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# Integrating Sustainability Goals in Innovation Processes: Applying a Decision Support Tool in a Dual-Purpose Chicken Case Study

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**Abstract:** The innovative dual-purpose chicken approach aims at contributing to the transition towards sustainable poultry production by avoiding the culling of male chickens. To successfully integrate sustainability aspects into innovation, goal congruency among actors and clearly communicating the added value within the actor network and to consumers is needed. The challenge of identifying common sustainability goals calls for decision support tools. The objectives of our research were to investigate whether the tool could assist in improving communication and marketing with respect to sustainability and optimizing the value chain organization. Three actor groups participated in the tool application, in which quantitative and qualitative data were collected. The results showed that there were manifold sustainability goals within the innovation network, but only some goals overlapped, and the perception of their implementation also diverged. While easily marketable goals such as ‘animal welfare’ were perceived as being largely implemented, economic goals were prioritized less often, and the implementation was perceived as being rather low. By visualizing congruencies and differences in the goals, the tool helped identify fields of action, such as improved information flows and prompted thinking processes. We conclude that the tool is useful for managing complex decision processes with several actors involved.

**Keywords:** value-based sustainability assessment; stakeholder participation; niche level; culling of male chickens; mixed methods

## 1. Introduction

The transition towards increasing sustainability is a pressing societal challenge on the global scale. While large-scale transitions take decades, the local implementation of sustainable practices could provide a suitable spatial scale for exploring and testing the feasibility of innovative approaches for upscaling and further transference [1]. However, there are multiple obstacles. Not the least of them, the term *sustainability* itself is linked to policies monitored by indicators that are selected top down and applied to national data. This approach has limitations regarding local actor-driven processes, since global or national indicators might not capture all aspects of sustainability relevant to local communities or initiatives [2]. Furthermore, sustainability is considered to be a ‘wicked problem’. Wicked problems encompass highly complex issues, such as climate change, that cannot be overcome through traditional solutions because the cause-and-effect relationships are often uncertain [3]. The effort toward sustainability usually requires the involvement of multiple actors, who can have different norms and value frames. Since these values are not available and transparent to everyone,

there are different perceptions of what the actual problem is [3]. Consequently, conflicting goals [4] and different ideas about how to accomplish sustainability [3] can exist, complicating the transition process [4]. To resolve sustainability issues, Blok et al. [3] suggested that the involved actors must possess both normative competence and action competence. Normative competence means that professionals are able to recognize sustainability issues and assess how to manage the application of their individual ethical norms. Action competence encompasses the ability of an individual to actively engage in improving the sustainability issues of social–ecological systems, products, or processes, together with other individuals. In this way, the involved actors acknowledge a sustainability issue but also accept the responsibility to address this issue accordingly together [3]. Therefore, to successfully establish an innovation [5], as well as to implement regional sustainability [6], the creation of a collective vision is considered crucial. Before measuring sustainability on a regional level is possible, local actors must be involved in integrating their understanding of sustainability goals according to the priorities defined by the complexities of their local socioeconomic situation [2,7]. Furthermore, the consideration of ethical and social aspects in an innovation process can be challenging for several additional reasons. Innovations linked to sustainability usually bear relatively higher production costs, rendering their provision more expensive. Hence, communicating their added value is important so that consumers and users can distinguish sustainably-produced goods from similar products [5]. The difficulties in steering innovation management processes and aligning sustainability goals to achieve clear communication within and outside an actor network call for the application of decision support tools [5,8]. For this study, we developed a tool that supports actors in identifying the most important sustainability goals of their innovation. Furthermore, the tool enables actors to rate the degree of implementation of these goals and to compare them with the perceptions of other actors. The tool was then applied to a sustainability innovation in the field of poultry production. In debates about sustainable animal production, there are strong focuses on animal welfare and environmental challenges [9]. On the one hand, consumers expect food producers to consider social and ethical aspects, for example, the biological needs and behavioral characteristics of animals [10]. Consumers are particularly concerned about highly industrialized animal production systems and associated practices, such as high livestock densities, the use of antibiotics, artificial living-environments in barns, or the use of genetically modified feed [11]. On the other hand, there are also producers that are intrinsically motivated to increase animal welfare [12], and retailers consider welfare aspects when choosing the products that they sell [13]. In the poultry industry, the focus is on improving the efficiency of production processes at the expense of the chickens. While public protests were initially triggered by environmental concerns, criticism also considered animal welfare issues, such as battery cages [14].

