Introduction
1. Introduction

In The Netherlands, animal welfare in animal production has acquired a permanent place on the political, scientific and private agenda (Hopster, 2010). However, despite a common agreement on the need for welfare improvement, the issue is still frequently a topic of debate without much progress (Eijsackers & Scholten, 2010). Within science and society, different perspectives exist on how to treat animals (Te Velde et al., 2002; Lassen et al., 2006; Miele et al., 2011).

This is partly caused by the fact that defining good animal welfare is complex (Fraser, 1997; Botreau et al., 2007; Hubbard & Scott, 2011; Miele et al., 2011). It depends on the rearing conditions, the current environment, the care that has been given, and the characteristics of the animal itself (Fraser & Broom, 1997). Another cause is the tension between economic interests and animal welfare. Most animal welfare improvements have negative economic consequences, and animal welfare quality is difficult to sell for an added value (Verbeke, 2009). Competition from South-East Asia and South America, price wars between retailers, and reforming of the Common Agricultural Policy are factors that put pressure on the turnover in animal production.

In general, animal welfare problems in animal production can be labelled as wicked (Rittel & Webber, 1973), complex (Bos & Grin, 2008), or unstructured (Hisschemöller & Hoppe, 1995) (hereafter named as unstructured). These types of problems are difficult to solve because they have a multitude of causes and involve an entanglement of social and wider contextual elements (e.g. consumption behaviour, market forces, governmental regulations) along with technical elements (e.g. available knowledge about animals). They are hard to separate from a wider circle of related problems, and the solutions provided frequently result in unintended consequences for other actors in animal production, such as the environment or consumers (Batie & Schweikhardt, 2010; Driessen, 2010).

Unstructured problems are hard to solve technically or from a mono-disciplinary approach alone (Rittel & Webber, 1973; Mason & Mitroff, 1981; Dunn, 1988; Hisschemöller & Hoppe, 1995). To realize animal welfare improvement, societal perspectives and trends should be taken into account along with knowledge from the natural sciences. A research approach is needed in which natural and social researchers collaborate together with societal stakeholders. This is named transdisciplinary research (Gadamer, 1965; Argyris & Schön, 1978; Dunn, 1988; Gibbons et al., 1994; Rip et al., 1995; Grin & van de Graaf, 1996; Broerse
& Bunders, 2000; Grin et al., 2004; Regeer, 2010). Multi-stakeholder learning approaches are an important strategy for this form of research. These processes aim to develop congruency among perspectives through a process of mutual learning which involves reflecting on one’s own and the total diversity of perspectives at stake (Argyris & Schön, 1978; Schön, 1983; Grin & van de Graaf, 1996).

This thesis presents the results of a multi-stakeholder learning process incorporated within the four-year transdisciplinary research program Seeking Sociable Swine. This program, funded by the Netherlands Organisation for Scientific Research (NWO) and the Ministry of Economic Affairs (NWO project number 827.09.010), is directed at animal welfare in pig production. Developing congruency among the perspectives of stakeholder groups appeared to be a real challenge. Pig farmers and urban citizens, for example, initially had different norms and values for animal welfare and consequently a different perspective on how to keep animals in production. Both groups labelled the other’s perspective as “wrong” and did not reconsider their own perspective (Benard & Cock Buning, 2013). In another part of the process, it appeared that the scientific knowledge about animals and their welfare that was presented by animal researchers was not accepted immediately by pig farmers; instead, some farmers resisted it (Benard & Cock Buning, 2013). The stakeholder groups mentioned in these examples believed at the start of the learning process that they could easily convince the other party with arguments based on facts and proposed one-way information as a strategy. However, the scientific literature indicates that this is likely to fail as a strategy to support or restore acceptance (mutual and public) when public norms and values are not taken into account (Gross, 1994; Hanssen et al., 2003; Osseweijer, 2006; Benard & Cock Buning, 2013).

Research is needed on how to organize and facilitate multi-stakeholder processes effectively, so they constructively support mutual learning and contribute to a sustainable innovation process (Hopster & Komen, 2007; Betten et al., 2013). The research described in this thesis serves a dual aim. The first aim is to generate scientific knowledge on stakeholder learning processes and facilitating strategies. By studying the dynamics of mutual learning between stakeholder groups within science and society, insight is gained into the barriers and catalysts of this process. In addition, by describing the transdisciplinary research program, an example is set of inter- and transdisciplinary research, which can be of help to other researchers. The second aim is to contribute to sustainable development in pig production and animal research. The research not only functioned to provide data, it also functioned as
intervention, thereby affecting the perspectives and relationships of participants as well as the animal welfare research program.
2. Theoretical concepts and background

This chapter provides an exploration of the relevant theoretical concepts that underlie this research. First of all, differing visions on animal welfare can follow from different frames of reference. Due to these variations, many animal welfare problems in pig production can be labelled as unstructured. Stakeholder learning processes are acknowledged in the scientific literature to be the right strategy to deal with the complexity of these problems, and to contribute to sustainable development and innovation. Transdisciplinary research is the type of research in which stakeholder learning processes play a central role. Discussed is how to operationalize multi-stakeholder learning, and considered are two frequently used methods. This chapter ends with a major challenge that should be taken into account when designing a multi-stakeholder learning process: the resistance to learning by participants.

2.1 Frame of reference

The vision that people have on animal welfare and animal production is constructed according to their frame of reference. This frame helps them to make sense of complex realities. It provides a perspective to structure knowledge, position experiences, and judge and respond to issues (Schön & Rein, 1994). A frame of reference is based on the entire set of a person’s norms, values, knowledge, convictions and interests (see table 2.1)(Te Velde et al., 2002). These variables are usually in coherence with each other (Vinken & Soeters, 2004), as people prefer to have a harmony between them (Festinger et al., 1956). Values are the most stable variable, and function as criteria in the decision of what is “good” or “bad” (Rokeach, 1973). Conflicting visions are frequently the result of implicit value conflicts. Such a conflict does not arise when deciding if single values are wrong or right, but contests the order in which a set of values is prioritized (Schwartz & Bilsky, 1990).
Table 2.1 The variables that form the frame of reference (Te Velde et al., 2002).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Values</td>
<td>The things that matter to people</td>
</tr>
<tr>
<td>Norms</td>
<td>The translation of values into behavioural rules</td>
</tr>
<tr>
<td>Convictions</td>
<td>Assumptions taken for granted</td>
</tr>
<tr>
<td>Interests</td>
<td>The issues people are concerned with</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Constructs from experiences, facts, stories and associations</td>
</tr>
</tbody>
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Due to their different frames, people tend to signal different problems with regard to animal welfare and suggest different solutions. For example, as farmers keep animals to make a living, their *interests* regarding animal welfare are primarily economic (Te Velde et al., 2002; Vanhonacker et al., 2008). Conventional farmers therefore exercise intensive farming with *norms* related to production improvement and efficiency in particular (Te Velde et al., 2002; Vanhonacker et al., 2008). Citizens, on the other hand, tend to have *norms* related to treating animals as sentient beings (Brom, 2000; Bennett et al., 2002). In line with their interests and norms, they *value* different welfare aspects as important. Fraser (1997) describes three animal welfare approaches: the biological functioning, feeling, and natural living approach. In describing good animal welfare, conventional farmers tend to have a *biological functioning approach* and emphasize the health, fertility and productivity of animals. Citizens tend to have a *feeling approach*, emphasizing their mental wellbeing, or *natural living approach*, emphasizing the natural behaviour patterns of animals (Te Velde et al., 2002; Boogaard et al., 2006; Lassen et al., 2006; Marie, 2006).

For example, conventional farmers might prefer to keep animals indoors. This allows better control of their health, as there is less chance that the animals will get dirty and suffer from infectious diseases. They might also prefer to house sows in crates during farrowing and lactation. Although it limits the freedom of the sow, it can prevent piglets from being crushed by the sow, thereby reducing piglet mortality. Citizens might prefer a husbandry that allows animals to go outdoors and a spacious housing for the sows. For them, keeping animals in an environment that limits their natural behaviours affects their welfare more seriously and for a longer duration than suffering an infection or being crushed (de Jonge & Spruijt, 2005). Differences in framing between stakeholder groups have been studied widely, but not how they influence the way pigs and their behaviour are observed. Chapter 7 aims to
provide an answer on the question of whether stakeholder groups observe pig behaviour differently and to what extent this is related to differences in framing.

The framing of animals by people depends on their role, and can vary over time, e.g., when farmers are at work or at home with their own pets (Kupper & De Cock Buning, 2011). Citizens might employ a different framing when they are acting as consumers: their main interest might then be easily available and affordable food that is healthy and tasty (Te Velde et al., 2002; Vanhonacker et al., 2008).

