



HAL
open science

Factors affecting French rabbit farmers' adoption of pro-welfare innovations

Pierre Chiron, Antoine Doré, Laurence Fortun-Lamothe

► **To cite this version:**

Pierre Chiron, Antoine Doré, Laurence Fortun-Lamothe. Factors affecting French rabbit farmers' adoption of pro-welfare innovations. *World Rabbit Science*, 2022, 30 (4), pp.249-265. 10.4995/wrs.2022.17882 . hal-04003538

HAL Id: hal-04003538

<https://hal.inrae.fr/hal-04003538>

Submitted on 24 Feb 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial - ShareAlike 4.0 International License

FACTORS AFFECTING FRENCH RABBIT FARMERS' ADOPTION OF PRO-WELFARE INNOVATIONS

Pierre Chiron*[†], Antoine Doré[†], Laurence Fortun-Lamothe*

*GENPHYSE, Université de Toulouse, INRAE, ENVT, 31320 CASTANET-TOLOSAN, France.

[†]AGIR, Université de Toulouse, INRAE, 31320 CASTANET-TOLOSAN, France.

Abstract: Consumers are increasingly animal welfare-conscious and critical of indoor caged housing systems such as those used in rabbit farming, and Europe has committed to legislate a ban on caged animal farming. Research has evidenced several technical and economic drivers of system change or lock-in in the livestock sector. Here we study determinants, motivations and/or resistance to adoption of pro-welfare practices among French rabbit farmers. First, we held 31 exploratory interviews with rabbit farmers and then performed a thematic analysis on the interview transcripts. We then assessed French rabbit farmers' receptivity to change, using questionnaires containing 83 variables addressing receptivity to change, technico-economic characterisation of the farms, professional situations, and the personal and professional life of the rabbit farmers. Receptivity to change was evaluated through two synthetic variables summarising pro-change practices (changes already made on-farm to housing, management, feeding, etc.) and interest in innovation (receptiveness to novelty and relationship with innovation) graded on a 3-point scale (low, moderate, high). We analysed effects of technico-economic and sociodemographic variables (social attributes, internal and external motivations) on interest in innovation and pro-change practices using Chi-square tests and Cramer's V. We collected 78 full questionnaires, i.e. covering 10% of the French population of professional rabbit farmers. Results showed a link between interest in innovation and pro-change practices ($P < 0.001$). Sociodemographic variables (33%, 21/63; $P < 0.05$) rather than technico-economic variables (5%, 1/19; $P < 0.05$) were linked to receptivity to change. Pro-change practices were more influenced by the variables capturing internal motivations (6/16, economic, technical, work facilitation, materialise the farmer's interests) than external motivations (3/21, societal incentives, family group or social environment). The weight of the sociodemographic variables suggests that transition support systems should be thought out in terms of farmer attributes.

Key Words: animal welfare, motivation, resistance, change, rabbit farmers.

INTRODUCTION

Consumers are increasingly animal welfare-conscious and strongly against cage housing systems (Delanoue *et al.*, 2017; Delanoue *et al.*, 2018), such as those in which rabbits are raised in small wired cages with no structural enrichment, which stops rabbits expressing important natural behaviours (EFSA AHAW Panel, 2020; Heezen, 2020). Surveys show that citizens across Europe would prefer animals to be in contact with nature (outdoor access) rather than confined in cages or buildings (Delanoue *et al.*, 2018; Gomant and Beddiar, 2018). As a result of the European Citizens' Initiative on 'End the Cage Age', Europe has committed to work towards new regulations that prohibit caged

Correspondence: L. Fortun-Lamothe, laurence.lamothe@inrae.fr. Received June 2022 - Accepted November 2022.
<https://doi.org/10.4995/wrs.2022.17882>

Cite as: Chiron P., Doré A., Fortun-Lamothe L. 2022. Factors affecting French rabbit farmers' adoption of pro-welfare innovations. *World Rabbit Sci.*, 30: 249-265. <https://doi.org/10.4995/wrs.2022.17882>

animal farming (Rojek, 2021). A report commissioned by the European Parliament's Policy Department for Citizens' Rights (Heezen, 2020) raised the need for alternative housing, although a cage-free housing system seems unrealistic in the short term. In this context, the French rabbit sector is thinking about reading ahead for future reforms (CLIPP, 2018) and has engaged in a participatory research project along with downstream stakeholders, consumers and non-profits to define systems that are more respectful of animal welfare (Huang *et al.*, 2021a,b). The present work is part of this participatory research project.

There has been ample research on the factors that explain farmers' adaptations to phenomena such as global warming or societal demands concerning animal welfare in other livestock sectors (cattle, sheep, pigs). The research has shown that social characteristics such as age and level of agricultural education have an effect on farmers' practices (Ndamani and Watanabe, 2016; Liu *et al.*, 2018; Ume *et al.*, 2018; Borges *et al.*, 2019). Economic motivations, such as ensuring high productivity and the price premium for welfare-friendly systems, also influence farmers' practices (Borgen and Skarstad, 2007; Prager and Posthumus, 2010; Singha *et al.*, 2012). However, farmers' practices and readiness to adapt are also influenced by non-economic motivations, such as social representations of the animal (its status, recognition that animals are sentient beings) and animal welfare (Dockès and Kling-Eveillard, 2007; Borgen and Skarstad, 2007; Wellbrock *et al.*, 2009), as well as external stimuli such as societal incentives, the social image of the profession and membership of a producer group (Michel-Guillou and Weiss, 2007; Mathé *et al.*, 2017; Delanoue *et al.*, 2018; Borges *et al.*, 2019).

In the field of rabbit farming, studies have been carried out on the technical factors that either motivate or prevent farmers from adopting new practices or technologies. For example, in Nigeria and Kenya, economic constraints arising from local market weakness, health problems related to the difficulty obtaining specific veterinary drugs for sick rabbits and the inability to isolate sick animals quickly prevent farmers from developing their rabbit farms (Ozor and Madukwe, 2005; Serem *et al.*, 2013). Nevertheless, in Nigeria, seasonal change, i.e. the transition from rainy to dry season, forces farmers to adapt their animal feeding and housing practices animals throughout the year (Ozor and Madukwe, 2005; Ume *et al.*, 2018).

In Europe, studies on poultry and rabbit farms have focused on the factors that influence antibiotic use and efforts to reduce it. The technical factors found to prevent farmers from changing their antibiotic use practices included high indoor animal density, biosecurity standards to curb the prevalence of certain diseases (Chauvin *et al.*, 2012), feed and water quality requirements, financial risk (Fortané *et al.*, 2019), low income, and small farm size (Le Bouquin *et al.*, 2013), whereas the sociological factor 'social norm and perception of others' had no effect on variation in antibiotic use (Le Bouquin *et al.*, 2013). Nevertheless, the belief or opinion that there are viable alternatives to antibiotics was found to motivate farmers to change their practices and reduce antibiotic use, and farmers who hold these views were then more likely to invest in renovating their buildings and improving their hygiene measures.

In the field of farmed rabbit welfare, the widespread use of 'welfare cages', understood as structurally-enriched cages with a wire-mesh platform (EFSA AHAW, 2020), in Dutch rabbit farms was brought about by new standards imposed in 2006 by the Dutch Rabbit Farmers Organisation to anticipate the cage ban legislation. The law was expected to prompt all Dutch rabbit farms to adopt welfare cage-based systems by 2016 (de Greef *et al.*, 2016; de Greef and Rommers, 2021), but de Greef *et al.* (2016) reported that 'the (not fully foreseen) improved rabbit productivity on the farms with this system caused an adoption faster than was mandatory and expected'. On the other hand, the disappointing technical results of the floor pen created reluctance among Dutch rabbit farmers to convert to this type of system (de Greef *et al.*, 2016), but this reluctance to change was reversed by a dedicated price premium for park-raised rabbit meat and the perspective of a decline in the market for standard caged rabbit. In France, the current low profitability of rabbit farming, the lack of candidates for new installations and the very low self-financing capacity of rabbit farms (which require a financial commitment over 10-20 yr) were found to be barriers to system transition (Lalaurette and Cadudal, 2019).

The technical factors that drive improvements and innovations in rabbit farms are well understood, but far less is known about the sociological factors that drive changes in rabbit farming. However, research has shown that there are social determinants that also play a role, such as legislation, price premium schemes provided by the slaughterhouse, the desire to develop a new market segment and collective collaboration to address societal expectations (de Greef *et al.*, 2016; de Greef and Rommers, 2021). Moreover, studies on rabbit farms in Kenya and Nigeria have found

significant effects of education, experience and, to a lesser extent, age (Ozor and Madukwe, 2005; Balogun *et al.*, 2012; Mbutu, 2013; Nmadu *et al.*, 2015; Ndamani and Watanabe, 2015). However, the study of social factors has been limited to these few indicators, and rabbit farms in Europe have different issues to contend with. African nations are heavily focused on growing rabbit production with little considerations for animal welfare issues, whereas Northern-European countries are seeking to improve animal welfare by changing their farming systems.

Here, to address this gap, we studied French rabbit farmers in an effort to unravel motivations for and/or resistance to adopting changes that address animal welfare regulations.

