Conclusion
10. Conclusion & Discussion

The central element of this thesis was the research program Seeking Sociable Swine. This was a transdisciplinary Dutch program directed at animal welfare in pig production. The initial aim of the program was to increase our knowledge about the positive and negative social interactions between pigs and their consequences for pig welfare and husbandry. A second aim was to investigate the consequences of a novel breeding strategy: does selection for pigs that have a heritable beneficial effect on the growth of their group mates indirectly lead to improved social interactions? The third aim, and topic of this thesis, was to bring the societal response to this animal welfare project to the research team, with the intention of synchronizing research questions arising and decisions with stakeholder input. To this end, a multi-stakeholder learning process was initiated about the novel breeding strategy and alternatives to improve social interactions among pigs.

The dynamics of mutual learning as an effect of this learning process were studied at a micro-level in three different situations, i.e. transdisciplinary team research (between a transdisciplinary Ph.D. student, animal Ph.D. students, senior researchers and societal stakeholders); knowledge exchange (between animal researchers and pig farmers); and frame reflection (by pig farmers and urban citizens). In this chapter, the overall conclusions of this thesis are presented, by answering the main research question:

How to design multi-stakeholder learning processes, so they will facilitate an interactive innovation process and support mutual learning with respect to animal welfare in pig production?

The identified barriers and achievements of mutual learning are summarized first (sections 10.1 and 10.2), followed by overall conclusions that can be drawn from these results (section 10.3). Additionally, transdisciplinary team research is examined by sharing and discussing first-hand experiences. The chapter ends with a discussion of the validity of this research (section 10.4) and by mapping future challenges and related strategies in finding shared solutions for animal welfare.
10.1 Barriers to mutual learning (summary of results)

The results showed that the intention to learn does not automatically lead to learning. In each situation, there were various barriers (small and large) caused by differences in the visions, practices, and underlying values and interests of stakeholder groups. The content and the package of a message were also influential, as were institutional factors. We aimed to provide insights into how to deal with these barriers, by describing as precisely as possible how they can hamper the learning process and how these given differences and factors can be taken as challenges to stimulate mutual learning.

10.1.1 Transdisciplinary team research

Chapter 5 described the process of mutual learning in transdisciplinary team research. In a four-year research program, animal behaviour researchers (3 seniors and 2 PhD students), geneticists (3 seniors and 1 PhD student) and transdisciplinary researchers (1 senior and 1 PhD student) studied how the social behaviour of pigs can be improved in combination with societal acceptance. A multi-stakeholder learning process was undertaken to ensure that the research program would take societal concerns into account (project 1, author of this thesis), in parallel with animal genetic and animal behavioural studies (projects 2 - 4).

In order to function successfully as a transdisciplinary team, three interdependent barriers needed to be resolved. Two were related to interdisciplinary collaboration, and one to transdisciplinary research specifically. The first barrier was to be able to relate two different research fields, i.e., social sciences and animal sciences, with different approaches, framings and types of knowledge. The second barrier was to find possible shared activities and to determine the roles of the different researchers. The third barrier was to acknowledge the relevance of experiential knowledge and to incorporate this into the research design of the animal science projects.

These barriers resulted primarily from a lack of experience with such collaborations among most researchers, and the animal researchers’ unfamiliarity with social sciences. This engendered confusion about what was expected from them in the context of transdisciplinary team research and how to shape the collaboration. The project leaders developed shared ambitions to realize an interdisciplinary program when writing the research proposal. They were all motivated to make this collaboration a success and made
agreements with the funders on this. However, as with most new approaches, it is not surprising that it turned out to be more difficult to realize, was more demanding than expected, and the operationalization required much additional effort from each of them. Consequently, a considerable amount of time was needed to establish shared thoughts on collaboration and a shared understanding of the objectives of the research program.

10.1.2 Knowledge exchange

Chapter 6 described the process of mutual learning between researchers and pig farmers about tail biting, which is an urgent animal welfare issue in pig production. This is a multifactorial problem, and scientific research states that the absence of suitable enrichment materials for rooting and chewing is a major risk factor. This is because pigs are still highly motivated to display appetitive foraging and exploration, even when provided with food (Moinard et al., 2003). The researchers aimed to exchange knowledge on this issue with farmers through an interactive science-society symposium called Peaceful Pigs.

During the symposium, the farmers and researchers disagreed on the causes of tail biting, and some farmers were only moderately open to the presented scientific insights. The initial assumption that the scientific insights speak for themselves did not apply. One barrier was the relatively low degree of usability of the scientific insights. They were frequently not concrete enough (e.g. cost/benefit numbers), too uncertain (e.g. no guarantee that enrichment will certainly stop tail biting) or did not relate to the real-world context of the farmers (e.g. focus on animal welfare as an isolated aspect, not taking into account the effect on the environment or costs).

Another barrier was that some of the involved farmers and researchers had different framings of animal welfare and the human–animal relationship, leading to polarization during the symposium. The farmers emphasized the biological functioning of the animal when defining good welfare. The researchers emphasized the natural behaviour pattern of animals. They framed animals primarily as sentient beings, acknowledging the pigs’ ability to experience emotions such as pleasure. Some of the farmers resisted the use of such “human” norms for pigs and framed pigs primarily as production animals.