In addition, the social context is of relevance in the process of developing a specific frame: through communication, people develop a shared view on the world (Moon, 2004). Termeer et al. (2010) provide an explanation, following configuration theory, of how people organize themselves around frames, and how that can lead to fixations. People are inclined to interact with others who have a similar background and way of framing, which is thought to result in more homogeneity between them and the development of configurations. The latter are understood as “the social relationships between people which determine the meaning of what they do together” (Termeer et al., 2010, p. 101). Through intensive interaction, people in a configuration are more prone to agree upon interaction rules, patterns and meanings. At the same time, they tend to respond from a preconceived perspective and exclude those who have other perspectives.

It is claimed that configurations have the potential to develop into fixations, where people are no longer able or willing to reflect on their own frame of reference and only try to confirm their own views (Termeer et al., 2010). Beekman and Van der Weele (2004) state that controversial issues, such as intensive husbandry, and related ones like animal welfare tend to end in a deadlock arising from sensitive contrasts or ritualized arguments as a result of fixations.

### 2.2 Unstructured problems

Due to differences in framings and backgrounds, people often differ in their idea of what the problem is and what the right solution could be. This means that problem definitions are socially constructed and subjective. This was the basis for Hisschemöller’s analysis (1993) which defined four different societal problem types (inspired by the work of William N. Dunn and Douglas & Wildawsky) based on two dimensions (see figure 2.1). The first
dimension is about the degree of consensus on the norms and values at stake, referring to the goal of the strategy. The second dimension concerns the means of the strategy and involves the degree of certainty (assumed) regarding the knowledge needed to deal with the problem.

Hisschemöller claims that each of the four fact-value combinations is a typical societal problem with a related strategy. When applying the wrong strategy to the fact-value problem, it will lead to predictable types of failures. He validated this mechanism during environmental policy research, where he showed that policymakers frequently tend to simplify problems and to select the wrong strategy. Instead, careful problem analysis is needed before strategies are decided upon. This is important because societal problems are not static and can shift from one type of problem to another, perhaps more complex problem. Below, we illustrate each type of problem and the related strategy (based on Cuppen, 2009).

The first of the four problem types is a structured problem. There is consensus on the norms and values at stake and certainty about the knowledge needed to solve the problem. Therefore, the level of participation needed is low. Mostly, these are technical problems with obvious solutions. For example, a farmer wants to scale up his breeding facilities from 1000 to 5000 pigs and therefore needs to build a new stall. Neighbours and the local government do not see a problem, as long as government regulations are taken into account. Experts know how to build this stall best, in line with regulations.
The second type is a *moderately structured problem* in which there is consensus on the norms and values at stake, but no certainty about the relevant knowledge. In other words, it is clear what the problem is and that there are different interests at stake. It seems as if the interests cannot be served at the same time. Negotiation is the strategy needed, to search for a solution that serves all interests. This is the case when neighbours oppose the plans of the farmer to scale up. They are concerned that the design of the new stall will not fit the landscape and that scaling up will bring more air pollution. Here, participation is needed in the form of negotiation to come to an agreement. Potential solutions are a different location for the stall, extra air filters, a stall design that fits the landscape, or a financial compensation for the neighbours for the negative consequences.

In a *badly structured problem* there is agreement on the means, but no consensus and lack of clarity of what the actual problem is and what goals to strive for. Conflicting norms and values can be pacified by searching for a compromise on the level of solutions. Everybody agrees on the building of the new stall, as long as it serves their goals. Members of animal protection organisations agree, because it is expected to contribute to a better welfare for the animals. Compared to the old stall, animals can be kept in group housing, and the climate and feed of the animals can be better optimized. Neighbours agree, because the new stall results in less air pollution compared to the old stall. Upscaling is beneficial for the farmer’s income, but also creates the opportunity to realize more sustainable and animal welfare-friendly farming.

The last type of problem is defined as *unstructured*. Here, the goal and its means (upscaling of farms) are points for discussion. Both animal activists and neighbours have a different solution for the problem. The bigger the stall, the more difficult it becomes to provide individual care to weak animals. Members of animal protection organisations therefore prefer a switch from conventional farming towards organic farming. Neighbours not only fear the consequences of upscaling for their health, they also prefer more nature in their surroundings. They want stalls to move to other districts. For unstructured problems, multi-stakeholder learning processes are the most constructive approach. This concept is explored in depth in the next section.
2.3 Learning processes as strategy

Many animal welfare problems in animal production can be defined as unstructured. Both within animal science and within society at large, there is no consensus on the prioritization of key values nor on the relevance of the facts at stake (Miele et al. 2011; Hubbard and Scott 2011a; Busch 2011). Animal welfare has a multi-dimensional nature, covering several aspects such as health, positive emotions, natural behaviour, absence of stress, the lack of pain and discomfort (Fraser, 1997; Botreau et al., 2007; Hubbard & Scott, 2011; Miele et al., 2011). Consequently, it is studied from different disciplines, resulting in a diversity of possibly competing definitions and related relevance of criteria and norms (Fraser, 1997; Botreau et al., 2007; Hubbard & Scott, 2011). As illustrated in section 2.1, due to differences in framings, different visions exist among stakeholders as to what aspects are most important for the welfare of the animal.

Oversimplifying the problem by applying the common strategy of assigning only one group as experts on the facts at stake (e.g. scientists) will lead to a reduction of the issue, a failure of support, and hence, a persistent problem. Instead, mutual learning between stakeholders is essential to obtain a more sophisticated understanding of the problem. This increases the chance of success in creating solutions that match the diversity of societal perspectives (Hisschemöller & Hoppe, 1995). The value of mutual learning is also acknowledged by the German philosopher Gadamer (1965), who speaks about the “fusion of horizons”. Mutual learning reduces bias and prejudices caused by an individual’s framing and stimulates the merging of different views, thereby transforming the initial individual vision.

Schön (1994) argues that learning processes should aim to change the frame of reference because differences in the underlying frames lead to different visions. He introduced the term frame reflection, which was defined as:

“to put themselves in the shoes of other actors in the environment (..) and to overcome the blindness induced by their own ways of framing the policy situation (1994, p. 187).”

This type of learning is defined by Argyris (1978) as second-order learning, and originates from the research field of organizational learning. In first order-learning, actions are modified based on the differences between attempted and obtained outcomes. Underlying framings are taken for granted, and reflection is done only within these framings. In daily life, learning tends to be limited to this first-order level (Schön, 1983). Second-order
learning involves reflecting upon each other’s underlying framings, which is expected to lead to different goals, strategies or framings, and is stated by Grin (1996) as required for congruency between different actors before undertaking common action.

2.3 Multi-stakeholder learning as part of science and technology development

There are pleas in the field of Science and Technology Studies (STS) (e.g., Gibbons et al., 1994; Rip et al., 1995; Grin & van de Graaf, 1996; Jasanoff, 2003a; Hagendijk & Irwin, 2006) and in policy contexts (e.g., financing of research programs on Responsible Research and Innovation by NWO and EU) for multi-stakeholder learning processes as an integral part of science and technology development. There are three arguments that are most often used: the substantial, the instrumental and the normative argument (described by Fiorino, 1990; Cuppen, 2009; Broerse & De Cock Buning, 2011).

The substantial argument states that multi-stakeholder learning helps to prevent scientific goals and societal needs being insufficiently synchronized (Grin & van de Graaf, 1996; Wynne, 1998; Betten et al., 2013). Traditionally, science tends to focus on isolated variables and to strive for generalizability, but this type of scientific knowledge is frequently inadequate for solving complex real-world problems in which many variables are entangled and context is of major influence. In his paper “May the sheep safely graze” (1998), Wynne shows the relevance of experimental knowledge and how it could complement scientific knowledge. Incorporating the wishes and experiences of stakeholders can contribute to more contextualized and needs-oriented suggestions. This study paved the way for many studies in the field of Science and Technology studies. Experimental knowledge can be understood as “obtained knowledge in daily experience within the context of application” (Broerse & De Cock Buning, 2011). Listening to societal needs and including experimental knowledge might result in more contextualized, needs-oriented science.