The originality of this study is that we focus both on technical and economic factors but also on sociodemographic factors in order to study their relative importance and how far they affect French rabbit farmers' receptivity to change. This research is interested in many sociological dimensions that have not yet been fully explored in the field of rabbit farming. We split the study into two steps: (i) an exploratory qualitative study of rabbit farmers' receptivity to change, which serves as a foundation to construct (ii) a questionnaire for a quantitative study of determinants, motivations and resistance to change in rabbit farmers.

MATERIAL AND METHODS

Preliminary qualitative study

First, we conducted 29 exploratory interviews with rabbit farmers during August and September 2022, to help prepare the ground for the subsequent quantitative survey. We chose rabbit farmers involved in the long supply chain, contacted through the head of their producer group, and farmers involved in local distribution channels, identified via their websites. At the beginning of the meeting, we informed the farmers that the interview would be anonymised for analysis and that they had the right to withdraw from the survey. The farmers gave their consent to allow the conversation to be recorded on a digital voice recorder and used solely for the purposes of this study. The interviews took place in the farmer's home and/or on the rabbit farm. These interviews enabled us to gain a grasp of the field of study and the rabbit farmers' receptivity to change, and to explain and give meaning to the results obtained in the questionnaire.

We sought to vary the characteristics of the respondents. With this aim in mind, we asked the producer group manager to propose us a diverse group of farmers to interview. As we had hoped, the respondents varied according to: (i) gender (8 women and 21 men, referred as W1 to W8 and M1 to M21 in Tables 1 and 2); age (mean 46 yr [range: 23–63 yr old]); (ii) producer group affiliation (24 affiliated and 5 independent); (iii) market outlet (7 with direct farmer-to-consumer sales, 19 with sales to a slaughterhouse and supermarket distributors, and 3 with a mix of marketing channels); and (iv) geographic location (3 from the Occitania region in southern France and 26 from the Pays de la Loire region in north-western France). The Pays de la Loire is the leading region for rabbit production in France and is covered by a network of producer groups, whereas the Occitania region has only one producer group and has very few rabbit farmers compared to other French regions. Western France (Nouvelle Aquitaine, Brittany, Pays de la Loire) has a high density of rabbit farming, whereas the rest of France presents a low density.

The mean professional experience was 22 years [range: 1–43 yr]. Mean number of in-farm does was 891 (range: 9–2300 does). Two farmers had fewer than 100 rabbits on their farm, and 8 farmers had more than 1000 rabbits on their farm.

The interviews were recorded and transcribed and the verbatim text was interpreted using thematic analysis (Paillé and Mucchielli, 2012) thanks to Nvivo software (Jackson and Bazeley, 2019). Thematic analysis consists of detecting 'significant ideas', i.e. ideas relevant to the research question that were emphasised by many respondents, and classifying them into a category. The analytical approach used was a modified version of grounded theory (Paillé, 1994). The first step was to construct major themes. Relevant extracts from each transcribed interview were then identified and distributed into the themes constructed, progressively enriching the themes constructed and with new themes emerging. Finally, 9 general categories of motivational factors emerged to qualify drivers of and/or resistance to change.

Table 1: Farmers' motivations to change.

Thematic	No. of farmers	Interview extracts
Economics	19	'We heard we had to use less antibiotics, but I stopped before that. Because the cost of these antibiotics in the feed was quite high, and yet they still didn't work.' M14 ^a
Support from the rabbit industry	19	'There was a price difference between the normal cage and the multi-purpose or specific heightened cage, and the slaughterhouse paid for that difference over 5 yr in order to encourage farmers to install these cages. We said: it was in our interest to do so.' W3 ^b
Improving and preserving animal health	18	'We had RHDV for a while, it hit us all. We reviewed the health protocols and [the entire] vaccination stuff [protocol]. These are things that we have improved, even on the feed. We have reduced medicated feed; all my does have changed to a richer feed, richer in energy.' M7
Improving and preserving working conditions (farmers' wellbeing)	16	'Look at working conditions [...] you go and adjust the automatic feeding system, you press the buttons. But we have improved working conditions over time. I do less work physical work today than I did ten years ago.' M8 'And it is especially because I sometimes spent three hours for nothing, three hours... I am not like that; I need to keep things moving. That is why we took insemination, it was time for insemination, and we had to go for it.' W5
Alignment with societal expectations	10	'It is true that we have to follow societal evolutions, we have children, we have... and this allows us today to address the rabbit's needs, to say 'we are in an welfare-friendly process', because we have just invested in an welfare-friendly animal building.' M8
Window of opportunity	10	'I had equipment on a site that was a bit old, and when they announced the price supplements for new investors I took my calculator, my reasoning was extremely quick.' M8
Interest in innovation	6	'I have done trials and they have all been very negative. But I'm still working on it, saying: we have to find a solution so that at some point our rabbits can go outside.' M3
Farmers' conceptions of animal welfare	6	'It is not that they were unhappy in the cages, but I think we would not be too happy in the cages either, we have to... move in that direction [floor pens].' M4
Adherence to certification/label standards	4	'We have specifications for certain rabbit products such as Bleu Blanc-Cœur ^c or Magistral ^d . I try to use as few antibiotics as possible, to produce healthful food' M5

^a The letter M indicates that the interviewee was a man. The number refers to the interview number (M1 to M21).

^b The letter W indicates that the interviewee was a woman. The number refers to the interview number (W1 to W8).

^c 'Bleu Blanc Cœur' is a certification that promotes the introduction of a diet that delivers omega 3, through flax seed, lucerne or lupin. It also ensures transparent traceability of products and their production methods.

^d 'Magistral' is a certified brand that corresponds to a strain of black-eyed rabbit (from Vendée, a department in the west of France).

Quantitative study

We developed a questionnaire containing 176 questions on the 9 themes identified: 18 open-ended questions, 32 multiple-choice questions and 126 closed-ended questions. Answers for closed-ended questions could be dichotomous (yes/no) or scaled (totally agree/slightly agree/slightly disagree/totally disagree). The questionnaire took about 30 min to complete. Respondents were informed at the start of the online survey of the time required to complete it and that responses would be processed anonymously.

The 9 themes were: work situation and status; characterisation of the farm; professional identity; receptivity to change; prospects of the farm; professional environment; personal environment; professional training; difficulty in farmer's career (accident or hard blow that called into question the farmer's decision to continue farming); personal situation. The 9 themes thus covered economic and technical characteristics (number of female rabbits, number

Table 2: Farmers' resistances to change.

Thematic	No. of farmers	Interview extracts
Economics	19	'Because it will not be for floor pens or multi-purpose or specific heightened cages. Even if it costs more per kilo, it's just not profitable. I think the conventional cage system is very good.' M7 ^a
Risk of deteriorating working conditions (deterioration in the farmer's wellbeing)	12	'If the farmer is not comfortable in his work, he will necessarily spend less time on his farm, and so performances will suffer. If a breeder is comfortable in his breeding, in his work, the rabbits will be comfortable in their environment' M18
Technical limitations or scepticism about new systems	10	'Today, those who use floor pens for growers are perhaps more advanced. But the problem is not in the growing phase, it is in the nursery.' M13 'The new floor pens they are installing, which in my opinion do not work, do not work.' M10
Disapproval of societal expectations	8	'It means we are not working well. That's how I see it, actually. It means that they want to change my way of doing things because I am not doing it well. 'People from the outside' tell me I don't do my job properly. I think I do it properly. I am increasingly in confrontation, in opposition [against societal expectations].' M10 'Now, finally, there is a minority that is not part of agriculture but that decides for everyone. For all the other consumers, for the professionals, what they should do, what they should not do.' W2 ^b
Uncertainty around the future of the farm of the wider rabbit industry	8	'If you take the people in charge of the WRBC (producers' cooperative), you have to continue, you have to invest, they say 'we are ready to help you'. But they are thinking for themselves. The people around me, some of them say: are we going to invest? I don't know. My brother raises rabbits, and he doesn't know if he will invest again.' M15
Degradation of animal health	7	'But I do not like the idea of going back to a fixed maternity system with on-floor growing [floor pens]. On the other hand, we will have to look at it again, to have a nursery unit that is cleanable. Buildings that can be washed, because from a hygiene point of view it is... otherwise it is going backwards.' M5
Farmers' conceptions of animal welfare	7	'As a farmer, for me, animal welfare is a rabbit that is in its own world, whatever its world, but that produces on a regular basis. [...] if a doe weans 9 rabbits throughout her career, then theoretically that does is in good shape, happy in its environment, and has everything it needs to produce what it is asked to produce' M18
Age	4	'I am not going to start investing in new housing for the rabbit welfare again; not at 60 years old. I'd be better off stopping altogether. At this stage, I just don't think it's worth it.' M1

^aThe letter M indicates that the interviewee was a man. The number refers to the interview number (M1 to M21).

^bThe letter W indicates that the interviewee was a woman. The number refers to the interview number (W1 to W8).

of maternity cages, type of buildings, farming system, loans and investments), the situation and sociological characterisation of the farmers (year of birth, primary place of residence, agricultural qualifications and certificates, spouse's educational qualifications, the farmer's original social background, personal involvement in associations and professional commitment), their professional status and professional identity (year started in business, take-on of the family farm, legal status of the farm, number of partners, number of employees, sale(s) process(es), rabbit

processing or not...), pro-change practices in the rabbit unit ('which aspects of farming you have made changes to in the last 5 yr, reasons for these changes, involvement in trials or experiments you created yourself, the improvements sought') and the farmer's perceptions around social expectations for livestock production or future agricultural reform (relationship to the technical innovations in rabbit farming, relationship to society's expectations about farm animal welfare, perception of the EU-planned ban on caged animal farming for 2027).