Follow-up, one-to-one dialogues were conducted to comprehend the encountered barriers, e.g. the origin of the different perspectives, and to stimulate mutual learning. It appeared
that some scientific relations between tail biting and farm practices were not recognized by farmers in their husbandry, and vice versa, researchers did not agree with some of the relations mentioned by the farmers. The farmers and researchers had their own observations, resulting in different convictions and beliefs and thereby strengthening and even validating their own framing. Differing observations were the result of different framings and praxis, which is understood here as the way of handling and understanding the environment, or the usual practices coherent with professionalism. The praxis appeared to function as an a priori filter, influencing what is actually observed in their environment and inducing blind spots. For example, the farmers scanned their surroundings, noticing abnormalities, while the researchers preferred to model and mould reality by eliminating confounding factors. These results imply that observational differences may lead to confusion when discussing welfare and are a serious barrier in mutual learning at a second-order level.

The differences observed between stakeholder groups were therefore studied in greater depth, as described in chapter 7. The participating stakeholders were pig farmers, animal scientists and urban citizens (N=15). They were asked to observe the behaviour of a pig on nine videos and to score for each video 21 given mood terms, such as happy or irritated, i.e. the Qualitative Behaviour Assessment (QBA) approach. The results of the QBA showed that pig farmers judged the behaviour of pigs systematically more positively than the urban citizens and animal researchers. Urban citizens and animal researchers observed the behaviour of pigs similarly. Intra-observer analysis indicated that the differences were likely not due to differing interpretations of the terms. From the additional questionnaire it appeared that the farmers framed pigs primarily as production animals (similar to the farmers who participated in the studies described in chapters 6 and 8), while the citizens and researchers thought of them as sentient beings. This study underlines that differences in observing might hamper the development of a shared understanding of pigs and their welfare and that there is a need to address differences in observing during multi-stakeholder learning processes.

10.1.3 Frame reflection

Chapter 8 described the direct effects of various frame reflection exercises on the framing of pig farmers and urban citizens regarding animal welfare, pig husbandry and each other. Five homogeneous focus groups were formed, consisting of either urban citizens or pig farmers.
Frame reflection was stimulated by the use of role-play and film fragments showing the perspectives of the other party. From the focus groups, it became evident that the urban citizens and pig farmers had different perspectives on how to treat animals. The pig farmers chose to disqualify the relevance of the knowledge of the urban citizens by labelling them as ignorant and preferred one-way information as a strategy. In contrast, after taking the role of farmers in a role play, the urban citizens were more open to the farmer’s objectives. Nevertheless, they did not discard their overall negative perceptions concerning the living conditions of pigs and pig husbandry. A barrier to mutual learning is that both showed the tendency to react from their frame of reference and related values, and to ignore or reframe information that does not fit their dominant value perspective. In particular, these insights show that one-way information that is framed around the values of the sender, as proposed by the farmers, is likely to fail as a strategy to gain public acceptance.

10.2 Successes in mutual learning (summary of results)

The multi-stakeholder learning process as presented in this thesis contributed to mutual learning between different stakeholder groups. In the case of **frame reflection by the farmers and urban citizens**, both experienced participation as informative. It helped the citizens to become aware of their own and other citizens’ perspectives, but also of the perspective of the farmers, who were “from the other side”. They gained insight into the farmers’ dilemmas, the complexity of animal production, and the improvement of animal welfare. On the other hand, although the farmers’ preconception of urban citizens’ ignorance was confirmed, it strengthened feelings of a need for urgent action (dissemination of information).

In the case of **knowledge transfer between researchers and farmers**, farmers generally valued the first symposium (*Peaceful Pigs*) on tail biting as informative, despite their critical attitude. During the follow-up facilitated dialogues between the researchers and the most critical farmers, both were open to the other’s perspective. Their perspectives appeared to be more nuanced and sometimes to differ less from each other than initially perceived. They were both satisfied with the outcome of the dialogues and stated that they had gained better insights and respect for each other’s reasoning and motives on animal welfare, natural behaviour and tail biting.
Based on the striking differences in the way pig farmers and animal scientists observe pig behaviour (problematic) as discussed in chapters 6 and 7, the second symposium (View on Tail Biting) took a completely different approach. Pig behaviours in video fragments were observed and discussed together in groups. Especially in groups in which the participants were optimally balanced according to backgrounds and professions, observations between them differed, resulting in a constructive, in-depth discussion. This way of organizing a symposium was generally positively valued by the participants.

Regarding **transdisciplinary team research**, the multi-stakeholder learning process stimulated the PhD students to move from a monodisciplinary approach towards a transdisciplinary one. In the third year, the added value of transdisciplinarity was recognized, and the internal motivation of the PhD students improved. A high degree of integration and internalization was realized among them. They learned from each other (disciplinary knowledge) and learned from stakeholders (developing a shared understanding of the research program and its objectives). They initiated transdisciplinary activities together, including two interactive farmer symposia; farmer dialogues; the writing of a brochure; and a shared experiment and paper on observing differences among stakeholders.