The instrumental argument states that multi-stakeholder learning is a tool to gain legitimacy (Kersbergen & Waarden, 2004). Science and technology can give rise to ethical, legal and social issues. For example, they are blamed by society (Miele et al., 2011) as the main causes of the crises of the last two decennia in husbandry (e.g., avian influenza, bovine spongiform encephalopathy, foot and mouth disease). Emerging technologies like animal
cloning and genetic modification are topics of concern, as are technologies that are standard in intensive animal production (very specialized breeds, feed additives and confined housing). These technologies raise ethical questions about how animals should be treated in animal production (Commission, 2007; Kjarnes et al., 2007; Miele et al., 2011).

Not responding appropriately to negative side-effects and societal concerns can lead to poor adaptation or even public resistance towards scientific knowledge and technology. Frequently, it is argued that acceptance can be created by arguments based on facts, and that the provision of one-sided information is the right strategy. This resembles the deficit model, which explains public resistance against scientific innovation as an effect of a lack of relevant knowledge, and thus assumes that more relevant information would create public acceptance by itself. This model has proven to be ineffective, as in many cases information is used to confirm existing opinions and views. Instead, a more effective strategy is to take into account public norms, values, knowledge and the context (Gross, 1994; Hanssen et al., 2003; Osseweijer, 2006; Benard & Cock Buning, 2013). In chapter 6 we explore in depth how to facilitate two-way knowledge exchange between scientists and farmers, taking different framings into account.

The normative argument states that the people who are affected by the science or technology should have the right to have a say in the decisions and discussions on the research (Fiorino, 1990; Abelson et al., 2003). This is needed to ensure that all different interests at stake are considered and taken into account. Examples of people who might be affected are end users, such as farmers and consumers, and representatives of animals and nature.

### 2.5 Transdisciplinary research

Responsible Research and Innovation (RRI) is an umbrella term for research in which multi-stakeholder learning processes play a central role (Owen et al., 2012; Betten et al., 2013). This term is relatively new and has its roots in policy making, but captures the major principles of research approaches that stimulate interactive innovation processes, such as Constructive Technology Assessment. These principles imply that research is directed at complex societal issues and aims to develop desirable knowledge and innovations which are perceived to contribute to societal progress. Therefore, starting with the design of the
research project (e.g. writing of the proposal) and throughout the research process, 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). One of the core characteristics of Responsible Research and Innovation is the use of a transdisciplinary research approach (Klein et al., 2001).

![Figure 2.2](image)

**Figure 2.2** Schematic representation of the differences in knowledge integration (dashed borders) in mono-, multi-, inter- and transdisciplinary research teams.

Figure 2.2 illustrates how transdisciplinary research differs from other research approaches. Monodisciplinary research typically aims at specialization of the natural sciences in particular. Multidisciplinary research is the investigation of a complex problem from different angles by a team composed of different disciplinary experts, with the experts each using their own disciplinary theories and methods. In the case of an interdisciplinary team, the disciplinary boundaries are open: disciplinary theories are connected to each other, and mixed methodologies are used to find answers to the shared objectives of the study (Bruce et al., 2004; Max-Neef, 2005; Wickson et al., 2006). Transdisciplinary research goes one step further by acknowledging the relevance of the experiential knowledge of non-scientifically trained stakeholders, investigating the shared objectives of the study with them.

In traditional science, the integration of experiential knowledge with scientific knowledge is perceived as a problematic process. Experiential knowledge is considered of equal value, but not as equally true compared to scientific knowledge. It is only scientific knowledge that represents an “objective” truth, while experiential knowledge is perceived to be personal, context-bound and specific (Regeer et al., 2009). However, the theory of Community of Practice shows that knowledge develops through communication and participating in social practices (Wenger, 1998). This means that knowledge is difficult to separate from practice and context (Regeer et al., 2009). Sociology and philosophy studies have shown that science
is also a social activity and that scientific knowledge is socially constructed (Mendelsohn, 1977; Van den Daele, 1977; Latour & Woolgar, 1986). This makes the distinction between scientific knowledge and experiential knowledge less relevant.

In transdisciplinary research, it is accepted that facts are difficult to distinguish from opinions, values and context, particularly in the case of unstructured problems (Regeer et al., 2009). The relevance of the experiential knowledge of non-scientifically trained stakeholders is acknowledged. Researchers investigate the shared objectives of the study together with societal stakeholders (Scholz, 2000; Bruun et al., 2005; Bunders et al., 2010; Pohl, 2011). According to Klein et al. (2001, p. 7), transdisciplinary research comprises:

“a form of learning and problem solving involving cooperation among different parts of society and academia in order to meet complex challenges of society.”

2.6 Operationalizing multi-stakeholder learning in transdisciplinary research

In this section we explore what insights can be found in the literature on how to operationalize multi-stakeholder learning. These insights form the basis of the design of the multi-stakeholder learning processes in this research. Chapter 9 provides insights based on the empirical results of this research on how to design multi-stakeholder learning processes.

The essence of multi-stakeholder learning in transdisciplinary research is knowledge co-creation (Regeer et al., 2009; Betten et al., 2013). This is an action-oriented and iterative process that compromises three phases: 1) knowledge articulation, 2) knowledge integration and 3) knowledge embedding. Different stakeholder groups have their own needs, perspectives and underlying framings, which are often implicit, and some people are unaware of them. Therefore, they have to be made explicit in the phase of knowledge articulation. In the second phase of knowledge integration, researchers and stakeholders learn from each other through processes like frame reflection or joint problem-structuring. The result aimed for is integration of scientific knowledge and experiential knowledge, a process that is described as more than the sum of the parts. In the third phase of knowledge embedding, research ideas become embedded that are derived from the other two phases (Regeer et al., 2009; Betten et al., 2013; Pittens, 2014). However, the effects of transdisciplinary research can be disappointing (Kloet 2011; Rip 2009; Roelofsen 2011;
Schusler et al. 2003; Steyaert and Jiggins 2007), and there are not many studies of the practical implementations of transdisciplinary research (Genus 2006; Guston and Sarewitz 2002; Reuzel 2001; Rip 2001). In chapter 5 an example is given of inter- and transdisciplinary research, which can be used to guide the designing of such processes and the selection and application of techniques. Although the research program ended satisfactorily, establishing the teamwork was not very easy at the start. This appeared to be primarily related to ‘not knowing’ rather than ‘not willing’.

![Figure 2.3 The process of knowledge co-creation, adapted from Regeer and Bunders 2003.](image)

Different methods can be used in the process of knowledge co-creation (Pittens, 2014). In this research, consultation methods such as in-depth interviews and focus groups were used to articulate knowledge, while interactive methods such as dialogues were used for knowledge integration. As focus groups and dialogues are less common tools than interviews, these two methods are discussed in this section.

### 2.6.1 Focus groups

A focus group is a selective set of unrelated individuals who engage in the collective activity of deliberating a specific topic from their own experience (Kitzinger, 1994). It is a method to explore the variety of opinions and ideas and to provide insight into the deeper motivations
and cognitions that underlie them (Kupper et al., 2007). This makes focus groups suitable for articulating knowledge. The advantage of focus groups relative to group or individual interviews is the recognition of group dynamics (Kitzinger, 1994; Stewart et al., 2007). Group dynamics are crucial because it is through communication that people develop a view of the world and give meaning to their norms and values. Kitzinger (1994, p. 108) states:

“the group work ensures that priority is given to the respondents’ hierarchy of importance, their language and concepts, their frameworks for understanding the world.”

In addition, the combined effort of the group might lead to more insights and ideas (synergism), and the comments of participants can trigger a chain of reactions from others (snowballing) (Stewart et al., 2007).

There are four principles that should be taken into account by the facilitator to realize a successful focus group session: 1) construct a safe and trustworthy environment, 2) engage participants in creative thinking, 3) balance between structure and freedom, and 4) balance between competitive and complementary interaction (De Cock Buning et al., 2008). These principles can be enhanced by the right use of group composition, the use of structured exercises and facilitator skills.

A focus group consists preferably of five to twelve participants to ensure a rich and dynamic discussion, while holding their attention throughout the session. Focus group sessions need to strive for homogeneity, because a shared background, knowledge level or perspective contributes to a safe and trustworthy environment (Morgan, 1997; Greenbaum, 1998; Stewart et al., 2007).

People are mostly unaware of their underlying motivations and framings, and therefore it is not possible to ask about them directly. The right set-up of exercises stimulates out of the box thinking. A typical method used in focus groups is the circling-in design, in which focus is found by following three phases: inventorying – clustering – prioritizing, as described by De Cock Buning (2008). Although endless variations of this design are possible, its basic format is described below.