The questionnaire was conducted online in 2021. It was diffused to French rabbit farmers through producer organisations or directly to independent farmers. The authority gathering all the French rabbit producer groups (National Federation of Rabbit Producer Groups: FENALAP) helped us distribute the questionnaire. We identified the independent farmers (not referenced by FENALAP) via websites dedicated to local distribution channels and local producers. The rabbit farmers were given one month to complete the questionnaire.

Analysis

To capture and objectify the notion of farmers' receptivity to change, we combined several questions to create two composite variables: (i) interest in innovation (INTERESTINOV) and (ii) pro-evolution practices (CHANGEPRACT).

INTERESTINOV describes the farmer's receptivity to novelty and innovation. This composite variable aggregated 4 variables that were previously transformed into scores and ranged from 0 to 13 after aggregation (with number of points given to the modalities of a variable): (1) confidence in the progress afforded by technical innovations in rabbit farming (confident or not: 0 or 1 point); (2) nature of the changes already made on the farm (incremental or disruptive: 1 or 2 points); (3) the attraction to the novelty on their farm (0 or 1 point); (4) main aspects targeted for farm improvement: production performance, quality of rabbit meat, rabbit comfort, rabbit health, rabbit injuries and pain, hygiene, atmosphere, comfort and ease of the work, and working time (1 point per item). Farmers were then ranked into three classes of interest in innovation: low (INTERESTINOV score from 0 to 3, $n=26$), moderate (INTERESTINOV score from 4 to 6, $n=28$) or high (INTERESTINOV score from 7 to 12, $n=24$).

CHANGEPRACT referenced changes already made in the rabbit farm (housing, management, feeding, etc.). This composite variable aggregated 4 variables that were previously transformed into scores (points) and ranged from 0 to 9 after aggregation: (1) practice changes already made on the farm: housing, management, building (ventilation, light, windows, etc.), automation (feed distribution, water, etc.), health (reduction of anthelmintics, antibiotics or other veterinary drugs), feeding (1 point per item); (2) changes in animal management already made on the farm (no or yes: 0 or 1 point); (3) participation in trial(s) conducted by the producer group or a food or animal supplier, research institution, technical organism or other (no or yes: 0 or 1 point); (4) personally setting up trials on the farm (no or yes: 0 or 1 point); (4) the main aspects targeted for improvement on the farm: production performance, quality of rabbit meat, rabbit comfort, rabbit health, rabbit injuries and pain, hygiene, atmosphere, comfort and ease of the work, and working time (1 point per item). Farmers were then ranked into 3 classes of pro-change practice: low (CHANGEPRACT score from 0 to 2, $n=22$), moderate (CHANGEPRACT score 3 and 4, $n=39$) or high (CHANGEPRACT score from 5 to 8, $n=17$).

We classified the independent variables (explanatory variables) into four categories: (i) technico-economic factors (19 variables), (ii) social attributes (27 variables); (iii) internal motivations (16 variables); and (iv) external motivations (21 variables).

The technico-economic factors refer to technical and economic parameters such as size of the farm, number of rabbits and existing loans. The social attributes refer to demographic data describing the farmer, such as age, level of educational attainment and parents' socio-professional category. Internal motivations relate to economic, technical, work facilitation/comfort, or farmer's technical performance such as production gains or health improvements. External motivations concern external influences from society (societal incentives), the family group or close social environment (neighbours, friends).

All analyses were performed using R statistical software version 4.1.3 (R Core Team, 2020). Frequency distributions were used to qualify the participants. To become familiarised with the data and emergent factors thought to be influential (de Singly, 2020; Martin, 2020), we used cross-tabulation with Chi-squared tests to analyse the relations between independent variables (technico-economic factors, social attributes, internal motivations and external

motivations) and the dependent variables (INTERESTINOV and CHANGEPRACT). The null hypothesis (H_0) of no relationship between two variables was rejected at the pre-set 95% threshold ($P < 0.05$). The Cramer's V measure enabled us to estimate the strength of the association (medium: $V [0.15-0.25]$, high: $V > 0.25$; Chanvriil-Ligneel and Le Hay, 2014). We found that if the Chi-squared test was significant ($P < 0.05$), then Cramer's V was higher than 0.26. Thus, in the results section, we only report the P value and not the Cramer's V for each association, but all significant relationships were of medium or high strength.

RESULTS AND DISCUSSION

Qualitative study

We identified nine themes that characterise rabbit farmers' motivations (Table 1) and resistances to change (Table 2). Note that some themes were identified as both motivations and resistances to change: economics was the most cited common theme ($n=19$ farmers in both cases), followed by working conditions (improving and preserving working conditions, risk of deterioration in working conditions; $n=16$ as a motivation and $n=12$ as a resistance), farmers' conceptions of rabbit welfare ($n=6$ and $n=7$, respectively), societal expectations (alignment with societal expectations, disapproval of societal expectations; $n=10$ and $n=8$, respectively), the material dimension (window of opportunity, technical limitations or scepticism about new systems; $n=10$ and $n=10$, respectively) and the health-hygiene dimension (improving and preserving animal health, degradation of animal health; $n=18$ and $n=7$, respectively).

The farmers' motivations had three specific themes: support from the rabbit industry ($n=19$), interest in innovation ($n=6$), adherence to the certification label standards ($n=4$).

The themes specific to farmers' resistances were uncertainty around the future of the rabbit industry or farm ($n=8$), and farmer age (being near retirement; $n=4$).

For motivations, the 'economics' theme consisted of sub-aspects such as innovating to increase productivity and profitability, positioning oneself in a market segment (or niche), or changing practices to save money (stopping antibiotics). For resistance to change, the 'economics' theme referred to banks refusing to loan, heavy investment and a refusal to move towards new more welfare-friendly rabbit farming systems as the resulting product prices will be unaffordable for customers. The theme of 'improving and preserving working conditions' included reducing arduousness (making work easier through new tools and automation) and working time (reducing time at work and reducing the time taken by one or more tasks to free up time to do others) as motivations but it also had the barrier of 'risk of deteriorating working conditions' due to the work to introduce a new housing system potentially increasing working hours and physical strain. The themes of 'improving and preserving animal health' and 'degradation of animal health' contained two dimensions: rabbit health and cleanliness of buildings and cages (using an all-in all-out system). The theme of 'windows of opportunity' mainly concerned a change of housing to address facility deterioration or a housing regulation that could prompt reinvestment. The theme of 'technical limitations or scepticism about new systems' concerned judgements on the feasibility of a new breeding system (floor pen) for rabbit does and their technical and economic results. The subject of animal welfare was cited in several themes, both as a motivation and resistance to change: 'alignment with' or 'disapproval of social expectations', 'farmers' conceptions of animal welfare', 'technical limitations or scepticism about new systems', 'degradation of animal health' and 'risk of deteriorating working conditions'.

Population characteristics of the quantitative study

We collected 78 full surveys. Mean age of the participants was 47 yr (7.9% were under 30 years old; 19.7% were aged 30 to 40 yr; 22.4% were aged 40 to 50 yr; 17.1% were aged 50 to 55 yr; 32.9% were over 55 yr old). The majority of the farmers who responded to the survey were men (men: 67%, women: 33%).

Geographic origin of the rabbit farms covered much of France: Pays de la Loire ($n=30\%$); Auvergne-Rhône-Alpes ($n=20\%$); Bretagne ($n=9\%$); Nouvelle Aquitaine ($n=9\%$); Hauts-de-France ($n=8\%$); Occitania ($n=8\%$); Grand Est ($n=7\%$); Bourgogne-Franche-Comté ($n=4\%$); Centre-Val de Loire ($n=3\%$) and Normandy ($n=3\%$).

For reproducing does, the farms were equipped with dual-purpose conventional cages (width≈38, length≈87 cm, height≈30 cm; 78%), specific doe conventional cages (width≈25 cm, length≈40 cm, height≈30 cm; 18%), dual-purpose enriched cages (width≈38 cm, length≈95 cm, height≥60 cm; 9%), dual-purpose elevated pens (length≈99 cm, height≈91 cm; 3%), floor pens (≈800 cm² per rabbit; 5%), or hutches (3%).

For grower rabbits, the farms were equipped with dual-purpose conventional cages (width≈38 cm, length≈87 cm, height≈30 cm; 64%), specific conventional cages for growers (width≈25 cm, length≈40 cm, height≈30 cm; 19%), dual-purpose enriched (width≈38 cm, length≈95 cm, height ≥60 cm; 1%), dual-purpose pens (elevated pens, length≈99 cm, height≈91 cm; 1%), floor pens (≈800 cm² per rabbit; 4%), hutches (1%), or a mix of different housing arrangements on the same farm (9%).

A small majority of the farmers (54%) raised rabbits in an all-in all-out system (management based on dual-purpose cage housing), while 35% of farmers raised rabbits in a fixed-housing system (the does remain in the same cage at weaning, and grower rabbits are housed in specific cages for growers) and the remainder used hybrid systems (both all-in all-out and fixed-housing systems in the same farm; 11%). Average number of does in the farms sample was 941 [738-1143].