As part of the multi-stakeholder process, different issues and topics were addressed and discussed, such as the terminology related to the social behaviour of pigs, and opportunities versus threats of the novel breeding strategy. Consequently, part of the research was directed towards the values and preferences of stakeholders. They indicated, for instance, that attention should not only be paid to negative social interactions between pigs, but also to positive social interactions and emotions. The research objective was refined after discussion with societal stakeholders: more emphasis was placed on the interaction of breeding and the environment provided to the animal (e.g. climate, pen design), instead of on breeding alone in order to improve social behaviour. Also the objective became more contextualized by linking the program to the target set by the Dutch government and agricultural section, which is a more animal-friendly production sector for 2023^23.

The strategy might aid in reducing tail-biting problems in the relatively short term, although breeding as a strategy to improve welfare stimulated discussion. Many stakeholders argued

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Last retrieved in April 2014.
that pigs do not need changing, but that there is a need to change husbandry conditions instead. The researchers argued that even in systems where pigs have more space and rooting materials (e.g. on organic farms), outbreaks of injurious biting (e.g. ear or tail biting) do occur, and complementary strategies, like breeding social pigs, are probably needed to successfully battle these undesirable behaviours and their consequences. The researchers emphasized that animal welfare is an interaction of the animal and the environment. Breeding for certain pig characteristics can accelerate the transition towards a more animal-friendly production sector in 2023.

10.3 Overall conclusions: Strategies in mutual learning

Based on the insights gained into the dynamics of mutual learning between stakeholder groups within science and society, this research brought forward several strategies to facilitate mutual learning on sensitive or wicked issues. These strategies can be reduced to the following three guidelines for the designing of multi-stakeholder learning processes:

- Planning: Structural and recurrent embedding of learning interventions, in order to realize change.
- Learning level: Organizing mutual learning at the level of the praxis, or first-order notions, in order to realize second-order learning.
- Design: Designing eye-opening sessions, in order to facilitate an open mind and stimulate commitment.

The three guidelines will be elaborated upon below (see also chapter 9 for details).

10.3.1 Guideline 1: Structural and recurrent embedding of learning interventions

The first conclusion is that structural and frequent embedding of learning interventions is of primary importance for realizing successful learning during a research program lasting four years. Active sessions on a frequent basis are needed to become aware of and reflect on one’s own framing; to open up to another’s knowledge and underlying framing; to synchronize expectations and language; and to search for shared activities needed to realize win-win solutions. The design of the multi-stakeholder learning process for the researchers included
an extensive Interactive Learning and Action (ILA) loop at least once a year, consisting of five phases: exploration, in-depth study of needs and perspectives, integration of different perspectives, agenda setting and planning, and implementation (Broerse & Bunders, 2000). The last three phases subsequently included different learning interventions, such as shared meetings, dialogue sessions or symposia (see chapter 5). In addition, five courses were organized by the program committee for the PhD students to learn how to relate the research project to its wider context.

10.3.2 Guideline 2: Organizing mutual learning at the level of the praxis

During daily practice, learning tends to be limited to a first-order level, to the skills and capabilities belonging to the profession, in which underlying framings are taken for granted (Schön, 1983). To increase the chance of creating solutions that match the diversity of societal perspectives, learning should take place at a second-order level, the frame of reference that steers daily activities and influences perspectives (Schön and Rein 1994). Multi-stakeholder learning processes aim therefore at second-order learning (Schön & Rein, 1994; Grin & van de Graaf, 1996). The second conclusion of this thesis is that second-order learning might be realized better or faster by a shared reflection on first-order notions. Frequent mutual visits to each other’s local environment to become aware of each other’s praxis, which is understood as the way of living, handling and understanding the environment, helps to make differences explicit and difficult to ignore and to escape from. This motivates internal team members and external stakeholders to address the discrepancies at a second-order learning level. When exchange visits are not an option, simulation of the praxis is also helpful. A successful example in this multi-stakeholder learning process the use of video fragments of pigs as an aid to discuss how to assess and interpret their welfare.

10.3.3 Guideline 3: Designing eye-opening sessions

Participants often had assumptions that were taken for granted and supported their remaining in their comfort zone where there is no need to undertake action (e.g. “we have a shared perspective on animal welfare, and therefore we do not need to discuss it”; “I think
it is the other’s responsibility and not mine”; “I think it is the other who does not understand, not me”). The third conclusion is therefore that learning interventions are most successful when different perspectives are used to problematize the issue and to create an eye-opening effect. It is necessary to show the unusual in what is taken for granted or to show the wide disparity between what is expected and what the real situation turns out to be (a shock). This was most effective when a lively, inescapable setting was created (a direct experience). It does not necessarily mean a face-to-face meeting, as other tools that represent the other perspective realistically and explicitly appear to be sufficient. Examples of tools that were successful are role-play, film fragments and documents based on quotes by other stakeholders. Often, due to the inherent explorative nature, participants had difficulty to operationalize the derived insights of the learning interventions, for example because the issue at stake was too big or not concrete enough. Therefore, from a facilitator’s perspective, it is essential to plan follow-up sessions or to discuss an issue that is manageable and can be translated into direct actions (self-efficacy).