In the inventorying round, participants are asked for their spontaneous associations, options, problems, etc. regarding the topic of the session (e.g. an issue, theme or innovation). They are asked to write down two or three of them on separate post-its and to declare them in a speech round. The facilitator summarizes and positions the post-its on a
flip-over, to show how they relate to each other. By interfering as little as possible (except to ask clarifying questions), the issues brought forward are their own choices, enabling the facilitator to assess the primary negative or positive attitudes and arguments behind the issue at stake. The result of this phase is the identification of a rough and broad problem definition.

In the clustering round, the participants discuss with each other if and how the post-its can be clustered into sub-themes and whether any fall outside the scope of these sub-themes. When the group is satisfied with the clustering, the facilitator asks for clarification in arranging the post-its and the rationale behind the pattern. This phase serves to narrow down and structure the problem definition.

In the prioritizing round, the participants prioritize the sub-themes (parts) of the previous round. This is mostly done by the participants individually, for example by pasting a sticker on the most relevant sub-theme. The facilitator asks for their rationale behind the prioritizations and their opinion on the end result (e.g. remarkable outcomes, (dis)agreements).

The use of post-its, speech rounds and reflection by the group on individual and group positions (e.g. by asking questions like “is this shared by all?”, or “would anyone like to comment on this?”) encourages an equal contribution of all participants and limits any dominance of perspectives. Visualizing on flip-over sheets or matrix schemes ensures that all input is shared and taken on board.

The facilitator should have the right skills to manage the group dynamics while ensuring all themes are covered and valuable data is obtained. These competences are related to interpersonal communication, process management and understanding (Morgan, 1997; Greenbaum, 1998; Stewart et al., 2007; Broerse et al., 2013). Competences relating to understanding include seeing connections between statements and the bigger picture, recognizing underlying norms and values, and quickly assimilating information (Broerse et al., 2013). A facilitator should be able to listen actively and to balance between empathic listening and analytical listening. The first is needed for a deep understanding of the participants’ perspective, while the latter is needed to link what is said to the research objective (Broerse et al., 2013).
2.6.2 Dialogue

Multi-stakeholder dialogues are used to realize mutual learning and to integrate knowledge. A dialogue is not about debating each other’s perspective, but about deliberation (Broerse & De Cock Buning, 2011). While a debate aims at convincing the other and winning the argument, a dialogue aims at learning and understanding the other’s argument and producing a change in the participants.

Contrary to focus groups, a dialogue strives for heterogeneity or group diversity, because diverse knowledge and insights can enrich the discussion and increase the learning potential (Benard & Cock Buning, 2013). The fact that dialogues are face-to-face meetings in which people listen to each other’s experiences might contribute to new perspectives on problems and solutions, and also to mutual trust and the elimination of prejudices (Abma & Broerse, 2010).

However, stakeholder groups are not used to collaborating together, and hierarchical differences can hamper the learning process, for example, the labelling of experiential knowledge as subjective by researchers (Betten et al., 2013). In order to have a meaningful dialogue, Habermas (1981) formulated the conditions equality, open deliberation and avoidance of power play. This means that the argument of other participants is taken seriously, regardless of their background. In addition, power plays should be avoided; instead, arguments should be exclusively accepted or rejected based on their validity. These principles have been taken over by various scholars of public engagement and demand a tailor-made design and strong facilitator skills (Webler et al., 1995; Abelson et al., 2003; Broerse & De Cock Buning, 2011; Langenberg, 2011). The tasks of the facilitator include ensuring validity, enhancing trust relations, and avoiding exclusion (Betten et al., 2013).

2.7 Resistance to learning

Is it realistic to think that the stakeholders who participated in the multi-stakeholder learning process of this research can and will truly learn from each other? A successful mutual learning process requires receptiveness to the perspectives of the other participants – an open mind – but the literature describes several potential barriers to this.
It is stated that people tend to develop a natural resistance towards second-order learning in which existing knowledge and assumed beliefs are challenged, and a personal change is aimed for (Mezirow, 1990; Atherton, 1999). One interpretation is that this involves a change from a safe status quo towards a new and unknown situation (Mezirow, 1990). The psychology literature provides another interpretation based on the theory of cognitive dissonance (Festinger et al., 1956). This is a feeling of discomfort caused by a lack of coherence between the elements (cognitions) that form the frame of reference and/or behaviours. Participants can experience cognitive dissonance when the perspectives of other participants conflict with their own framings.

People tend (unconsciously) to reduce cognitive dissonance (dissonance reduction) and to make the situation more manageable by applying several strategies (Aarts & Woerkum, 2010). One is the tendency to stick closer to their own “safe” framing. Threatening information can be rendered harmless by neglecting it, interpreting it differently, making it less important, or making it someone else’s responsibility. Another strategy is excluding or stereotyping the one with the “threat message”. New convictions can also be added (pigs lost their natural needs due to domestication) or existing ones changed (I have no other choice because consumers do not want to pay more).

In order to avoid cognitive dissonance, people tend to stay in the safe information zone of shared knowledge and normative standards. Consequently, the outcome of the dialogue will only reflect

“the common knowledge shared by members before discussion, and not the diverse knowledge emanating from their unique perspectives and experiences” (Cuppen, 2009, p. 28).

This implies that although learning is more likely to occur when participants are confronted with new and different perspectives (Moon, 2004), an overly large value-conflict between participants might hinder the learning process. For the management of the learning process, this implies that each learning session has to be prepared in such a way that the challenges of new information balance the flexibility of the participants’ frames. This implies for this project that the frames of reference have to be assessed in the phase of knowledge articulation (by in-depth interviews and focus groups) before dialogue sessions are designed and executed in the phase of knowledge integration.

The designer and facilitator of the learning process should anticipate more forms of resistance. The social context also influences a person’s receptiveness to the perspectives of
others. People with similar backgrounds are usually more able to share and understand each other’s perspectives, while there is the risk that people with very different backgrounds will be labelled “different” in a process called social division (Moon, 2004). This labelling of others provides a reason not to listen to their arguments.

Other influential factors are the emotional state of the participants and their conception of knowledge, e.g. if they believe that there is only one fundamental truth or not (Zimbardo & Leippe, 1991; Moon, 2004). The need to reflect can be experienced as low: participants can feel a topic is unexciting, involvement in and feeling of ownership can be low, or they can be convinced that they are already informed enough. Participants can have insufficient prior knowledge or too many distractions and time constraints (Knight, 2006; Aarts & Woerkum, 2010).

In chapter 8 we investigate in depth how to open the fixed patterns of thoughts of pig farmers and urban citizens by the use of focus groups.

2.8 Summary

This chapter provides a scientific basis for the need for multi-stakeholder learning processes as an integral part of science and technology development in the context of pig production. They are needed in order to deal with the complex nature of animal welfare and to realize solutions that take into account the different perspectives at stake. Transdisciplinary research aims to realize co-creation between scientists and other stakeholders. In this process, scientific and experiential knowledge are integrated. Methods that are used in this research include in-depth interviews, focus groups and dialogues. It is not easy to realize mutual learning among stakeholders with different perspectives, however: the literature describes several aspects that result in resistance to learning among participants. A major challenge in this research is, therefore, how to realize mutual learning with respect to animal welfare in pig production.
3. Research Design

3.1 Objective & Research question

Scientific insights and technological innovations are important contributors to the improvement of animal welfare. However, they are often contested or insufficient for solving animal welfare problems in which many variables are entangled and the context is of major influence. To stimulate the creation of shared solutions for animal welfare improvement, a transdisciplinary research approach is required, in which mutual learning among stakeholders within science and society is facilitated. However, there are not many studies of the practical implementations of such a research approach, and the process of learning is hardly addressed in the literature.

This thesis presents the design, process and effects of an intensive, longitudinal, multi-stakeholder learning process around the research program Seeking Sociable Swine, which is directed at animal welfare in pig production. It describes the dynamics of mutual learning between transdisciplinary and animal researchers; between animal researchers and societal stakeholders; and between different societal stakeholders. It reports the hands-on experiences and challenges related to inter- and transdisciplinary research and potential fact-value conflicts on animal welfare between stakeholder groups. The first aim of this research is:

A. To contribute to the development of a methodological framework for multi-stakeholder learning processes around the research on sensitive issues,
   by developing a better insight into the dynamics of mutual learning and the barriers and catalysts in this process

This research provides insight into the achievements of multi-stakeholder learning processes. It contributes to the understanding of mutual learning between stakeholders in general, and an example is presented of inter- and transdisciplinary research. These insights may help practitioners, policy-makers and funding agents to build shared solutions for the complex problem of animal welfare in animal production. They are also relevant to other
studies on societally sensitive issues, and especially in relation to the trend exhibited by funding bodies to demand transdisciplinary designs and interdisciplinary research teams.