The population characteristics in this quantitative study are representative of the reference population studied by FENALAP (2019) and the ITAVI (Lalaurette and Cadudal, 2019). Our population of rabbit farmers over-represented farmers aged under 40 yr old and under-represented farmers in the 40-55 age bracket compared to the reference population. Our sample over-represented rabbit farmers from Auvergne–Rhône-Alpes and under-represented farmers from Pays de la Loire and Normandy. For grower-stage housing, our sample slightly under-represented farms with hutches and multi-purpose or specific heightened cages.

Relation between interest in innovation and pro-change practices

The results for interest in innovation (INTERESTINOV) and pro-change practices (CHANGEPRACT) were strongly correlated (Chi-square: $P < 0.001$).

Table 3 shows that 20% ($n=16/78$) of rabbit farmers with a low INTERESTINOV score also had a low CHANGEPRACT score, while 19% ($n=15/78$) of rabbit farmers with a moderate INTERESTINOV score also had a moderate CHANGEPRACT score, and 22% ($n=17/78$) of rabbit farmers with a high INTERESTINOV score had a moderate CHANGEPRACT score, whereas 9% ($n=7/78$) of farmers with a high INTERESTINOV score also had high CHANGEPRACT score. None of the farmers with a high INTERESTINOV score had a low CHANGEPRACT score.

The strong link between interest in innovation and pro-change practices suggested that regardless of their interest in innovation, rabbit farmers were unlikely to introduce new practices or change their farm. This is consistent with Ducrot *et al.* (2018), who showed that without personal ambition or objectives to pursue, farmers will not develop or change their practices or their farm or implement innovations. Thus, the farmer is clearly the main driving force for any on-farm changes, rather than any other technicians or commercial advisors or civil society (Ducrot *et al.*, 2018).

Effects of technico-economic variables on rabbit farmers' receptivity to change

Most of the studied variables (Table 4) were independent of CHANGEPRACT and INTERESTINOV (61/83) (Table 5). Very few variables (3/83) were dependent on both INTERESTINOV and CHANGEPRACT. Some variables were dependent on INTERESTINOV only (7/83) or on CHANGEPRACT only (13/83).

Table 3: Relationship^a (%) between interest in innovation (INTERESTINOV) and pro-change practices (CHANGEPRACT).

Interest in innovation (INTERESTINOV)	Pro-change practices (CHANGEPRACT)		
	Low	Moderate	High
Low	20	9	4
Moderate	8	19	9
High	0	22	9
Total	28	50	22

^aThe variable Interest in innovation and Pro-change practices are correlated ($P < 0.001$; Cramer's $V = 0.75$).

Table 4: list of all variables in the questionnaire.

Technico-economic variables: Possession of welfare-friendly housing (without distinction between housing for reproducing does or for fatteners); number of females in the farm; existence of a rabbit production unit at the moment of farm creation; number of production units in the farm; year of installation; legal status of the farm; transferee of the farm at the time of retirement; borrowing in progress on the rabbit farm; number of buildings for rabbit farm; possession of tunnel as building; type of buildings on the rabbit farm; farming system (all-in all-out, fixed system or hybrid system); marketing mode; animal processing (meat-processing); number of partners on the rabbit farm; number of permanent employees on rabbit farms (part-time work or full-time work); production choice (growing rabbit production and/or breeder)

Social attributes: Other professions before becoming a farmer; possession of an agricultural qualification; spouse's level of education; farmer's level of agricultural qualification; setting up on farms within the family; socio-professional category of the farmer's father; socio-professional category of the farmer's mother; socio-professional category of the father-in-law; socio-professional category of the mother-in-law; professional experience on a farm (number of years); farmer's educational qualifications; age; young and old farmers (age class variable distinguishing between young and older farmers); gender of the farmer; farmer's residential status; marital status; distance between home and farm; distance from parents' residence; number of children living at home, number of children (total); number of siblings working on a farm; farmers' parents blue collar and/or employed; farmers' parents with a higher or middle occupation; farmers' parents with liberal or independent professions; index of the level of qualification within the farmer's couple; farmers' parents with agricultural profession; farmers' parents-in-law with agricultural profession

Internal motivations: Satisfaction with professional identity; appetite for knowledge; perception of the rabbit farm's future; seeking to improve the health dimension; seeking to improve the quality work dimension; seeking to improve the animal welfare dimension; seeking to improve the productivity and profitability dimension; perception of the future of the rabbit industry; taking pride in and making sense of the work; index of the farmer's position in relation to societal expectations (close or distant); seeking to improve product quality; quality of working life satisfaction index; index of satisfaction with the amount of free time left over from working in the rabbit farm; index of farmers' personal involvement in extra-professional life (association or group); index of farmers' involvement in their professional world; willingness to develop a new agricultural activity in addition to the rabbit farm (within the next 5 years)

External motivations: Perception of the consequences of the 'End the Cage Age' reform (2027) on the farmer's image; Discussion about animal welfare with friends and neighbours; estimation of the effects of societal expectations on the formation of new motivations; Frequency of thinking about stopping rabbit farming; adherence to certification schemes; disapproval of societal pressures; discussion about animal welfare with family; good social image of the farmer's profession (strong point of the professional activity); index of perception of the end of cages reform as a risk generally; index of perception of the consequences of the 'End the cage Age' legislation on the farmer and the animals; family resources; index of family tension around the farm's business; index of perceived effects of societal expectations on the industry; index of perceived effects of societal expectations on farmers and their animals (on the farm); opening the farm to visits; perception of the 'End of Cage Age' as a risk for the viability of rabbit farming; estimation of the negative consequences of societal expectations on rabbit farming; discussion on animal welfare with agricultural professionals; membership of an agricultural organisation; index of attachment to the producer group (degree of belonging to the producer group); frequency of visiting other rabbit farms

The only technico-economic variable linked to receptivity to change concerned animal housing, as high CHANGEPRAC scores were more frequent for rabbit farmers owning welfare-type housing such as structurally-enriched cages and elevated pens or floors. Rabbit farmers that own only alternative housings or a mix between conventional cages and alternative housings had higher pro-change practices scores.

Effects of sociodemographic variables on rabbit farmers' receptivity to change

The sociodemographic variables (social attributes, internal motivations and external motivations) were more often linked to CHANGEPRAC or INTERESTINOV than the technico-economic variables (21/64 vs 1/19 variables; Table 5). Nevertheless, the number of sociodemographic variables associated with receptivity to change was moderate for

Table 5: Number of technico-economic and sociodemographic variables having an effect (+) or not (-) on interest in innovation (INTERESTINOV) and/or pro-change practices (CHANGEPRACT).

INTERESTINOV & CHANGEPRACT (+/-) ^a / Types of variables	Sociodemographic				Total (%)
	Technico-economic	Social attributes	Internal motivation	External motivation	
INTERESTINOV - CHANGEPRACT -	18	23	7	13	61 (73%)
INTERESTINOV + CHANGEPRACT +	0	2 ^c	0	1 ^g	3 (4%)
INTERESTINOV + CHANGEPRACT -	0	0	3 ^e	4 ^h	7 (8%)
INTERESTINOV - CHANGEPRACT +	1 ^b	2 ^d	6 ^f	3 ⁱ	12 (15%)
Total (%)	19 (23%)	27 (33%)	16 (19%)	21 (25%)	83 (100%)

^aThe symbol '-' means independent and '+' means dependence with the independent variables.

^bList of variables: possession of welfare-friendly housing ($P < 0.001$).

^cList of variables: Other professions before becoming a farmer ($P < 0.05$); Possession of an agricultural qualification ($P < 0.05$).

^dList of variables: Spouse's level of education ($P < 0.05$); Farmer's level of agricultural qualification ($P < 0.05$).

^eList of variables: Satisfaction with professional identity ($P < 0.05$); Appetite for knowledge ($P < 0.001$), Perception of the rabbit farm's future ($P < 0.05$).

^fList of variables: Seeking to improve the health dimension ($P < 0.01$); Seeking to improve the quality-of-work dimension ($P < 0.001$); Seeking to improve the animal welfare dimension ($P < 0.001$); Seeking to improve the productivity and profitability dimension ($P < 0.001$); Perception of the future of the rabbit industry ($P < 0.05$); Taking pride in and making sense of the work ($P < 0.05$).

^gList of variables: Good social image of the farmer's profession (strong point of the professional activity) ($P < 0.05$).

^hList of variables: Perception of the consequences of the 'End the Cage Age' reform (2027) on the farmer's image ($P < 0.05$); Discussions about animal welfare with friends and neighbours ($P < 0.05$); Estimation of the effects of societal expectations on the formation of new motivations ($P < 0.05$); Frequency of thinking about stopping rabbit farming ($P < 0.05$).

ⁱList of variables: Adhesion to certification schemes ($P < 0.01$); Disapproval of societal pressures ($P < 0.05$); Discussion about animal welfare with family members (family members: farmer's parents, children, spouse) ($P < 0.05$).

both internal motivations (9/16), external motivations (8/21 variables) and social attributes (4/27). Sociodemographic variables were more often associated with CHANGEPRACT (11/64) than INTERESTINOV (7/64) or both (3/64). Internal motivation variables were more often associated with CHANGEPRACT (6/16) than INTERESTINOV (3/16). Conversely, most of the sociodemographic variables that were associated with CHANGEPRACT and/or INTERESTINOV (see footnote to Table 5) had a positive relationship, i.e. stronger values of one variable equated to stronger values of the other variable. Below, we detail only the more complex relationships (also Figure 1) for social attributes, internal motivations and external motivations.