10.4 Recommendations for realizing transdisciplinary team research

As stated by Davis regarding interdisciplinary research (1995, p. 44): “The greater the level of integration desired, the higher the level of collaboration required”. For this reason, the transdisciplinary PhD student was embedded in the research program as a team member. The animal and transdisciplinary PhD students formed a team with no hierarchical difference between them. Based on the input provided by the transdisciplinary PhD student during learning interventions, transdisciplinary activities were decided upon and undertaken together (this typical interdisciplinarity collaboration is here defined as transdisciplinary team research).

10.4.1 Facilitating interdisciplinary collaboration

Half-way through the program, conducive circumstances were provided to fully embrace transdisciplinary inclusion activities and to act as a transdisciplinary team. The first long-term experiments were finished, which was beneficial in two ways. First, there were results
ready to share with society. Second, new experiments had to be decided upon, creating room for reflection and societal input. The international mid-term evaluation\textsuperscript{24} functioned as a catalyst for undertaking transdisciplinary activities together, as it called for a critical reflection on the societal ambitions of the NWO research program. Most importantly, as illustrated in chapter 5, it took a process of two years for a fruitful interdisciplinary collaboration to arise, in which transdisciplinary activities are undertaken together. The interventions in the first two years functioned primarily to

A. stimulate the development of a shared understanding of the research program and how it relates to its wider context;

B. align expectations on the interdisciplinary collaboration.

(A) One major challenge of interdisciplinary collaboration that is described in literature is the heterogeneity among the team members. They are often from different disciplines across different institutions along with different cultures, framings, languages and methods (Dusseldorp & Wigboldus, 1994; Klein, 2005). Consequently, before shared actions can be decided upon, it is necessary to develop a shared understanding of the problem to be investigated and the objectives and context of the research program (DuRussel & Derry, 2005; O'Donnell & Derry, 2005). In this program, it took two years for the PhD students to gain enough (inter)disciplinary knowledge for a direct confrontation with society. One challenge was that they were relatively inexperienced with research at the start and unfamiliar with the context. This meant that the first year was primarily filled with setting up their own project and developing an understanding of it. In addition, they found it difficult to respond adequately to societal input and to each other. The five courses (each lasting 18–29 hours) that were designed\textsuperscript{25} for the PhD students over the four years contributed positively to the development of a shared understanding. Each course related the research program to its wider socioeconomic context. They all had the same structure, consisting of lectures from speakers from the universities or the sector, an excursion (e.g. to farms), and an assignment in which the PhD students reframed the research program using what had been learned during the course. They were asked to present the outcomes of the

\textsuperscript{24} The Sociable Swine Project is one of the five research programs under the NWO program “Valuation of animal welfare” (Waardering van Dierenwelzijn).

\textsuperscript{25} By the involved senior transdisciplinary researcher, Prof. Tjard de Cock Buning, as commissioned by the program committee of the National Science Foundation for research on responsible innovation in animal welfare research.
assignment to a panel of stakeholders, followed by a speed-dating session to discuss the linkage between the research program and different stakeholder perspectives.

(B) It became apparent that it is difficult to realize in advance what transdisciplinary teamwork really involves, which resulted in differing expectations and confusion about the collaboration. As confirmed in the literature, the practical meaning of role clarification, task distribution and negotiation in teamwork and in integration had to be learned (Hackman, 1987; DuRussel & Derry, 2005; Klein, 2005). Therefore, much time can be saved when the expectations and attitudes of the team members are aligned at an early phase (Klein, 1996; Bruun et al., 2005; Stokols et al., 2008). In hindsight, it seems beneficial to consider the following questions:

- What skills can we expect from each other?
- How much time do we have available?

The first question (skills) requires insights into competences like personal/team skills and disciplinary skills. To raise awareness about each other's team skills and qualities, team management tools could be used, such as the Belbin test for team roles and Core Quality Quadrants for individual qualities. The first one helps to identify which team role a person could take up easily and which ones are more difficult, and the second tool helps us to identify and reflect on our own characteristics and their related pitfalls. To raise awareness of each other's disciplinary skills, it might be helpful to discuss each other's key literature and to step into each other's praxis, as argued in the section 10.3.2 from this chapter. For example, the animal behaviour PhD students could have joined the transdisciplinary PhD student in interviews or in focus group sessions, and the transdisciplinary PhD student could have joined pig observations during experiments.

The second question requires agreements on the intensity of the collaboration, because inter- and transdisciplinary research is typically more time-consuming than mono- and multidisciplinary research (Epstein, 2005). Issues that must be discussed include how much time to spend on society-related activities or the number of joint papers that need to be written. Some negotiation and compromises can be expected with these agreements. For example, the animal behaviour PhD students were expected to join in the organization of a science-society symposium, but could have in return received assistance from the transdisciplinary PhD student with observations during animal experiments. Another option is that the writing of joint papers or organization of science-society activities might lead to a contract extension or exemption from other duties.
The major lesson that can be distilled from these insights (see also discussion in chapter 5) is that transdisciplinary teamwork demands a different organization and management than mono- or multidisciplinary research. The alignment of expectations and the development of a shared understanding, needed for optimal transdisciplinary teamwork, demand intensive facilitation during the first two years. Although it is tempting to start directly with the planning of experiments, it seems a better strategy to start with team building instead, followed by structural and frequent embedding of learning interventions. Teambuilding facilitates the alignment of expectations and the forming of an open mind for shared research in a very early phase. Follow-up learning interventions are needed because learning is a continuous process consisting of different phases and different learning needs, as the results presented in this thesis show. Table 10.1 lists the potential learning interventions that can be used to establish a fruitful interdisciplinary collaboration.