As a reaction, the poultry production sector has undergone several changes in recent decades. Chicken farming in Germany has been influenced by factors such as changing legislation and consumer demands. These changes have been exemplified in the abandonment of battery farms on a national level in 2009 and on the EU level in 2012 [12]; additionally, organic eggs accounted for more than 20% of the sales value of the entire egg market in 2017 [15]. Furthermore, animal welfare, particularly in egg and broiler production, has become a public concern. In an EU-wide survey, consumers reported that compared to the rearing conditions of cattle and pigs, the husbandry conditions of laying hens and broiler chickens need the most improvement. Almost 75% of the surveyed German population reported that the animal welfare of laying hens was very bad or fairly bad [16]. Aspects that are considered problematic are, for example, beak trimming, cannibalism among chickens, artificial light regimes to increase productivity, and the aforementioned high stocking densities [17]. Recently, the practice of killing day-old chicks has gained societal attention [8]. Specialization processes in the poultry industry led to the use of chicken breeds that either lay many eggs or rapidly gain meat. However, there is no economic incentive to raise the male chicks of layer breeds, as they neither lay eggs nor produce a sufficient amount of meat. As a result, more than 40 million male chicks are killed annually in Germany one day after hatching, and on the EU level, the number is 280 million [18,19]. The killing of day-old chicks is increasingly criticized in media reports and by animal welfare organizations, and

is thus being taken up on the political agenda [12]. Furthermore, consumers who are aware of this issue start to raise ethical questions, which was revealed in a study in the Netherlands: almost half of the respondents demanded a ban of chicken culling [20]. These concerns call for alternative practices; one such practice is in ovo sex determination, and another is the re-establishment of dual-purpose chickens. The in ovo sex determination method detects the sex of chickens before they are born. Eggs that are developing into male chickens are destroyed, preferably before embryonic development starts. However, the respective technology has not been fully developed [20,21]. Another alternative practice is the use of dual-purpose chicken breeds that are suitable for the production of both eggs and meat, but the production costs are higher compared to those of specialized layer hens and broiler chickens [19]. The governments of Germany and the Netherlands have recently promoted the abovementioned alternatives to foster a transition towards more sustainable management practices. In 2018, the legal ban on male chick killing was also included in the coalition agreement of the governing parties in Germany [12,18–20]. Overall, changing consumer culture and governmental efforts are prerequisites for changing the existing meat and egg production system, but changing the system also requires entrepreneurs who react to these new demands and regulations on a niche level with innovative ideas. In fact, business actors are assumed to play an increasingly important role in sustainability transitions. In the context of implementing alternatives to killing male chicks, a reorganization of the value chain is necessary, for example, because hatcheries have to rear dual-purpose chicks instead of hybrid breeds [12]. In general, the improvement of animal welfare is considered a joint task, for which many actors along the value chain bear responsibility [22]. Capturing the sustainability goals of the actors involved in production, distribution, and retail is important for creating a joint strategy and defining areas of responsibilities regarding sustainability tasks. This process has several benefits for the successful establishment of a market niche. Identifying the most important sustainability goals helps distinguish the alternative production model from the prevailing regime. Goal prioritization also builds a basis for communicating the sustainability benefits of dual-purpose chicken products clearly to consumers. In a broader context, building a coherent network with aligned goals increases the visibility of the alternative and can create pressure on the existing regime [12].

Due to the complexities of actors' goals and the respective decision-making in innovation processes, we applied the tool to analyze the potential for making the congruencies and differences between actor perceptions explicit for the case study of implementing dual-purpose chickens in Germany. In detail, we had two objectives:

- To test whether the tool was suitable for improving communication between actors along the value chain, as well as marketing sustainability to consumers;
- To explore whether the tool could help the coordinating actors identify fields of action for steering and adjusting the value chain.

## 2. Materials and Methods

### 2.1. Case Study: Dual-Purpose Chicken Production and Marketing in Germany

The case study consisted of an actor network that was linked to the establishment of dual-purpose chickens in Germany. The actors cooperated to address the practice of male chicken culling within their network by introducing an alternative production pattern, thereby following a niche-driven transition approach. A marketing organization for organic farmers and a wholesale trader for organic products launched the initiative in 2011; the group cooperated with five farmers at the time of data collection. The aim of the initiative was to raise dual-purpose chicken breeds in small herds, based on organic farming principles, and to produce meat and eggs from male and female chickens on the same farm. The initiative was characterized by a strong regional focus. For example, the feed was grown regionally, and the transportation and distribution channels were limited by using the shortest possible distances to slaughterhouses and by building a market for sales in the metropolitan area of the project region. The products carried a label that went beyond the guidelines of organic farming and set standards for

mutual trust, social responsibility, and reliable trade partnerships. Consequently, the actors attempted to combine the alternative practice of farming dual-purpose chickens with several other sustainability goals. At the time the tool was applied, five producers had implemented the criteria for organic and diversified production. All farmers started their farms under this initiative, thus avoiding any transition periods from conventional farming. The marketing organization incentivized dual-purpose produce by offering fixed prices for eggs and meat to secure revenue, particularly in regard to the experimental stage of implementing the approach.