There is an added value as this study not only provides scientific knowledge, it is also an intervention, thereby affecting the perspectives and relations of participants, as well as the animal welfare research program. A second aim of this research is therefore:

B. To contribute to sustainable development in pig production and animal research, by organizing learning interventions for stakeholders within science and society

These two objectives led to the formulation of the following 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?

In order to answer this question, we explored in depth the potential of various self-designed and tailor-made learning interventions for mutual learning between stakeholder groups. Through detailed descriptions and ad-hoc and post-hoc analyses of the dynamics of the learning process that took place, insights were developed into the enabling and blocking variables and mechanisms in mutual learning. The following questions structured the analysis:

- What are the differences in framings on animal welfare (related issues) in pig production between the selected stakeholder groups, and are there possible value conflicts on the issue at stake?
- What are the effects of various interventions as part of the multi-stakeholder process on the learning progress of the selected stakeholder groups, e.g. their willingness to reflect on the issue and the diversity of perspectives at stake?
- What barriers and strategies can be identified that affect mutual learning?

Section 3.2 clarifies what research approach and strategy were chosen in this research, while section 3.3 discusses how these approaches were tailor-made specifically for this research.
3.2 Research approach

The research in this thesis took an action research approach. This approach is characterised by its dual aim: besides generating scientific knowledge, the research is problem-oriented and functions to contribute to sustainable development (Regeer, 2010). The task of the transdisciplinary researcher is to facilitate and monitor the multi-stakeholder learning process. This implies more than observing and interpreting; it means that the transdisciplinary researcher actively takes part in the process and organizes interventions (Mierlo et al., 2010; Regeer, 2010; Hoes, 2011).

Action research means that the research is taking place in the real world, which is less predictable than a typical, carefully designed experimental setting. The issues of stakeholders cannot be known in advance, circumstances can change, and effects can be unexpected (Benard et al., 2010; Regeer, 2010). Transdisciplinary research therefore involves a continuous process of observation, reflection, planning and action (see figure 3.1) (Guba & Lincoln, 1989; Stringer, 1996; Regeer et al., 2009). Observing and reflecting upon earlier interventions enable the designing and planning of adequate, follow-up, tailor-made interventions. Multi-stakeholder learning processes therefore need a flexible, cyclic design that is open to change, instead of a fixed and predefined approach (Burns et al., 2003; Zweekhorst, 2004; Hoes et al., 2008; Regeer, 2010).

Figure 3.1 Action-learning spiral, adapted from Kemmis and McTaggert 1988.
For the strategy of the multi-stakeholder learning process in this research, the Interactive Learning and Action (ILA) approach was used (Broerse & Bunders, 2000). One of its strengths is that it can function as a guide, while leaving room for an emergent design. Another strength is that it has been widely tested in practice and the results published. It was developed in the 1980s and 1990s to broaden decision-making on science and technology and has been tested, evaluated and adapted since then in various projects. Originally created to stimulate the involvement of small-scale farmers in innovation processes in developing countries, it is nowadays widely used in different fields such as patient participation in decision-making on health research (Caron-Flinterman, 2005) or in emerging science fields in health and agriculture, such as genomics (Kloet, 2011), synthetic biology (Betten et al., 2013) and neurosciences (Arentshorst et al., 2014).

The ILA approach is typically based on loops of five phases of consultation and deliberation and uses participatory methods like focus groups, in-depth interviews and dialogue sessions. These methods ensure active participation and learning among the researchers and societal stakeholders from the start of the process (Broerse & Bunders, 2000; Bunders et al., 2010; Betten et al., 2013).

1. **Exploratory phase:** Through a literature review and exploratory interviews, the stakeholders to be involved in the process are identified.

2. **In-depth study of needs and perspectives:** Through various participatory data collection methods (e.g. interviews and focus groups), the needs and visions of the relevant researchers and stakeholders are identified and analysed. On the one hand, insight is gained into their frame of reference and into the ethical and societal issues at stake; on the other, second-order learning is stimulated among the participants, and knowledge is articulated.

3. **Integration of different perspectives:** A number of heterogeneous dialogue sessions are organized to compare and analyse jointly the different perspectives at stake (frame reflection), thereby stimulating mutual learning among researchers and stakeholders and realizing knowledge integration.

4. **Agenda setting and planning:** Subsequent dialogue sessions are held to set priorities and to develop an action plan for the involved stakeholders to define options for socially embedded, responsible research.

5. **Implementation:** The execution of the action plan and embedding of research plans.
3.3 Participating stakeholders

The research described in this thesis is part of the four-year research program Seeking Sociable Swine (see the next chapter for a detailed case description). 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 (see Table 3.1 and Figure 3.2). The first category includes the researchers involved in the research program. The following 11 researchers were involved: animal geneticists (3 seniors and 1 PhD student), animal behaviour researchers (3 seniors and 2 PhD students), and transdisciplinary researchers (1 senior and 1 PhD student (author of thesis)). Together they studied how the social behaviour of pigs can be improved in combination with societal acceptance. The study of social pig behaviour relates to productivity and pig welfare, but also to societally relevant themes like tail biting and the keeping of undocked pigs in the near future.

The second category includes two groups of stakeholder representatives: the panel that was invited for each dialogue session to deliberate with the researchers on future research directions; and the group that was part of the program committee and invited to deliberate each course with the PhD students. The outer circle stakeholders are a broad range of stakeholders who were consulted once by interview or focus group. They were selected according to the topic that was part of the emergent design and varied over the course of the four years. Also included in this last category are farmers and other professionals from the sector who participated in one of the two symposia organized by the PhD students.

Table 3.1 Categorization of stakeholders involved in the multi-stakeholder learning process. The inner circle stakeholders participated in each dialogue session or course. The outer circle stakeholders were consulted only once or joined one of the two symposia.

<table>
<thead>
<tr>
<th>Category</th>
<th>Including</th>
</tr>
</thead>
<tbody>
<tr>
<td>Researchers</td>
<td>Animal behaviour (3 seniors and 2 PhD students)</td>
</tr>
<tr>
<td></td>
<td>Animal genetics (3 seniors and 1 PhD student)</td>
</tr>
<tr>
<td></td>
<td>Transdisciplinary (1 senior and 1 PhD student)</td>
</tr>
</tbody>
</table>
### Inner circle

<table>
<thead>
<tr>
<th>Stakeholder representatives dialogue session</th>
<th>Animal protection (senior policy maker)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Farmer (chair of Dutch farm branch organization)</td>
</tr>
<tr>
<td></td>
<td>Food industry (corporate director)</td>
</tr>
<tr>
<td></td>
<td>Genetic industry (senior researcher)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stakeholder representatives courses</th>
<th>Animal protection (senior policy maker)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Animal research (2 seniors)</td>
</tr>
<tr>
<td></td>
<td>Economic affairs (senior policy maker)</td>
</tr>
<tr>
<td></td>
<td>Farm branch (consultant)</td>
</tr>
</tbody>
</table>

### Outer circle

<table>
<thead>
<tr>
<th>Stakeholders working in</th>
<th>Animal health</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Animal nutrition industry</td>
</tr>
<tr>
<td></td>
<td>Animal protection organization</td>
</tr>
<tr>
<td></td>
<td>Branch media</td>
</tr>
<tr>
<td></td>
<td>Breeding industry</td>
</tr>
<tr>
<td></td>
<td>Food industry</td>
</tr>
<tr>
<td></td>
<td>Government</td>
</tr>
<tr>
<td></td>
<td>Husbandry design</td>
</tr>
<tr>
<td></td>
<td>Knowledge institution (university, agricultural institutions, consultancy)</td>
</tr>
<tr>
<td></td>
<td>Politics</td>
</tr>
<tr>
<td></td>
<td>Retail</td>
</tr>
<tr>
<td></td>
<td>Others</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Individual stakeholders</th>
<th>Citizens</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Farmers</td>
</tr>
</tbody>
</table>
3.4 Applying design principles in practice

The task of the transdisciplinary researchers was to realise a multi-stakeholder learning process in synchrony with the animal and genetics research. Animal welfare in pig production is a context in which there is a tradition of conflict, and therefore it demands a high degree of reflection. The learning interventions as part of the learning process were therefore reflective in nature. The transdisciplinary PhD student formed a team with the other PhD students, enabling an inside analysis of the learning process. Based on the learning process, transdisciplinary activities were decided upon together and undertaken as a team (here defined as transdisciplinary team work).