Table 10.1 Interventions that can be used in order to align expectations and develop a shared understanding of the research program and its context.

<table>
<thead>
<tr>
<th>Development of shared understanding</th>
<th>Alignment of expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures by speakers from the university and sector to broaden vision</td>
<td>The use of management tools to identify team skills (e.g. Belbin test and Core Quality Quadrants)</td>
</tr>
<tr>
<td>Excursions to broaden visions (e.g. husbandry systems, production processes, organisations related to animal production)</td>
<td>Discussing each other’s key literature to become familiar with the theories and models of the other’s discipline</td>
</tr>
<tr>
<td>Interactive sessions with stakeholders to broaden visions or to practise a shared vision (e.g. dialogue sessions or speed-date sessions)</td>
<td>Stepping into each other’s praxis (e.g. joining focus group sessions or observing animal experiments)</td>
</tr>
<tr>
<td>Shared assignments to practise a shared vision (e.g. writing joint texts such as a folder or paper, shared presentations, the building of a shared research design and problem definition)</td>
<td>Negotiating intensity of collaboration and task division</td>
</tr>
</tbody>
</table>
10.4.2 Defining interdisciplinary skills

In this section we reflect on the skills that are needed for transdisciplinary team research. The ideal skills and attitudes for interdisciplinary team work identified in the literature are summarized by Klein (2005, p. 40):

"Team members should be flexible, patient, willing to learn, sensitive toward and tolerant of others, and willing to venture into uncharted waters."

Klein also states that members of interdisciplinary teams are initially “self-protective of themselves, thinking in terms of ‘I’”, and time is needed to transform this into thinking in terms of ‘we’ and to develop dedication to shared activities (Klein, 2005, p. 34). This was also the case in this research program, as the PhD students applied primarily for the different disciplinary sub-projects and were selected for them. Some of these ideal team skills were therefore initially in the background. However, by applying for the sub-projects, they had committed themselves to the shared research objectives, and there was “no other choice” than to develop such team skills. Selecting for these team skills will not guarantee a successful interdisciplinary team, but it might fasten its establishment. In addition, as stated by Klein, it can be expected that people with these characteristics will enjoy interdisciplinary teamwork better.

Another way to reflect on the team skills in the research program is by using the Belbin roles. Belbin identified nine team roles that clarify the effectiveness of a team based on team composition (Belbin, 2012). The role that was taken up by some of the PhD students from the beginning was the completer, one who is accurate and has an eye for detail. Three roles were initially taken up by seniors but were slowly taken over by the PhD students as a result of their shared development in the interdisciplinary team. The first two roles have in common that they keep a certain distance and overview: the coordinator, who sees the big picture and consults each team member before decisions are made; and the monitor evaluator, who is an observer, has a broad view of the problems, and detaches him- or herself from bias. The third role was the team worker, who is a good listener and keeps the team running. Additionally, due to their individual development, they became specialists, who are dedicated to a particular topic and single-minded.

Two roles were not taken up by any of the PhD students, but this lack was not problematic. They were the plant, who is the generator of ideas; and the resource investigator, who explores opportunities and is a good networker. For example, the set-up of the research
program brought us into contact with several stakeholders, and the NWO courses were designed to stimulate creativity. The role that should be of primary importance, but was not dominant in our team, is the implementer, one who turns ideas (of others) into action and gets work done. There was a frequent struggle with the operationalization of what was decided during dialogue sessions and how to deal with the different framings of the research program that we learned in the courses. It was challenging to translate the moral deliberation into practical research design strategies, or to combine different visions into a joint scientific paper. In hindsight, it can be concluded that training the skills that belong to this role would be beneficial for any research program.

10.5 Validity

This section discusses issues related to the internal and external validity of the research underlying this thesis. Regarding internal validity, the role of the transdisciplinary PhD student, the design and execution of interactive learning interventions, and stakeholder representativeness are discussed. Regarding external validity, the generalizability of the results is discussed, in particular the contribution of this research to multi-stakeholder learning processes in the context of wicked issues and technology development.

10.5.1 Internal validity

The transdisciplinary PhD student had different activities and responsibilities, including designing, facilitating and analysing the multi-stakeholder processes and, as team member, the joint execution of several science/society-related activities. Consequently, there was a risk of self-evaluation. In this study, four strategies were used to minimize researcher bias: methodological triangulation, the use of rich data, member checks, and investigator triangulation. These strategies were discussed in section 3.4, and below we reflect on the design pitfalls of learning interventions and on the representativeness of the stakeholders.

Design pitfalls

De Cock Buning and others have described several pitfalls in the design and execution of interactive methods (De Cock Buning et al., 2008; Mierlo et al., 2010). These pitfalls are
used to reflect on the interactive learning interventions (e.g. focus groups, dialogue sessions, workshops, symposia) that were part of the four-year multi-stakeholder learning process, by discussing what their role was and how we dealt with them.