Influence of social attribute variables on rabbit farmers' receptivity to change

The four social attribute variables associated with receptivity to change are listed in Table 5 (footnotes c and d). The farmers that had not had a linear farming career, i.e. coming into farming from another job ('Other profession before becoming farmer'), more frequently had low INTERESTINOV and CHANGEPRACT scores than farmers with a more linear career. Moreover, farmers without agricultural qualifications more frequently had low INTERESTINOV (56%, $n=9/16$) and CHANGEPRACT (50%, $n=8/16$) scores, while only 27% ($n=17/62$) of farmers with at least one agricultural qualification had a low INTERESTINOV score. Farmers with higher level agricultural qualifications (Figure 1: F) mainly had moderate CHANGEPRACT score (58%, $n=18/31$). Farmers with level-three agricultural qualifications had moderate or high CHANGEPRACT scores (56%, $n=10/18$ and 39%, $n=7/18$, respectively). Therefore, the rabbit farmers with a moderate-level agricultural qualification (level 3, equivalent to a UK National Vocational Qualification) or higher level of agricultural qualification (level 5 or higher, equivalent to a National Diploma, Bachelor's degree or Postgraduate) had higher pro-change practices score than those without a qualification. These results suggested that possession of at least one agricultural diploma is a driving force for pro-change practices. Thus, agricultural education can provide farmers with the knowledge and foundations to develop and adapt their farm. Education provides inclination for risk-taking (Balogun *et al.*, 2012) and thus the confidence to adopt new practices and technologies (Ndamani and Watanabe, 2016; Brown and Roper, 2017). Surprisingly, farmers with a moderate-level agricultural qualification (level-3 diploma) had adopted pro-change practices slightly more frequently than those with a high

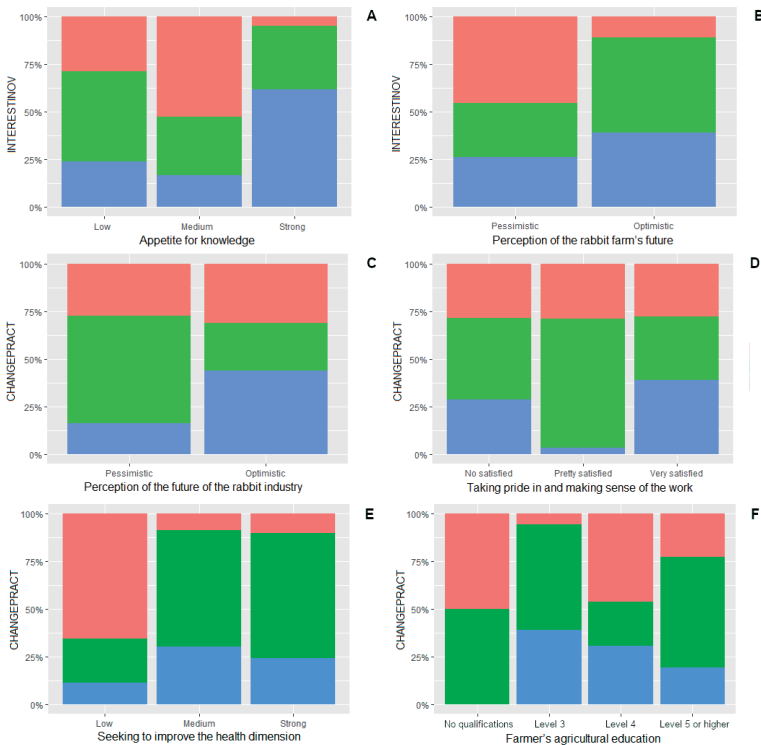


Figure 1: Effects of (A) appetite for knowledge and (B) perception of the rabbit farm's future on interest in innovation (INTERESTINOV, $P < 0.05$, $V > 0.25$), and effects of (C) perception of the future of the rabbit industry, (D) taking pride in and making sense of the work, (E) seeking to improve the health dimension, and (F) farmer's agricultural education on pro-change practices (CHANGEPRRACT, $P < 0.05$, $V > 0.25$). ■ Low; ■ Moderate; ■ High.

agricultural qualification (level-5 degree). This same trend was previously found among poultry farmers in Nigeria (Balogun *et al.*, 2012) due to their higher propensity for risk-taking.

The 'Level of education of the farmer's spouse' variable showed that 73% of rabbit farmers whose spouse 'had a level-5 qualification' had a moderate CHANGEPRRACT score and 53% of farmers whose spouse 'had a qualification above level 5' had a high CHANGEPRRACT score, 44% of farmers whose spouse 'had a level 3 or lower qualification' had a moderate CHANGEPRRACT score, and 42% of farmers whose spouse 'had a level-4 qualification' had a low CHANGEPRRACT score. The spouse's influence could be mediated through the economic and/or cultural resources available to the farmers. Cultural resources refer here to capacity for self-reflexivity and possibly receptivity to animal welfare and/or societal expectations. A previous study on Swedish farmers and their spouses found that a higher level of education correlated with higher interest in environmental and animal welfare issues (Lund *et al.*, 2004). Economic resources here refer to the spouse having a high and/or guaranteed salary that can provide the rabbit farmer with the financial security to make changes (Hennessy and O'Brien, 2008).

Influence of internal motivation variables on rabbit farmers' receptivity to change

The 9 internal motivation variables associated with receptivity to change are listed in Table 5 (footnotes e and f). Farmers with a moderate 'Appetite for knowledge' score (Figure 1: A) mainly had a low INTERESTINOV score (53%,

n=19/36) and farmers with a low 'Appetite for knowledge' score mainly had a moderate INTERESTINOV score (48%, n=10/21). However, farmers with a high 'Appetite for knowledge' score and a high INTERESTINOV score were over-represented (62%, n=13/21).

The variables themed as 'Seeking to improve the [health, animal welfare, quality of work, productivity and profitability] dimension' were all associated with CHANGEPRACT. The farmers with a moderate or a high score on 'Seeking to improve the health dimension' (Figure 1: E) had a moderate CHANGEPRACT score (61%, n=14/23 and 65%, n=19/29, respectively). Conversely, farmers with a low score on 'Seeking to improve the health dimension' had a low CHANGEPRACT score (65%, n=17/26). Regarding the 'Taking pride in and making sense of the work' variable (Figure 1: D), 68% (n=21/31) of farmers who self-declared as pretty satisfied had a moderate CHANGEPRACT score and 39% (n=7/18) of the farmers who self-declared as very satisfied had a high CHANGEPRACT score. However, the proportion of farmers having a low CHANGEPRACT score was similar in the three groups (not satisfied, pretty or very satisfied) of the 'Taking pride in and making sense of the work' variable (27%). Farmers with a pessimistic 'Perception of the future of the rabbit farm' (Figure 1: B) had a low INTERESTINOV score (45%, n=19/42) and farmers with a more optimistic perception had a moderate INTERESTINOV score (50%, n=9/18). The proportion of farmers with an optimistic perception of the future of the rabbit farm and a high INTERESTINOV score was higher (39%, n=7/18) than the proportion of farmers with a pessimistic perception (26%, n=11/42). Farmers with a pessimistic 'Perception of the future of the rabbit industry' (Figure 1: C) had a moderate CHANGEPRACT score (56%, n=35/62) whereas farmers with an optimistic perception of the future of the rabbit industry had high CHANGEPRACT score (44%, n=7/16). These results showed a link between appetite for knowledge, i.e. the farmer's inclination to seek out and appropriate new information, insight or knowledge, and interest in innovation. The farmer's curiosity and receptiveness to new knowledge or information plays a role in the interest for innovation and can be explained by interest in novelty and investigating new knowledge, techniques and technologies, etc. This relationship to knowledge is an important factor, as it enables the farmer to adapt to evolutions in certain tasks and the wider agricultural world. Jacques-Jouvenot (2014) showed that a difficult relationship with knowledge could be a constraint, and Richardson (2005) demonstrated that inclination to get informed and learn new knowledge is part of the process of searching out knowledge and innovation. Internal motivation could be supported or strengthened by external motivation.

Our results also show that setting improvement objectives for one or more aspects of their rabbit production system was a positive driver of change in the farmers' practices. Their aims focused on improving production performance, working conditions, animal welfare or animal health. The French rabbit farmers who showed strong pro-activeness on making such improvements had higher pro-change practice scores than those who showed pro-activeness on making improvements (whatever the target dimension). Our qualitative study (Table 1) also allowed us to confirm that rabbit farmers wanted to improve their farm and practices for both financial reasons and non-financial reasons, as previously shown for a variety of farmer communities such as Norwegian pig farmers, Swedish dairy farmers or other European farmers (Borgen and Aadnegard Skarstad, 2007; Prager and Posthumus, 2010; Owusu-Sekyere *et al.*, 2022). In rabbit farms, the financial reasons typically concerned motivation to improve profitability, save money by cutting back or stopping costly practices such as buying antibiotics or feeds with antibiotics, or to penetrate a market segment and capture the associated price premium. The non-financial reasons were a driver for change and innovation by prompting farmers to find ways to improve working conditions by reducing the drudgery of the work and/or the time required for work tasks. The rabbit farmers also indicated that improvement could focus on animal welfare, through the installation of floor pens and plastic net floors that avoid injuries to footpads (Rosell and de la Fuente, 2009; Rosell and de la Fuente, 2013). We find that societal incentives have less effect on bringing about change in farmers' practices, but that desire to change is a key prerequisite to the decision to progress (Ducrot *et al.*, 2018). However, injury to footpads entails an economic cost, so the rationale for meeting societal expectations around animal welfare (non-financial reasons) may stem from farmer's economic (financial) interest (Borges *et al.*, 2019).