At least one ILA loop was conducted per year (see table 3.2 for an illustration). Each loop resulted in shared activities, which were also reflected upon, often becoming the starting point of a new loop. A typical loop started with inventorying whom to involve (ILA Phase 1), followed by consulting the researchers, inner- and outer-circle stakeholders through the use of focus groups and/or in-depth interviews (ILA Phase 2). This data was then used as input for one or more dialogue sessions, in which the researchers deliberated together with the standard panel of the inner-circle stakeholders (representatives of farm branch, animal protection, pig breeding and food industry) on future research directions (ILA phase 3). This panel of representatives had committed themselves to the research program. The aim of the sessions was to induce reflection by making similarities and differences explicit, and subsequently explore options for a shared vision.

To learn how to relate the research program to its wider socioeconomic context and to stimulate transdisciplinary teamwork among the PhD students, five courses (each 18–29 hours) were additionally designed1 over the four years. After the sessions and/or courses, one or more dialogue sessions and supervision meetings were organized for the PhD students to operationalize derived insights (ILA phase 4). Each loop resulted in shared science-society learning activities such as the organizing of a symposium, farm visits and the writing of a brochure (ILA phase 5). These activities aimed to bring about societal embedding of the research program, but also had a strong interventionist character as they

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1 By the involved senior transdisciplinary researcher, Tjard de Cock Buning, under commission from the program committee of the National Science Foundation for research on responsible innovation in animal welfare research.
writing of a brochure (ILA phase 5). These activities aimed to bring about societal embedding of the research program, but also had a strong interventionist character as they aimed to stimulate second-order learning among all the participants. Table 3.2 provides an illustration of one ILA loop.

**Table 3.2** Illustration of the first ILA loop in the multi-stakeholder learning process.

<table>
<thead>
<tr>
<th>Month</th>
<th>Phase</th>
<th>About</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ILA Phase 1</td>
<td>Identifying the stakeholders to be involved in the process. <strong>Based on a website and literature inventory</strong></td>
</tr>
<tr>
<td>2</td>
<td>ILA Phase 2</td>
<td>Issues at stake. Semi-structured interviews and focus groups on how the researchers and stakeholders perceive the research program and related issues. Some of the researchers directly involved (N=6), stakeholders (N=9: two animal protection organizations, food industry, two branch organizations, branch media, pigs genetic institute, the Dutch Ministry of Agriculture, ethical science), and citizens (N=27)</td>
</tr>
<tr>
<td>6</td>
<td>ILA Phase 3</td>
<td>Issues at stake. Dialogue session on the positive and negative aspects of the research program. Researchers directly involved and the panel of stakeholder representatives</td>
</tr>
<tr>
<td>11</td>
<td>ILA Phase 2</td>
<td>Concepts at stake. Semi-structured interviews on how the researchers and stakeholders interpret the research concepts at stake. Some of the researchers directly involved (N=2) and stakeholders (N=10: two animal protection organizations, two food industries, branch organization, pigs genetic institute, two animal welfare researchers, political party, animal nutrition industry, pig husbandry architect)</td>
</tr>
<tr>
<td>12</td>
<td>ILA Phase 3</td>
<td>Part one: Understanding of concepts. Dialogue session on the interpretation of the research concepts at stake</td>
</tr>
</tbody>
</table>
Part two: Issues at stake. Dialogue session on the different perspectives of stakeholders regarding the research program

Researchers directly involved and the panel of stakeholder representatives

18  ILA Phase 4  Implications of past dialogue sessions. Dialogue session on the meaning of insights derived during the first two workshops for the research program and what actions then need to be taken

Researchers directly involved

18-28  ILA Phase 5  Writing of a folder by the PhD students to address the questions and concerns of the research program.

Self-organized symposium by PhD students to stimulate knowledge exchange between researchers and sector on social pig behaviour

3.5 Validation

Four strategies were used to minimize research bias, enhance validity and thereby improve the quality of the research. The first strategy was methodological triangulation, the use of different research methods to collect data. In this thesis, conclusions are based on combinations of interviews, observations of the dynamics during dialogue sessions, evaluations with participants and/or the literature review.

Second, to ensure rich data, all interviews, focus group sessions and dialogue sessions throughout this research were recorded and documented by verbatim transcripts. Because an emergent design was used, it was possible to combine inductive analysis (themes emerge from the empirical data) and deductive analysis (themes are predefined, based on concepts and models from the literature). This has the benefit that the influences of practice and literature are balanced.
Third, participant checks were conducted on all interventions to check the authenticity of the results, i.e. whether the researchers interpreted them correctly. During interventions, information was summarized and asked if this was done correctly, and during the analysis, feedback was requested after sending summaries and/or reports. Sometimes, participants highlighted subtle nuances that were overlooked whilst writing the summaries which contributed to our analysis.

The transdisciplinary PhD student and animal PhD students reflected frequently (informally) on the individual and shared learning progress, and the role of the learning interventions in this. An extensive evaluation of the first three years of the learning process, including all past interventions, was conducted with the animal researchers (month 35). It consisted of a questionnaire survey and an in-depth interview lasting approximately one hour. In addition, the researchers commented on a final version of the paper that describes their learning process (chapter 5). Because of this, the results presented in this thesis (chapter 5 and 9) are not only based upon observations by the transdisciplinary PhD student, but are rather the combination of these observations and shared experiences of the animal researchers.

Fourth, investigator triangulation was used, which means that multiple researchers were involved in this study. Tjard de Cock Buning was responsible for the overall management and supervision of the project, but he also participated in the design of the methodologies and in the analysis. Learning interventions were designed on the basis of discussions and not as solo activities of the PhD student. Transcripts of interviews and focus groups sessions were additionally coded and cross-checked by teams of 6 – 10 interns.

3.6 Methodological design (& Reading guide)

In five studies, the design, process and outcomes of specific parts of the learning process are described (see figure 3.2 and table 3.3). A special focus was placed on the extent to which the interventions of the learning process stimulated mutual learning between stakeholder groups and what practical factors hampered or encouraged this process. Below, we discuss briefly how these five studies formed part of the four-year learning process, what the topic and methodology were, and which stakeholders were involved. An elaborate description of the research methodologies for each study is given in the corresponding chapters.
This thesis is based on five studies (A to E), which each show a specific part of the multi-stakeholder learning process. Figure 3.2 shows which stakeholders are key in each study. Table 3.3 shows how each study corresponds with a chapter, and what specific part of the multi-stakeholder learning process is described.

<table>
<thead>
<tr>
<th>Paper</th>
<th>Chapter</th>
<th>Design, execution and evaluation of specific parts of the process</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5</td>
<td>Transdisciplinary teamwork: Process description of interdisciplinary teamwork to realize transdisciplinarity and the effect of the multi-stakeholder learning process on this</td>
<td>(Benard &amp; De Cock Buning, 2014)</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>Knowledge transfer: Farmer symposium including workshops followed up by one-to-one dialogue sessions between farmers and researchers</td>
<td>(Benard et al., 2013)</td>
</tr>
<tr>
<td>C</td>
<td>7</td>
<td>Framing differences: Assessment of observed differences in pig behaviour between the stakeholder groups: pig farmers, urban citizens and animal researchers</td>
<td>(Duijvesteijn et al., 2014)</td>
</tr>
</tbody>
</table>
3.6.1 Transdisciplinary teamwork (Study A, Chapters 4 & 5)

Central issue: organizing teamwork among PhD students with different disciplines in order to realize transdisciplinarity together.

Chapter 4 is an introduction to the Seeking Sociable Swine program. Through interviews and focus groups, the issues at stake were explored, and potential value conflicts concerning this program were anticipated between researchers and stakeholders. The outcomes were used as input for the learning process of the researchers as described in chapter 5.

Chapter 5 focusses on the challenges related to interdisciplinary collaboration and transdisciplinary activities that the researchers faced in the animal welfare research program. We analysed to what extent the interventions that were part of the first three years of the multi-stakeholder learning encouraged the researchers to move from a monodisciplinary approach to a more transdisciplinary one. Three learning phases that the PhD students went through were identified and described along with elements that worked as either barriers or facilitators of learning.

3.6.2 Knowledge transfer (Study B, Chapter 6)

Central issue: Facilitating two-way knowledge exchange, taking into account different educational backgrounds and framings.

The multi-stakeholder learning process revealed a gap in the perspectives of the researchers and farmers on social pig behaviour and the related societally relevant theme of tail biting...
between pigs. Tail biting is abnormal pig behaviour, which can have detrimental consequences for animal welfare and can bring high costs for the farmer. One of the shared science-society learning activities of the research team consequently became the organizing of an interactive symposium for farmers on what is already described in the scientific literature on these themes.