The first pitfall is an overly large difference between the participants concerning knowledge related to the topic of the intervention, or their intellectual and verbal competences. This might induce dominance and negatively affect the atmosphere of equal exchange. This pitfall was expected to influence the learning process between farmers and urban citizens (chapter 8). Although urban citizens generally have no or little direct experience with animal husbandry, they are clearly able to deliberate on how to keep animals in animal production. However, in a dialogue session, farmers might automatically label them as uninformed and might use this as an excuse not to listen to them, as we did indeed observe in a dialogue between researchers and farmers. To ensure a safe environment, we decided to design a dialogue at a distance. Homogenous focus groups were arranged, consisting of either urban citizens or farmers. Although the indirect communication (e.g. the use of role-play and film fragments showing the perspectives of the other party) might have drawbacks for the learning potential, the reflection and learning process of both groups could be observed in explicit argumentations, unhampered by group conflicts around the table.

The second pitfall is that people with strategic interests are attracted to learning interventions, potentially resulting in convincing strategies and power play instead of explorative deliberations. In the case of dialogue sessions for the researchers, which was a structural element of the multi-stakeholder learning process, this was prevented by inviting the same panel of four stakeholder representatives each time. They had committed themselves to the learning process at the start of the research program. To stimulate second-order (reflective) learning, the results of other stakeholder interviews were used as input for these sessions. As part of the learning process, citizens were consulted through focus groups. They were invited by a recruitment company without knowing the topic of the session. Their invitation only mentioned that the session concerned a societal issue. We did not encounter strategic behaviour in any of our focus groups.

The third pitfall is that the invitation was not motivating enough to convince potential participants to join. This pitfall was relevant to the first farmer symposium, which was organized around the main theme of the research program Social pig behaviour. It appeared to be difficult to motivate busy conventional farmers for an animal welfare-related theme. This might be due to the fact that the majority of conventional farmers generally have an agro-industrial paradigm which is associated with intensifying in order to reduce input costs.
(Horlings & Hinssen, 2010). In describing good animal welfare, conventional farmers tend to have a biological functioning approach and emphasize the health, fertility and productivity of their animals (Te Velde et al., 2002). Therefore, it was decided to link the theme of social pig behaviour at the second symposium to production efficiency, health and the issue of tail biting, which was at that time high on the governmental and sector agenda. Nevertheless, their attendance was still relatively low. This did not affect the liveliness of the discussion, but made it difficult to scale up the learning processes and disseminate the results. As a strategy, specialist media and farm consultants were also invited. Their input for the open deliberation was constructive.

The fourth pitfall involves a facilitator of learning interventions who is skilled in the process but not in the content. We avoided this pitfall because the animal and transdisciplinary PhD students formed one research team, and learned from each other. The transdisciplinary PhD student gained the knowledge needed from the animal PhD students, while the animal PhD students were trained in process skills in order to facilitate workshops at the farmer master class (month 42). Farmers who participated in the multi-stakeholder process (e.g. in focus groups as described in chapter 8, at symposia and in interviews as described in chapter 6) often assumed that the transdisciplinary PhD student was unfamiliar with the content because she was living in an urbanized area. However, they appreciated that she was interested in animal production. This had the advantage that it was legitimate to ask why-questions, needed to derive deeper insights and validation of undirected input by the participants.

The fifth pitfall is that the facilitator of learning interventions misses the moments of knowledge co-creation, formulates summaries lacking the essence of the participants, or uses keywords that are not in line with their frame of reference. We avoided this pitfall because the chosen design of the learning process, the ILA approach, ensured that needs, perspectives and underlying framings were inventoried (ILA phase 2) prior to heterogeneous dialogue sessions (ILA phases 3 and 4). The transdisciplinary PhD student was responsible for each ILA step, helping her to become familiar with the perspectives, language and underlying framings involved. This enabled anticipation of value conflicts or moments of knowledge co-creation during the facilitation of learning interventions.

The last pitfall is that contingent aspects affect the findings because a small number of people participate in deliberative sessions. Therefore, we strove for saturation of data by conducting focus groups multiple times, and organising farmer work groups at symposia parallel to each other followed by a plenary discussion of the results.
Stakeholder representativeness

To deliberate with the researchers on future research directions, we regularly arranged meetings of a panel consisting of a senior researcher of the breeding organization who financed PhD project 2 and three spokespersons at a national level, representing pig farmers, animal protection and the food industry (inner circle stakeholders, see figure 10.1). They were not invited to defend the stakes they represent, as that increases the risk of strategic power play. Instead, they were asked to function as individuals, with an open deliberative attitude, while contributing their knowledge of the practice of the stakeholder groups in which they are imbedded, during carefully designed dialogue sessions. They were expected to have a broad understanding of animal production and to rise above the bias related to individual or institutional interests. A broad range of stakeholders was consulted in addition, and those results were used as individual and institutional input from the field during the sessions (outer circle stakeholders), thus reducing the drive to defend their stake personally.

