAB, ERF...).

10 Abbreviations

B/F: breeders/farmers

id: unique identifier attributed to each questionnaire by the software LimeSurvey

M/Oth: other roles (manager, processor or other)

NR: number of responses per question

11 Additional Figures

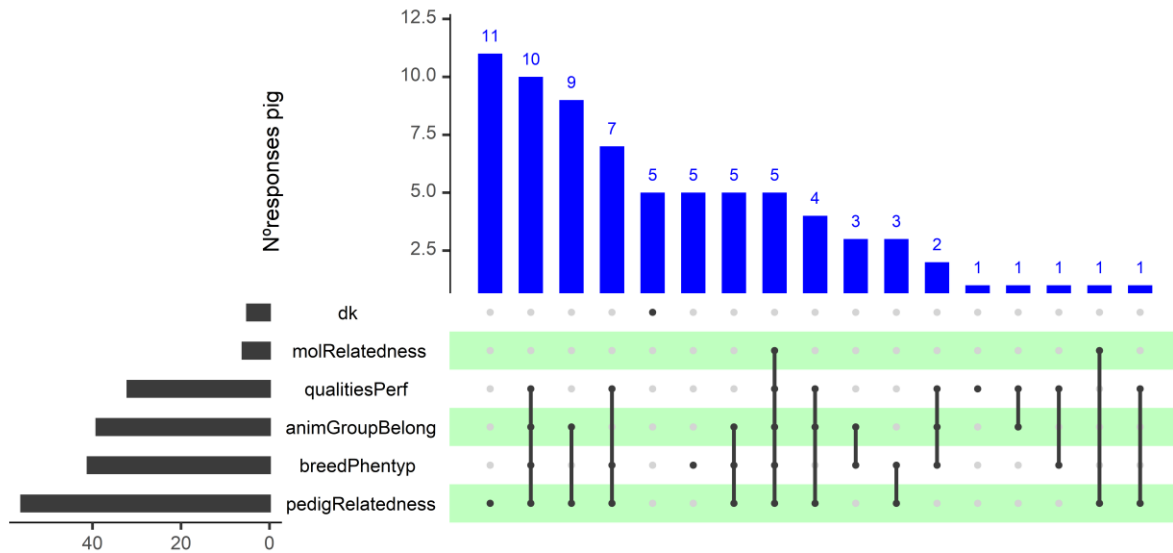


Figure S1: Criteria taken into account when defining mating plans in pigs (responses of M/Oth)

From bottom to top: Relatedness male-female (inbreeding of the offspring estimated with pedigrees (pedigRelatedness); Phenotype of the breeding animals (breedPhentyp); Belonging to a group of animals (family, lineage) (animGroupBelong); Qualities & performances of the breeding animals (qualitiesPerf); Molecular relatedness male female (molRelatedness); don't know (dk).

NR=81

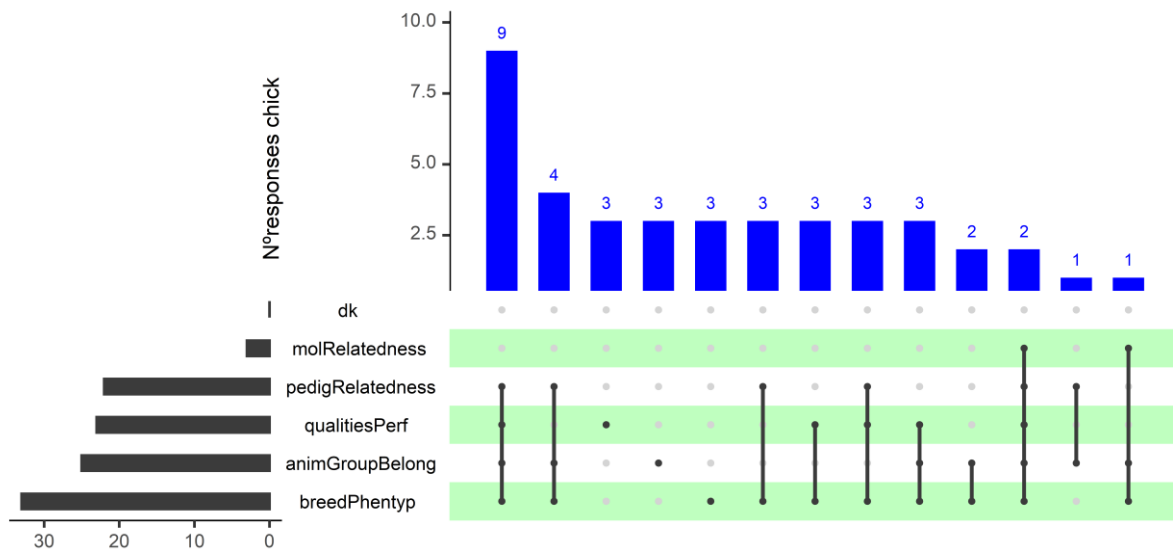


Figure S2: Criteria taken into account when defining mating plans in chickens (responses of B/F)

From bottom to top: Phenotype of the breeding animals (breedPhentyp); Belonging to a group of animals (family, lineage) (animGroupBelong); Qualities & performances of the breeding animals (qualitiesPerf); Relatedness male-female (inbreeding of the offspring) estimated with pedigrees (pedigRelatedness); Molecular relatedness male female (molRelatedness); don't know (dk).

NR=48