The first part of the symposium was based around four presentations by four of the animal science researchers. The second part included a workshop to gain insights into the knowledge needs of farmers, so societally relevant research questions could be distilled from them. Although directed to pig farmers, other professionals from the sector were also present.

The four most critical farmers were asked to participate in follow-up, one-to-one dialogue sessions with the researchers to understand the criticisms encountered, i.e. the origin of the different perspectives, and to stimulate mutual analysis and learning.

Chapter 6 describes what elements affected the mutual learning between researchers and farmers in these two settings.

3.6.3 Observing differences (Study C, chapter 7)


The PhD students were introduced to qualitative behaviour assessment (QBA) in one of the courses (month 18). This is a method to assess animal welfare with an extended class of terms close to the vocabulary and meaningful language of citizens. Different observers are asked to label an animal’s mood by using descriptive terms such as active, happy or irritated (Wemelsfelder 2007). The method is unique in the sense that it goes beyond identifying pain and distress, and addresses positive aspects of animal welfare by observing the animal as a whole (Wemelsfelder et al. 2000).

This inspired the PhD students (including the author of this thesis) to set up a shared experiment on the differences in observations between stakeholder groups established by the use of QBA and to make this the topic of a joint paper. Three stakeholder groups were selected which were expected to have a different framing and way of observing: pig farmers
(N=11), animal behaviour researchers (N=18), and urban citizens (N=15). They were recruited through personal invitation by a person known to the participant (colleague or farm advisor).

Different observations of the same situation can result in different convictions and beliefs and thereby strengthen and even validate a personal framing. Observation differences may hamper a meaningful dialogue. In chapter 7, the results of the study are presented along with the implications for multi-stakeholder learning processes.

3.6.4 Frame reflection (Study D, chapter 8)

Central issue: Opening up fixed patterns of thoughts and rise above negative perceptions?

When consulting farmers and citizens separately on the research program as part of the multi-stakeholder learning process, we noticed negative assumptions about each other’s behaviours and choice. Citizens often had difficulties discussing the program as they could not rise above their general negative perceptions on animal production and the way animals are kept. On the other side, farmers often had difficulties taking citizens seriously.

Chapter 8 describes the direct effects of various frame reflection exercises on the framing of pig farmers and urban citizens on animal welfare, intensive pig husbandry and each other. Three urban citizen focus groups were conducted in December 2010 (N=21), and two with pig farmers in April 2011 (N=11). In the first part of the session, awareness of their own perspective was created by different association exercises. In the second part, the participants had to reason and react from the perspective of the other (vicarious abilities), through the use of film and role-playing.
3.6.5 Design principles (Study E, Chapter 9)

Central issue: Organizing multi-stakeholder learning processes around animal welfare research?

Chapter 9 provides insights into how to design and facilitate multi-stakeholder learning processes, in such a way that it most constructively supports mutual learning with respect to animal welfare. We take stock of the studies described in chapters 4 - 8 and analyse them in perspective over the total four-year period during the multi-stakeholder process.

3.6.6 Conclusion and Discussion (Chapter 10)

In chapter 10 the main research question is answered, and conclusions are drawn. The validity of the findings is discussed, and recommendations are made for further research.
4. Setting the scene of the Seeking Sociable Swine project: Exploring possible value-conflicts$^{2,3}$

Breeding to date has generally focussed on the performance of the individual animal. Recently, a new breeding method has been designed that includes the genetic effects that an individual has on the growth performance of its group mates. Potentially, these social genetic effects are associated with social interactions. Undesired aggression of pigs might be replaced by positive social interactions: a balanced improvement of welfare and production might be achieved.

In 2009, a large research program started to investigate the prospects of this selection for social effects in pigs. Aim was to study the opportunities to improve pig performance and welfare with this breeding method, in coherence with societal acceptance. A constructive multi-stakeholder learning process regarding the upcoming laboratory results will run parallel with the technical research program to decide on future directions.

Exploration through in-depth interviews and focus groups showed that, among others, non-researchers appeared to be concerned that economic motives are the main drivers behind this research strategy, instead of the expressed motives of improving animal welfare. In addition, the approach to include social interactions in breeding was perceived as an end-of-pipe solution and an implicit acceptation of the intensive pig husbandry. These results might indicate irresolvable value conflicts between the stakeholders and researchers involved. This chapter ends with a discussion of options to proceed constructively.

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$^{3}$ A brochure about the Sociable Swine project, written by the involved Ph.D. students is presented in Annex III.
4.1 Introduction: The *Seeking Sociable Swine* project

Pigs live a complex social life, and their social interactions are known to profoundly affect their wellbeing (Gonyou, 2001). In current husbandry, negative social behaviours, such as tail biting and aggression, are partly the result of the way the animals are housed and managed (e.g. barren environments, high density, mixing of pigs) (Gonyou, 2001). In the Netherlands, both the government and agricultural sector aim for a sustainable and animal friendly animal production sector by 2023. Stricter regulations towards animal production might, however, put more pressure on social interactions. For instance, a ban on castration or tail docking may lead to increased aggression and increased oral manipulation of group mates, respectively.

Incorporating social behaviour traits in pig breeding may circumvent these negative effects. Breeding is of significant economic importance in the production sector. It is a powerful tool to select animals that better meet the needs of the producers (Knap, 2012). Breeding on social behaviour traits is however highly complex compared to production traits. Growth performance is easily measurable, but social behaviour is only measurable by observing thousands of animals. A solution potentially lies in an indirect measurement: the effect that animals have on the growth of their group mates. This was the rationale behind the designing of a new selection strategy. It is based on the observation that some animals have a positive effect on the growth performance of their group mates and that this effect is genetically based (Bijma et al., 2007). The suggested explanation is that breeding for these types of animals positively affects the social interactions of pigs, thereby positively affecting the growth of all the animals in the group. A targeted breeding strategy might indirectly reduce negative social behaviours (such as aggressive behaviours) and increase positive social behaviours (such as social skills and social support), resulting in a win-win for animal welfare and growth performance (Rodenburg et al., 2010).

In a transdisciplinary research project funded by the Netherlands Organisation for Scientific Research (NWO) and the ministry of Economic affairs, the implications of the new breeding strategy for animal welfare were scheduled to be explored continuously in the research design. The research program included four projects which were conducted by four Ph.D. students and several supervising senior researchers (see figure 4.1). Project 2 concerned genetic research, including the genetic estimations for social effects. Project 3 and 4 focussed on animal behaviour research: comprehensive animal experiments were scheduled, such as a
genotype by environment set-up. A multi-stakeholder learning process was included in project 1 to ensure that the research strategy would take societal concerns into account.

In this chapter, we 1) analyse the results of a qualitative probe to describe the issues at stake, 2) discuss possible value conflicts around the breeding strategy, and 3) identify appropriate options to deal with these value conflicts.

**Figure 4.1** Overview showing the different activities within the research program (source: research proposal).

<table>
<thead>
<tr>
<th>Project 1</th>
<th>Project 2</th>
<th>Project 3</th>
<th>Project 4</th>
</tr>
</thead>
</table>
| • Stakeholder analysis  
   • In-depth study needs and visions | • Social genetic effects in different life stages and their relationships | • Behavioural and physiological characterisation of pigs with high vs. low social breeding values  
   • Behaviour and welfare-related traits  
   • Welfare assessment | |
| • Integration: meetings with stakeholders to exchange information, stimulate mutual learning and to decide on the desired direction of the project:  
   • Formulate priorities, actions and roles to be taken up by stakeholders during the project  
   • Discuss findings of the previous phases  
   • Identify shared future visions on ‘sociable swine’  
   • Writing a joint publication (PhD students 1, 2, 3 and 4) on the development of a societally acceptable (breeding) strategy for sociable swine | | |
| • Facilitation and coordination of joint activities | • Environment  
   • Predict responses to selection  
   • Experimental selection and validation | • Impact of group composition and coping styles  
   • Welfare assessment | • Effects environment (e.g. enrichment, social skills)  
   • Commercial scale genotype x environment interactions |
| | | | |
| • Integration: continued dialogue meetings with stakeholders | | | |
| • Priority setting and planning towards a joint innovation: dialogue meetings leading to:  
   • Concrete design options for socially embedded, responsible breeding programs  
   • A process and production architecture for realisation of these programs  
   • Time frame and setting of engaging different stakeholders in the future | | |

### 4.2 Methodology: Explorative study

To identify the societal issues at stake, nine relevant stakeholders (two animal protection organisations, meat industry, two branch organisations, branch media, the Dutch ministry of agriculture, pigs genetic institute, animal welfare science) and six researchers who are directly involved in the program were interviewed by means of semi-structured interviews.
Selection of the informants was based on a literature inventory of the relevant stakeholder groups. The inclusion of the opinion of Dutch citizens was done by the use of focus groups. Although most people are not aware of using values, a focus group is a suitable method to provide insight into the deeper motivations that lie behind opinion and ideas (Kupper et al., 2007). We performed three focus group sessions with each nine citizens (N=27), whom were recruited by a commercial recruitment company. The citizens were mixed in gender, age and education, and not selected/invited on the animal welfare issue.