Figure 10.1 The stakeholders who participated in this research can be divided into three categories, based on their degree of involvement in the Seeking Sociable Swine program: 1) the researchers; 2) the inner circle stakeholders; and 3) the outer circle stakeholders. The inner circle stakeholders were invited frequently to deliberate with the researchers on future research directions. The outer circle stakeholders consisted of a broad range of stakeholders who were consulted by means of interviews or focus groups.
How did the representativeness of the inner circle stakeholders work in these sessions? During the dialogue sessions, the animal and food industry representatives showed a scientific approach and seemed to be very familiar with scientific insights, methodologies and language. Therefore, discussions on work progress and future research directions often tended to have a scientific character. Nevertheless, they still represented the praxis for which they were invited. The animal representative argued from an animal perspective, but was open to deliberate on the other perspectives, too. This was in line with the vision of that organization, that animal welfare can best be realized by searching for shared solutions, instead of rebelling against other stakeholders. The food industry representative was critical about the experiments and the researchers’ hypothesis. This was in line with the general culture in the food sector, where health claims and the safety of the consumer product must be guaranteed at all times. The farmer representative did not have a scientific approach, but was very capable of bridging science and practice. She was aware of the farmers’ knowledge needs and argued about which strategies to improve welfare are feasible and which were not.

The representatives had a full agenda and therefore were often unable to participate in the dialogue sessions. But because the input of the sessions was based on societal input, derived from interviews and focus group sessions with diverse stakeholders (outer circle stakeholders, see figure 10.1), the reflection and learning of the researchers were impaired only to a limited extent. For example, in the third session, stakeholder representatives were absent, while a fact sheet of the societal concerns functioned as a catalyst and worked as an eye-opener, resulting in fruitful reflection on the research objectives.

Because the stakeholder representatives were already familiar with science and were often not participating, the learning effect for them was difficult to observe and might be minimal. There is no straightforward answer for whom else to invite, but to realize mutual learning, the important characteristics of representatives seem to be enthusiasm and having free time. In the research process, several individual farmers and citizens participated who had these characteristics. On the one hand, there is a potential risk that they lack a broad overview on animal production, are less familiar with the scientific literature and context, and there is less chance for a wide dissemination of the learning effect. On the other hand, the advantage might be more mutual learning and shared actions.
10.5.2 External validity

Research approaches such as Responsible Research and Innovation (RRI) and Constructive Technology Assessment (CTA) are directed at complex societal issues and aim to develop useful knowledge and innovations. They highlight the importance of interactive innovation processes, in which real-life complexity and the wide range of different perspectives within science and society are taken into account (Rip et al., 1995; Klein et al., 2001; Jasanoff, 2003b; Hagendijk & Irwin, 2006; Regeer, 2010; Owen et al., 2012; Betten et al., 2013). One of the core characteristics of these approaches is reflection and learning among stakeholders within science and society by means of multi-stakeholder learning processes (Klein et al., 2001).

However, the effects of multi-stakeholder learning processes around innovation processes are frequently unclear or limited, e.g. in the context of neuro-imaging (Arentshorst, 2014), ecogenomics (Kloet, 2011; Roelofs, 2011) and nanotechnology (Merkerk, 2007). For example, Kloet and Roelofs describe a research consortium on ecological genomics that had a clear social mission. Roelofs underlined that it was nevertheless difficult to motivate the researchers to participate in science-society dialogues. Although the potential of multi-stakeholder learning processes for the social mission was recognized later in the program, resulting in more enthusiasm and the start of bridging initiatives, these initiatives were not or only partly realized in the long term. These researchers concluded that for a more successful interactive innovation process, a multi-stakeholder process is needed that is designed as a continual learning process and is not taking place from the sidelines, but as an integrated part of the innovation process (Merkerk, 2007; Kloet, 2011; Roelofs, 2011; Arentshorst, 2014).

In the transdisciplinary research program described in this thesis, the aim was to realize this challenge. A four-year, multi-stakeholder learning process was designed and facilitated by transdisciplinary researchers who were embedded in the research program. The added value is that the learning process of the researchers could be described from an imbedded position over a complete research program at a micro-level. This provided relevant insights (as described in chapter 5 and in section 10.4) needed for the organization and management of inter- and transdisciplinary research.

The design of the multi-stakeholder learning process elaborated on the Interactive Learning and Action (ILA) approach (Broerse & Bunders, 2000). This approach has proven its effectiveness in broadening the decision-making in science and technology development and
is applicable in different research fields (Bunders et al., 2010). It has been tested, evaluated and adapted in various emerging research fields such as the agenda-setting of patients in health policy (Caron-Flinterman, 2005), responsible research and innovation like genomics (Kloet, 2011), synthetic biology (Betten et al., 2013) and neuroscience (Arentshorst et al., 2014).

The design of the multi-stakeholder process reported here was tailor-made for animal welfare improvement in pig husbandry, while standing at the same time as an example for controversial or wicked issues. Wickedness and controversy can frequently be found in research contexts, and in policy contexts where the question of an adequate policy strategy is central. The guidelines for the multi-stakeholder learning process described in section 10.3 therefore have a broader relevance than for animal welfare improvement in pig husbandry alone. They can be used to structure tailor-made designs more efficiently in other interactive science and society innovation processes and in interactive policy-making (Driessen et al., 2001), where the challenge is to deal with wickedness.