The rabbit farmer's image of their professional activity, i.e. their general satisfaction with their farm and the sense of pride that the rabbit farmer gains from their profession, plays a driving role in farmers' receptivity to change. In fact, more positive perceptions of professional identity correlated to a higher 'interest in innovation' score. Along the same lines, taking pride in and making sense of the work was a determining factor in farmers' pro-change practices. The self-identity as a professional farmer determines the farmer's intent to adopt innovation.

Finally, the farmer's perception of the future of their farm and the rabbit industry as a whole affected their receptivity to change. Rabbit farmers with an optimistic vision of the future scored higher on pro-change practices or interest in innovation. Perception of the future of their farm and the rabbit industry as a whole proved to be both a motivation and a barrier for the farmers surveyed. The interviews held for the qualitative study underlined inability to plan ahead as resistance to change. Instability of the rabbit market, the changes in the rabbit sector, the decrease in number of rabbit farmers from year to year and uncertainty about whether or not to take over the farm were all mentioned as barriers to change. A pessimistic view of the future is therefore linked to this uncertainty. Wellbrock *et al.* (2009) showed that Croatian pig farmers' future perspectives constituted both a lever for change and a barrier to change. Farmers can respond to uncertainty by adopting various patterns of behaviour: waiting without changing their way of working in response to the vagaries of crises or market trends crises, or else making do with the situation and trying to make continuous progress so as not to get left behind (Lemery *et al.*, 2005). For this reason, some farmers wait for the right time to decide on any changes to make.

Influence of external motivation variables on rabbit farmers' receptivity to change

Five variables (Table 5) classified as external motivations were linked to one or both of the two dependent variables characterising receptivity to change. The external motivation variables were slightly more strongly associated with the INTERESTINOV (4/21) score than the CHANGEPRACT score (3/21). There was only one external motivation variable, 'Good social image of the farmer's profession' (a strong point of the professional activity), that was associated with both the INTERESTINOV and CHANGEPRACT scores.

The 'Discussion about animal welfare with family members' variable was linked to CHANGEPRACT while the 'Discussion about animal welfare with friends and neighbours' variable was linked to INTERESTINOV. The more the rabbit farmers discussed animal welfare with family members or friends and neighbours, the more their receptivity to change was affected: the rabbit farmers who discussed animal welfare with all family members had high CHANGEPRACT scores, while the farmers who discussed animal welfare with friends and neighbours had high INTERESTINOV scores. The two variables concerning the effects of societal incentives, i.e. 'Perception of the consequences of the "end the cage age" reform (2027) on the farmer's image' and 'Estimation of the effects of societal expectations on the formation of new motivations' were linked to INTERESTINOV whereas the variable 'Disapproving of societal pressures' was linked to CHANGEPRACT. Farmers with more positive perceptions of societal incentives or future reforms were more likely to have high CHANGEPRACT score.

The 'Adhesion to certification standards' variable was linked to CHANGEPRACT. Among rabbit farmers working under standard certification (0 engagement in quality control or quality label schemes), 52% had a low CHANGEPRACT score and 11% had a high CHANGEPRACT score, whereas 65% of rabbit farmers engaged in a quality label had a moderate CHANGEPRACT score and 24% had a high CHANGEPRACT score. Furthermore, 36% of the farmers engaged in at least two quality control schemes 36% had a high CHANGEPRACT score, which was 12 points higher than those subscribing to a quality label only.

These results showed that rabbit farmers are concerned about their social image. More specifically, farmers who consider that they have a good social image have high interest in innovation score and high pro-change practice score. In some of the interviews, rabbit farmers mentioned that media campaigns drawing attention to rabbit housing conditions may result in them having a poor image of their profession. This situation may prevent them from engaging in the transition. In contrast, a good social image is a driving force to change practices, because rabbit farmers want a positive social image of their profession (Michel-Guillou and Weiss, 2007) and are increasingly concerned about society's negative perceptions (Couzy and Dockes, 2008; Borges *et al.*, 2019).

The results also suggested that the farmers are close to their family environment and that this relational proximity may influence the farmer's decisions and practices. The family, i.e. the farmer's parents, spouse and children, is one of the most important socialising spaces (Darmon, 2016). Thus, having family discussions around animal welfare could challenge the farmer's practices and encourage them to move towards greater animal welfare. The family can influence the farm manager's decisions, whether in terms of organising working hours (Billon and Pomiès, 2006; Dufour and Dedieu, 2010) or in terms of the sense and meaning given to work on the farm (Fiorelli *et al.*, 2014). The spouse may influence the decisions and orientations of the farm through emotional arguments that take priority over

financial interests and reasons (Lepage *et al.*, 2014). Rabbit farmers that care about their family members are likely to listen to their arguments and make decisions accordingly (Borges *et al.*, 2019).

Unexpectedly, more distant relationships from the farmer, such as friends and neighbours, were found to influence interest in innovation, especially through discussions around animal welfare. Farmers may take decisions in response to remarks from neighbours (Borges *et al.*, 2019) and friends, such as decisions to address negative aspects of farming such as farm smells (Hansson, 2012). Note that these are non-financial motivations. These farmers thus adopt a kind of 'customer management' approach, pro-actively addressing 'customer' demands to resolve criticism from of the local community and adapt their practices as far as possible (Granjou and Mauz, 2009).

Although the quantitative study did not reveal a link between level of attachment to a producer group and receptivity to change, the qualitative study found that support from actors in the rabbit sector was a lever for change. Belonging to a producer group means getting the support of technicians who can suggest making changes, or having the support from the community to innovate. Producer organisations play a decisive role in the evolution of farmers' practices (Commandeur, 2006) through specifications or professional training (Mathé *et al.*, 2017) or through direct price premiums (de Greef and Rommers, 2021) such as those guaranteed by the slaughterhouse.

The results showed that membership in a label scheme (quality label, new quality mark of the slaughterhouse or environmental value certification) influenced or even forced the rabbit farmers to develop new practices in order to adapt to the rules of the quality procedure. Currently, some brands in France, such as Lapin & Bien, operate as a label (<https://lapinetbien.com/>) and inform consumers on the production system used (floor pens). An animal welfare label for livestock products emerged in France in December 2018. Based on an evaluation adapted from the Welfare Quality Project[®], it gives a welfare score from A (best level) to E (lowest level) based on more than 230 criteria. However, this label scheme has not yet become mainstream and is only based on voluntary participation.

Farmers' receptivity to societal expectations can influence receptivity to change. Our results showed that the perception of the future 'End the Cage Age' reform (Rojek, 2021) was linked to the farmers' interest in innovation. Societal incentives create new motivations for some rabbit breeders and likewise increase their interest in innovation. The rabbit farmers' stances on societal pressures determined their practices. Thus, a negative perception or opposition to these external elements reduced interest in innovation and readiness to adopt change. In addition, the qualitative study emphasised stance on social expectations as both a lever for and barrier to change. Some rabbit farmers agreed with societal expectations and the demands of animal welfare organisations, and therefore responded to them or even sometimes pro-actively adopted changes in advance. Conversely, other farmers were defiant of societal demands and refused to change. Our data showed that these demands may be perceived as illegitimate, because they come from non-professionals (who are not familiar with livestock farming) who will have a different conception of animal welfare, or else the pro-welfare solutions proposed give rise to fears (incompatibility with current farming systems, technical limitations, increased drudgery of the work, poor production performance and profitability, etc.). The farmer's perception of social pressures determines their intention to adapt to change (Borges *et al.*, 2019). Disagreement between farmers and citizens or animal welfare associations/societal expectations can explain resistance to social pressures. Farmers are more receptive and willing to address the issue of animal welfare in a trusted relationship (family circle, see above) or with a person that they know and recognise as legitimate, such as an expert with qualifications and experience (Croyle *et al.*, 2019). We thus see two types of stance on societal expectations emerge: farmers seeking to improve their practices, who are concerned about the care of animals they are housing but feel that consumers fail to recognise their efforts; and farmers who hold a stance that is resistant to criticism, who employ economic rhetoric (Delanoue *et al.*, 2018). Farmers who self-declare as aligned with societal incentives share common conceptions of animal welfare (Dockès and Kling-Eveillard, 2006; de Greef *et al.*, 2016), want to address societal concerns (Wells *et al.*, 2010) and have already made changes to their farms to meet expectations (Delanoue *et al.*, 2018).