At the beginning of the interviews and focus groups, we asked for first associations regarding the specific aim of the new breeding strategy, but also regarding more contextual aspects such as the current situation for pig husbandry, their attitude towards the pigs, and ideas on animal welfare. By asking for first associations and letting people declare their associations, we derived insights in their moral intuitions. By interfering as less as possible (except for clarifying “why” questions), the issues brought forward were own choices, enabling us to assess the primary negative or positive attitude (and arguments behind) towards the new breeding strategy.

4.3 Results: Stakeholder perspectives

To structure the results, the data was grouped according to the stakes of the different stakeholder groups. The Researchers included the researchers directly involved in the project. The Social Actors included the informants of the two animal protection organisations and consumers, and the Intermediaries included the remaining stakeholders.

The interviews and focus groups provided insights into various issues that the stakeholders came up with related to the new breeding strategy (see figure 4.1). These issues were grouped into four clusters 1) Support for the Aim of Research to increase welfare by breeding more sociable pigs, 2) Breeding as a Suitable Solution for welfare problems, 3) Comments regarding Breeding as Method, and 4) Respecting the animal.
Figure 4.1 Responses to the new breeding strategy: Number of times issues mentioned, grouped per thematic cluster and per stakeholder groups. The Y-axis represents how often an issue was mentioned. The numbers in the bars refer to the specific issues and the colours in the bars indicate by which groups these issues were stated (in a positive (+), negative (−), or neutral (±/−) sense). See for details the text.

The first cluster Aim Research shows a steep divide in perspective between the involved researchers on the one side, and the social actors on the other side regarding the contribution of the breeding strategy towards animal welfare. The researchers mentioned an improvement of the welfare of pigs as significant or primary aim of the strategy (1). In contrast, the social actors believed the primary aim was economical (2), and animal welfare at best at a second place. The social actors shared the idea that as long as economical aims have priority in the current husbandry and research strategies, animal welfare cannot truly be improved. The consumers perceived the aim of the strategy as a combination of economical aims fed by consumer greed (3). These reasons were, according to the consumers, unacceptable to adapt the animal.

The cluster Suitable Solution shows the issues involved the improvement of animal welfare by the use of breeding. According to the researchers, breeding was a suitable method (4). They emphasized that the pig husbandry is a complex system with different interests involved, including the environment and the ‘farmer as entrepreneur’. Other options that improve animal welfare – such as more space or the adding of straw in sties – would might
have a better result for the animal but excluded other interests with the consequence that they were unrealistic (on short term) or undesirable. Both intermediaries and consumers had moral problems with the strategy because they saw it as adapting the animal to its environment (small spaces) – instead of the environment to the animal (more space) (5). In addition, one intermediary and one social group believed that this strategy would not increase animal welfare, since the bad circumstances would still induce the adapted pig to be unhappy. In a similar line of thought, one researcher agreed that it is questionable whether welfare can be improved when the physical environment is left untouched (6). Other intermediaries and social actors perceived the breeding strategy as a plausible strategy, but perceived it mainly as an end-of-pipe solution. Aggressive behaviour or unhappiness of pigs was seen as the result of the bare environment and the management by the farmers. Therefore, the strategy could help to improve animal welfare but was not accepted as the right solution (7). For one social actor, the best solution was to stop eating meat (9). One intermediary had no problems with adapting the animal to the environment but questioned if it is acceptable to sort out needs of animals (8).

*Breeding* in general was not valued as positive or negative, but it did raise concerns of the intermediaries and social actors. One should be careful with pig breeding, because of the probabilistic character of its statistics. As in every generation, breeding produces only a proportion of the desired phenotypes, which implies that also a proportion of undesired phenotypes is produced. This might decrease the welfare of those animals (13). Breeding could also harm the integrity of the animal as a result of inbred (12). Poultry and dogs were frequently used as extreme examples of harming the naturalness or integrity of the animal. Positive valued by an intermediary was the changed attitude of breeders who tried more to breed in a responsible manner (10), and the potential of the method (11).

The fourth cluster *Respecting the Animal* contains the comments with respect to the relation between our normative position towards animals and the new breeding strategy. Diverse stakeholders, primary researchers and intermediaries, believed that the naturalness (14), integrity (16), and the animal itself (15) would not directly be harmed by the new research strategy. However, the animal, its naturalness or its integrity could be harmed when the concerns on breeding – discussed under number (12) and (13) in text – would not be taken into account or when the strategy would make pigs indifferent for their environment (17). In addition, one should be alert not to use this strategy as argument to restrict the available space of the animal (18). The social actors shared the same concerns but were more pessimistic in comparison with the intermediaries because the new strategy emphasized the
instrumental position of the animal (19). The strategy could also harm the development of the species: aggression might be necessary for surviving of the species (20).

Values

Besides the new breeding strategy, we also asked during the focus groups and interviews for the personal attitudes towards the pig. Eight of the nine stakeholder groups, except for the animal protection organisations, saw the pig as a production animal, as a means to an end (food). Nevertheless, the use of the same issues as positive, neutral and negative comments by different stakeholder groups (figure 4.1: 2,5,6,7,14,17), shows that each informant had its own particular consideration to draw the line regarding the acceptability of this project. Where some regarded it as acceptable to adapt the animal as long as the animal was not harmed (consequentialism), others regarded the action in itself as unacceptable (deontology). Although all the researchers, intermediaries and citizens positioned the pig as a production animal, they differed in their valuation of the human-animal relationship. For example, many of the intermediaries stated the necessity to keep an emotional distance of the pig. Especially the farm representatives rejected the projection of human norms to the pig. In contrast, the citizens did assign human norms to the pig when discussing the current pig husbandry and the new breeding strategy. This brings them more in line with the representatives of the animal protection organisations: they regarded the pig as a subject, a respectful end in itself. This distinction might explain the different valuing of the intensive pig husbandry. The researchers and the intermediaries accepted that the current commercial pig husbandry is economically driven and commented from that perspective, while the frame of reference of consumers and animal protection organisations is a husbandry that will satisfy the natural needs of the animal.

4.4 Conclusion & Discussion

This explorative study provided insights into the various issues related to the new breeding strategy. Especially the social actors were primary negative towards the aim and the strategy; while the intermediaries expressed more nuanced concerns; and the researchers were primary positive. It also appeared that within the groups different considerations were made when and how the intrinsic value of the pig was harmed. We suggest that these differences between and within groups are correlated with the positioning of the pig against other values
that influence the acceptability of the breeding program. If this is true, is there a way out to escape from an endless and frustrating deadlock and repeating arguments for deaf ears (Beekman & Weele, 2004)? An option to deal from a governance perspective with irresolvable fact-value conflicts is provided by Hisschemöller’s and Hoppe’s General policy theory (1995). They identified four different societal problem types based on consensus and dissensus about values and facts. As for the new breeding strategy no agreement among researchers and social actors exists on the weighting of animal and market values and uncertainty exists on the available knowledge, the breeding program can therefore be perceived as an unstructured problem. The general policy theory claims that each of the four types of fact-value problems has a related policy strategy. Applying the right strategy to the wrong problem will lead to predictable failures. The strategy for an unstructured problem focuses on the problem itself instead on the solution: acknowledge that stakeholders do possess different perspectives on facts and values at stake. The usual solution, assigning only the researchers as the expert regarding facts will lead to failure, hence a persistent problem. Instead the strategy should focus on a shared vision on the problem; only then solutions can be created. In other words, a learning process among the stakeholders should be facilitated.

Next steps in this project were devoted to experiments in joint learning as described in chapter 5 t/m 9. Conditions were set in which the stakeholders were invited to explore together win/win options that respect the various value positions and result in enhanced animal wellbeing. Two to three times a year methodological workshops were organized 2010-2012 with the researchers and other stakeholders to discuss the data, the interpretation and the follow up decisions. However, this approach is not without risks of conflict. It was therefore important that for such kinds of sensitive learning processes a commitment is asked by the participants, in the line of Habermas (1981) “Machtsfreie” Dialogue.
Results