This research was restricted to animal welfare in pig production. However, from other animal welfare programs that were also supported by the NWO program The Value of Animal Welfare, it appeared that other animal production systems (e.g. broiler chickens, laying hens, veal, fish) have comparable animal welfare issues and similar dilemmas (e.g. animal's natural behaviour needs versus economic interests), the same potential value conflicts (e.g. animal framed primarily as an end in itself or as a means to an end (food)), and similar difficulties with the knowledge transfer of animal welfare from science to practice. The results of this thesis are therefore relevant for science-society projects in other animal production systems, too.
10.6 Mapping future challenges

Collaborations and learning processes between researchers from different scientific disciplines and societal stakeholders are becoming more common in the Netherlands, and are actively promoted by the Dutch government\(^{26}\). However, despite a promising landscape, there are still challenges at the micro-level in learning processes that demand a step further in facilitation. In this research, the major challenges were related to mutual learning between animal researchers, conventional pig farmers and urban citizens. Their relation appeared to be complex because the farmers on the one hand and the animal researchers and urban citizens on the other had different framings about animals and their welfare (chapters 6, 7 and 8). In addition, the participating animal researchers and farmers took the current way of pig farming for granted, while the urban citizens were against this way of pig farming (chapters 4 and 8). Creating successful learning processes among these stakeholders groups is challenging, but crucial in order to realize shared animal welfare solutions. In this section, we discuss our three particular challenges and potential strategies for future research:

- How to transfer scientific insights on animal welfare to conventional pig farmers who have a modest interest in animal welfare?
- How to facilitate active dialogue between farmers, scientists and urban citizens who have different framings and backgrounds?
- How to involve pig farmers and urban citizens in animal research?

The first challenge is related to the valorisation of science, which is understood as the utilization of scientific knowledge in society or practice. In this research program, insights were gained about pigs and their welfare, but in order to realize true welfare improvement, these insights needed to be taken on by pig farmers. Wageningen University is making a valiant effort with their multifunctional research centre, called the Swine Innovation Centre (VIC) Sterksel. On experimental farms, experiments are conducted and innovations tested in collaboration with farmers and other stakeholders. Additionally, excursions and network meetings are organized for farmers and interested others. However, as noted during this


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research program, it is still very difficult to motivate conventional farmers to become interested in animal welfare and societally related themes. The first challenge is how to reach the conventional pig farmer, who is particularly concerned with production efficiency and understands pig welfare primarily as a functional mean, i.e., the health, fertility and productivity of the animals.

A potential solution lies in bringing derived insights closer to the network of farmers. In the Netherlands, most farmers listen to consultants from the feed industry or veterinarians. One inspirational approach to interact with farmers was created by the SAC Animal Welfare Research Department of the University of Edinburgh. Along with 5 experimental farms, it has 24 farm business services offices where farmers can consult scientists about their animal issues and questions. In this way, scientific knowledge becomes easy accessible to each farmer. Another potential strategy is the use of indirect communication in the form of peer education and the setup of a learning environment among farmers. People mostly develop their perspectives during everyday conversations with peers such as colleagues, friends and family members (Kitzinger, 1994; Wenger, 1998; Moon, 2004; Kupper et al., 2007), and the influence of peers must therefore not be underestimated. An interesting initiative is VarkensNET, an online network platform that connects interested farmers in order to stimulate mutual learning and innovation. An additional strategy might be to make use of so-called change agents, individuals who believe in another system to deal with complex problems (Geels, 2006; Loorbach, 2007). They are characterised by an inspiring vision, know how to define the problem well, and are open to and learn from pilots or experiments. Some people are self-made change agents, or become one after training and support others through their activities. Experiments could be conducted in which farmers are trained as a change agent and inspire other farmers about animal welfare improvement.

In order to realize shared solutions for animal welfare, one-way communication from science to the sector is insufficient. The active facilitation of dialogues between farmers, researchers and urban citizens is needed in order to stimulate knowledge co-creation. In this study, these stakeholder groups tended to react from their own frame, and to ignore or reframe information that did not fit that frame (chapter 6 and 8). Framing differences are therefore a major barrier to the process of knowledge co-creation among stakeholder groups. We experimented with how to use different framings as a facilitating tool instead of a barrier to learning, resulting in several design guidelines (designing of eye-opening sessions; stepping into each other’s praxis; discussion at a tangible level). However, full congruency between the participants’ perspectives was not always achieved. More research is needed to
understand how to translate these design guidelines (chapters 9 and 10.3) into tailor-made designs for learning processes. In addition, multi-stakeholder processes aim to search together for shared starting points, shared problem definitions and shared solutions. They can be difficult to find, especially when citizens are involved who are critical about pig husbandry and not “experienced” with farming. On the one hand, participating citizens tended to move away from responsibility by labelling themselves as outsiders. On the other hand, farmers and researchers had difficulty with thinking out of the box as they were used to the practices of current husbandry. Learning processes in which citizens learn to move from outsider towards owner of the complex problems in pig husbandry, while scientists and pig farmers learn to look at animal husbandry through the eyes of outsiders, stimulated an open perspective.

The third challenge was how to implement the insights that are derived from dialogue in the innovative university, from research to education. The involved PhD students initially perceived scientific knowledge as the dominant truth and as the key solution to animal welfare problems. This resulted in a preference for one-way communication and in difficulties with incorporating societal needs and wishes into their research design (see chapter 5). Potential strategies include new curricula in the education of researchers, additional selection criteria for PhD students and researchers; and further development of effective training courses during the PhD projects (see section 10.4).