CONCLUSION

Societal incentives are pushing the rabbit industry and rabbit farms to evolve towards greater consideration for animal welfare. We are well aware of the technical and economic factors involved in changes in rabbit farming, but

few studies have focused on the sociodemographic factors affecting rabbit farmers' decisions in terms of innovation and changes in practices. This study shows that sociodemographic factors, namely internal and external motivations, have a greater influence on French rabbit farmers' attitudes to change than technical-economic factors. Internal motivations mainly influence the pro-change practices of rabbit farmers, while external motivations mainly have an effect on interest in innovation.

Given these findings, to support the French meat rabbit industry and rabbit farmers in making pro-welfare transition, transition support systems should be thought out in terms of farmer attributes (described here with sociodemographic variables) rather than farm attributes (described here with technico-economic variables). To facilitate pro-welfare changes, we advocate focusing on the positive consequences that the change can bring for rabbit farmers, in other words, the farmer's own interests (internal motivations) such as health of their animals, organisation of their work and profitability of their enterprise. However, it is also important for the rabbit sector to provide rabbit farmers with support and coaching on how to leverage price premiums, innovation trials and other solutions to help implement pro-welfare innovation.

Acknowledgements: This work was funded by the CLIPP, the Occitania Region, ERDF support (Living Lab Lapins project) and the INRAE (SANBA metaprogramme). We thank the members of the Living Lab Lapins consortium for testing the online questionnaire, and the CLIPP and FENALAP for distributing the online questionnaire to rabbit producer groups. We also thank the French rabbit farmers surveyed for their contribution to this work.

REFERENCES

- Adam C. 2017. Étude des pratiques en antibiothérapie dans la filière poulet de chair Label Rouge. *Doctoral dissertation. Université Clermont Auvergne, Clermont-Ferrand, France.* <https://tel.archives-ouvertes.fr/tel-03092261>
- Balogun S.K., Ojedokun O., Macaulay O.I. 2012. Psychological factors predicting risk-taking propensity of poultry farmers. *Agrosearch*, 12: 1-19. <https://doi.org/10.4314/agrosh.v12i1.1>
- Billon P., Pomiès D. 2006. Robotic milking 15 years after its first implementation on commercial farms. In *Proc.: 13e Rencontres Recherches Ruminants, December 2006. Paris, France*, 1:143-150.
- Borgen S.O., Skarstad G.A. 2007. Norwegian pig farmers' motivations for improving animal welfare. *Br. Food J.*, 109: 891-905. <https://doi.org/10.1108/00070700710835705>
- Borges J.A.R., de Faria Domingues C.H., Caldara F.R., da Rosa N.P., Senger I., Guidolin D.G.F. 2019. Identifying the factors impacting on farmers' intention to adopt animal friendly practices. *Prev. Vet. Med.*, 170: 1-7. <https://doi.org/10.1016/j.prevetmed.2019.104718>
- Brown P., Roper S. 2017. Innovation and networks in New Zealand farming. *Aust. J. Agric. Resour. Econ.*, 61: 422-442. <https://doi.org/10.1111/1467-8489.12211>
- Chanvrlil-Ligneel F., Le Hay V. 2014. Méthodes statistiques pour les sciences sociales. *Ellipses, Paris, France*, 261
- Chauvin C., Le Bouquin S., Sanders P. 2012. Usage des antibiotiques en filières porcine, avicole et cunicole en France. Résultats d'enquêtes. *Bulletin Épidémiologique, ANSES*, 53: 12-15. Available at <https://hal-anses.archives-ouvertes.fr/hal-00751500> Accessed November 2022.
- Clearfield F., Osgood B.T. 1986. Sociological aspects of the adoption of conservation practices. Soil Conservation Service staff paper, Washington, D.C. 1:16. <https://doi.org/10.1037/e668232007-001>
- CLIPP interprofession du lapin. 2018. Plan de filière lapin 2018–2022. Comité Interprofessionnel du Lapin de chair. 2018. Paris, France, 1-24. Available at <https://agriculture.gouv.fr/telecharger/88269> Accessed November 2022.
- Commandeur M., Le Guen R., Dourmad J., Casabianca F. 2006. Diversity in pig farming styles in Brittany (France). An approach in Côtes d'Armor. In *Proc: 38e Journées de la recherche porcine en France, 31 January-2 February, 2006. Paris, France*. 1:247-254.
- Couzy C., Dockes A. C. 2008. Are farmers businesspeople? Highlighting transformations in the profession of farmers in France. *Int. J. Entrepreneurship Small Bus.*, 6: 407-420. <https://doi.org/10.1504/IJESB.2008.019135>
- Croyle S.L., Belage E., Khosa D.K., LeBlanc S.J., Haley D.B., Kelton D.F. 2019. Dairy farmers' expectations and receptivity regarding animal welfare advice: A focus group study. *J. Dairy Sci.*, 102: 7385-7397. <https://doi.org/10.3168/jds.2018-15821>
- Darmon M., 2016. La socialisation. *Armand Colin, Paris, France*, 128.
- de Greef K.H., Rommers J.M., Lavrijzen S. 2016. Market and society driven innovations in the Dutch rabbit production system. In *Proc: 11th World Rabbit Congress, 15-18 June, 2016. Qingdao, China*. 1:953-956.
- de Greef K.H., Rommers J.M. 2021. The Dutch route to improve commercial rabbit welfare – rather collectively than by law. In *Proc: 12th World Rabbit Congress, 3-5 November, 2021. Nantes, France*. 1:1-4.
- de Singly F. 2020. L'exploitation du questionnaire. In: de Singly. (Dir.) *Le questionnaire. Armand Colin. Malakoff, France*, 88-122.
- Delanoue E., Dockès A.C., Chouteau A., Philibert A., Magdelaine P., Roguet C. 2017. Consumers and citizens' opinions and expectations about livestock farming. A quantitative survey. In *Proc: 49e Journées de la Recherche Porcine, 31 January-1 February, 2022. Paris, France*. 1: 295-300.
- Delanoue E., Dockès A.C., Chouteau A., Roguet C., Philibert A. 2018. Social acceptability of French livestock production: debated issues and controversies on livestock production, points of view of multiple stakeholders. *INRA Prod. Anim.*, 31: 51-68. <https://doi.org/10.20870/productions-animales.2018.31.1.2203>

- Dockes A.C., Kling-Eveillard F. 2006. Farmers' and advisers' representations of animals and animal welfare. *Livest. sci.*, 10: 243-249. <https://doi.org/10.1016/j.livsci.2006.05.012>
- Ducrot C., Adam C., Beaugrand F., Belloc C., Bluhm J., Chauvin C., Rousset N. 2018. Contribution of sociology to the study of the decrease of antimicrobial use on farms. *INRA Prod. Anim.*, 31: 307-324. <https://doi.org/10.20870/productions-animales.2018.31.4.2395>
- Dufour A., Dedieu B. 2010. Conception of working time and organization in dairy farms. *Cah. Agric.*, 19: 377-382. <https://doi.org/10.1684/agr.2010.0422>
- EFSA AHAW Panel (EFSA Panel on Animal Health and Welfare), Saxmose Nielsen S., Alvarez J., Bicot D.J., Calistri P., Depner K., Drewe J.A., Garin-Bastuji B., Gonzales Rojas J.L., Gortazar Schmidt C., Michel V., Miranda Chueca M.A., Roberts H.C., Sihwonon L.H., Spooler H., Stahl K., Velarde Calvo A., Vilrop A., Buijs S., Edwards S., Candiani D., Mosbach-Schulz O., Van der Stede Y., Winckler C. 2020. Scientific Opinion on the health and welfare of rabbits farmed in different production systems. *EFSA J.*, 18: 1-96. <https://doi.org/10.2903/j.efsa.2020.5944>
- FENALAP. 2019. Enquête FENALAP Bilan 2019, *Fédération Nationale des groupements de producteurs de lapins, Année 2019, Paris*.
- Fiorelli C., Porcher J., Dedieu B. 2014. Famille et élevage: sens et organisation du travail. In: *Gasselin P., Choisis J-P., Petit S., Purseigle F., Zasser-Bedoya S. (Dir.) L'agriculture en famille: travailler, réinventer, transmettre, EDP Sciences INRA Institut National de la Recherche Agronomique, Les Ulis, France, 183-198.* <https://doi.org/10.1051/978-2-7598-1192-2.c011>
- Fortané N., Ducrot C., Paul M. 2019. Sociologie des usages d'antibiotiques en élevage avicole. In *Proc: 13e Journées de la Recherche Avicole et Palmipèdes à Foie Gras, 20-21 March, 2019, Tours, France. 1: 5*
- Gomant F., Beddiar A. 2018. Etude sur l'image de la viande de lapin et de la filière cynicole en 2018. *IFOP July, 2018. 1-11*.
- Granjou C., Mauz I. 2009. Cattle farmers and their neighbours. Study of the new professional discourses of a contested profession. *Rev. Agric. Environ. Stud.*, 90: 215-235. <https://doi.org/10.3406/reae.2009.1969>
- Hansson H., Ferguson R., Olofsson C. 2012. Psychological constructs underlying farmers' decisions to diversify or specialise their businesses—an application of theory of planned behaviour. *J. Agric. Econ.*, 63: 465-482. <https://doi.org/10.1111/j.1477-9552.2012.00344.x>
- Heezen J. 2020. End the cage age: Looking for alternatives. Policy Department for Citizens' Rights and Constitutional Affairs. November 2020, PE 658.539. Available at [https://www.europarl.europa.eu/RegData/etudes/STUD/2020/658539/IPOL_STU\(2020\)658539_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2020/658539/IPOL_STU(2020)658539_EN.pdf) Accessed November 2022.
- Hennessy T., O'Brien M. 2008. Is off-farm income driving on-farm investment? *J. Farm Manage.*, 13: 235-246.
- Howley P., Donoghue C.O., Heanue K. 2012. Factors affecting farmers' adoption of agricultural innovations: A panel data analysis of the use of artificial insemination among dairy farmers in Ireland. *J. Agric. Sci.*, 4: 171-179. <https://doi.org/10.5539/jas.v4n6p171>
- Huang Y., Bréda J., Savietto D., Debrusse A.M., Bonnemère J.M., Gidenne T., Combes S., Fortun-Lamothe L. 2021. Effect of housing enrichment and type of flooring on the performance and behaviour of female rabbits. *World Rabbit. Sci.* 29: 275-285. <https://doi.org/10.4995/wrs.2021.15848>
- Huang Y., Breda J., Savietto D., Debrusse A-M., Combes S., Fortun-Lamothe L. 2021. Part-time grouping of rabbit does in enriched housing: effects on performances, injury occurrence and enrichment use. *Animal.* 15: 1-7. <https://doi.org/10.1016/j.animal.2021.100390>
- Ingrand S., Bardley H., Brossier J., Dedieu B., Degrange B., Lemery B., Pasdermadjian P. 2007. Flexibility of suckler cattle farms in the face of uncertainty within the beef industry: a proposed definition and an illustration. *J. Agric. Educ. Ext.*, 13: 39-48. <https://doi.org/10.1080/13892240601162098>
- Jacques-Jouvenot D. 2014. A novel hypothesis on suicide among livestock farmers: the relationship to professional knowledge. *Etud. Rurales*, 193: 45-60. <https://doi.org/10.4000/etudesrurales.10006>
- Jackson K., Bazeley P. 2019. *Qualitative Data Analysis With Nvivo. SAGE Publications Ltd. 376*.
- Lalaurette C., Cadudal F. 2019. Evaluation de la capacité d'adaptation des élevages cynicoles français aux mutations sociétales et économiques. *ITAVI. September 2019. 1-52*.
- Le Bouquin S., Rouxel G., Mihoc E., Chauveau V., Terrade F., Chauvin C. 2013. Human factors and antibiotic use in rabbit production: A study of some psychological determinants. In *Proc: 15e Journées de la Recherche Cynicole, 19-20 November, 2013. Le Mans, France. 1: 115-119*.
- Lemery B., Ingrand S., Dedieu B., Dégrange B. 2005. Beef cattle farmer's strategies in the face of uncertainty. *Econ. Rurale*, 288: 57-69. <https://doi.org/10.4000/economierurale.2718>
- Lepage F., Couderc J.P., Perrier J.P. 2014. Determinants of investment decisions in dairy farms. An approach using the governance theory. *Econ. Rurale*, 341: 6-24. <https://doi.org/10.4000/economierurale.4301>
- Liu T., Bruins R.J., Heberling M.T. 2018. Factors influencing farmers' adoption of best management practices: A review and synthesis. *Sustainability*, 10: 1-26. <https://doi.org/10.3390/su10020432>
- Lund V., Hemlin S., White J. 2004. Natural behavior, animal rights, or making money—A study of Swedish organic farmers' view of animal issues. *J. Agric. Environ. Ethics*, 17: 157-179. <https://doi.org/10.1023/B:JAGE.0000017393.31486.c2>
- Martin O. 2020. Concevoir et préparer les variables nécessaires à l'analyse. In: *L'analyse quantitative des données. Armand Colin, Malakoff, France, 47-62*.
- Mathé S., Rey-Valette H., Chia E., Aubin J. Fontaine P. 2017. Determinants of fishfarmer aptitudes for eco-innovation related to ecological intensification. Examples from France and Brazil. *Rev. Francaise Gest.*, 262: 51-64. <https://doi.org/10.3166/rtg.2016.00083>
- Mbutu E. 2013. Factors influencing rabbit farming: A case of rabbit production project in Abothoguichi West Division, Meru County, Kenya. *Doctoral dissertation. University of Nairobi. Nairobi, Kenya. http://hdl.handle.net/11295/63559*
- Michel-Guillou E., Weiss K. 2007. Representations and behaviours of farmers with regard to sustainable development: A psycho-environmental approach. In: *Larson A. B. (Ed.) Sustainable development research advances. Nova Science Publishers, Inc, New York, USA, 207-221*.
- Ndamani F., Watanabe T. 2016. Determinants of farmers' adaptation to climate change: A micro level analysis in Ghana. *Sci. Agric.*, 73: 201-208. <https://doi.org/10.1590/0103-9016-2015-0163>
- Nmadu J.N., Sallawu H., Omojoso B. V. 2015. Socio-economic factors affecting adoption of innovations by cocoa farmers in Ondo State, Nigeria. *Eur. J. Manag. Bus. Econ.*, 3: 58-66.

- Olina Bassala J.P., Dugué P., Granié A.M., Vuningah M. 2015. Agricultural practices and farmer's perceptions of using herbicides in familial farms in north-Cameroon area. *Int. J. Adv. Stud. Res. Africa*, 6: 94-107.
- Owusu-Sekyere E., Hansson H., Telezhenko E. 2022. Use and non-use values to explain farmers' motivation for the provision of animal welfare. *Eur. Rev. Agric. Econ.*, 49: 499-525. <https://doi.org/10.1093/erae/jbab012>
- Ozor N., Madukwe M. C. 2005. Obstacles to the adoption of improved rabbit technologies by small scale farmers in Nsukka Local Government Area of Enugu State. *Agro. Sci.*, 4:70-73. <https://doi.org/10.4314/as.v4i1.1527>
- Paillé, P. 1994. L'analyse par théorisation ancrée. *Cahiers de recherche sociologique*, 23,147-181. <https://doi.org/10.7202/1002253ar>
- Paillé P., Mucchielli A. 2012. Chapitre 11 - L'analyse thématique. In: Paillé P., Mucchielli A. (Dir.) *L'analyse qualitative en sciences humaines et sociales*. Armand Colin, Paris, France, 231-314. <https://doi.org/10.3917/arco.paill.2012.01>
- Prager K., Posthumus H. 2010. Socio-economic factors influencing farmers' adoption of soil conservation practices in Europe. In: Napier T. L. (Ed.) *Human Dimensions of Soil and Water Conservation: A Global Perspective (Agriculture Issues and Policies)*. Nova Science Publishers, Inc. New York, USA, 203-223.
- R Core Team. 2020. R: A language and environment for statistical computing. *R Foundation for Statistical Computing, Vienna, Austria*. <https://www.R-project.org>
- Richardson M. 2005. À la recherche de savoirs perdus? Expérience, innovation et savoirs incorporés chez des agriculteurs biologiques au Québec. *Vertigo-la revue électronique en sciences de l'environnement*, 6: 1-8. <https://doi.org/10.4000/vertigo.2926>
- Rojek B. 2021. European Citizens' Initiative: 'End the cage age'. *EPRS. June 2021, PE 690.636*.
- Rosell J.M., De la Fuente, L.F. 2009. Effect of footrests on the incidence of ulcerative pododermatitis in domestic rabbit does. *Anim. Welf.*, 18:199-204.
- Rosell J.M. De la Fuente L.F. 2013. Assessing ulcerative pododermatitis of breeding rabbits. *Animals*, 3: 318-326. <https://doi.org/10.3390/ani3020318>
- Serem J.K., Wanyoike M.M., Gachuri C.K., Mailu S.K., Gathumbi P.K., MwanzaR. N., Borter D.K. 2013. Characterization of rabbit production systems in Kenya. *J. Agric. Sci. Appl.*, 2: 155-159. <https://doi.org/10.14511/jasa.2013.020304>
- Singha A.K., Baruah M.J., Bordoloi R., Dutta P., Saikia U.S. 2012. Analysis on influencing factors of technology adoption of different land-based enterprises of farmers under diversified farming system. *J. Agric. Sci.*, 4: 139-146. <https://doi.org/10.5539/jas.v4n2p139>
- Ume S.I., Ezeano C.I., Onwujiariri E.B. 2018. Effect of climate change on rabbit production and choice of adaptation coping strategies by smallholder farmers in Anambra State, Nigeria. *Int. J. Innov. Agric. Sci.*, 2: 161-173.
- Verburg R., Rahn E., Verweij P., Van Kuijk M., Ghazoul J. 2019. An innovation perspective to climate change adaptation in coffee systems. *Environ. Sci. Policy*, 97: 16-24. <https://doi.org/10.1016/j.envsci.2019.03.017>
- Wellbrock W., Oosting S.J., Bock B.B., Bela Njari B.A., Dobranić V. 2009. Low motivation and unawareness in small farmers as an obstacle for implementation of the EU pig welfare rules. *Ital. J. Anim. Sci.*, 8: 199-201. <https://doi.org/10.4081/ijas.2009.s3.199>
- Wells A.E., Sneddon J., Lee J.A., Blache D. 2011. Farmer's response to societal concerns about farm animal welfare: The case of mulesing. *J. Agric. Environ. Ethics*, 24: 645-658. <https://doi.org/10.1007/s10806-010-9284-0>