## 2.2. Tool Design

The application of the decision tool had several purposes: actors could select the most important sustainability goals of an innovation from a catalogue of sustainability goals or add additional goals. Based on the selection, the actors could rate the degree of implementation of the goals and then compare their ratings with those of other actors. The catalogue of sustainability goals was compiled during a pre-study that consisted of 13 open expert interviews with actors that were related to the initiative. The interviews were conducted with farmers, shop managers, traders, and marketing organization and restaurant staff. The interviews were semi-structured and consisted of questions on the actors' sustainability value perceptions of the dual-purpose chicken innovation [23,24]. The recorded interviews were subsequently transcribed. Content analysis was applied as an empirical method for this qualitative and inductive research [25]. The results indicated that the sustainability aspects differed between actors in relevance and in prioritizing activities. It became apparent that a discussion between the actors would be relevant to jointly prioritize sustainability goals to target a viable strategy for marketing and further improve production efficiencies.

The content analysis of interview transcripts produced 45 sustainability goals that the actors associated with the initiative [23,24]. Two additional goals were added during the pretests. Consequently, the catalogue of sustainability goals used as input for the tool encompassed 47 items. The tool was designed based on ditto software (Ontopica GmbH, Germany). Iterative feedback loops between the software developers and two researchers, as well as two additional pretests, ensured both the usability and the comprehensiveness of the tool. The content of the tool was aligned to the research objectives of this paper. On the front page, the participants were provided with a description of the aim of the tool and the possible benefits of the results. The steps that were necessary to obtain the results were explained as follows:

1. Select goals: From an initial selection and range of 47 goals, the interviewees were asked to select seven sustainability goals that were considered most important for the added value of the initiative. The interviewees were also able to add further goals or to comment on and discuss the goal set;
2. Rate goals: The selected goals were rated on a scale from one to ten, indicating to what degree they were considered to be already implemented (1 = not implemented at all, 10 = fully implemented);
3. Compare groups: The goal selection and rating were directly visualized in spider diagrams.

The results were displayed so that participants were able to compare their own spider diagram with the results of their own group and to make comparisons between groups.

## 2.3. Tool Application

The establishment of dual-purpose chicken products as an innovative and alternative way of organic meat and egg production required at least partial reorganization of the value chain. Furthermore, the production method considered sustainability aspects that went beyond the common guidelines of organic production. The marketing of these aspects had to be emphasized accordingly. We included the following three main actor groups in the tool application: (a) farmers, (b) the marketing organization, and (c) shop managers. Due to their close linkage with the innovation process, the actors were in a position to strategically integrate and implement sustainability goals in their practices.

To select interviewees, we created a pool of potential participants that included the three main actor groups. All potential participants were contacted beforehand via email to provide them with basic information about the interview. Subsequently, each person in this pool was called personally to discuss details and questions and to schedule the appointments. Overall, this process resulted in a sample size of 20 interviewees. The first group consisted of five farmers that produced eggs and meat for the initiative. Five logistic staff members who were currently or had been closely connected with the marketing and distribution of dual-purpose chicken products formed the second group. The compilation of the third subgroup was based on information provided by the marketing organization. Ten organic shops with good sales figures for eggs and meat from our case study initiative were randomly selected from a list. The survey period started on 18 June and ended on 3 September. The length of this period was justified by the harvest season, which delayed the scheduling of appointments with the farmers.

Computer-aided interviews were conducted in personal interactions with each actor individually. Prior to the application of the tool, a brief thematic introduction about the relationship between innovation processes and the consideration of sustainability aspects was given to each interviewee. The actors were familiarized with the method, the development of the tool, and the sustainability goals. If problems arose regarding technical usability or there were content-related questions during the tool application, the participants could ask the interviewer for help. Prior to the interview, the interviewees were encouraged to comment on their goal selection, their rating, and the comparison of their results with those of others. The comments on the content, the selection, and rating of goals, and the responses to the displayed spider diagrams, were written down by the interviewer in a structured form.

#### 2.4. Data Analysis

The tool results were quantitative, and the comments on the goal selection and ratings were qualitative; therefore, we followed a mixed methods approach. The quantitative data were analyzed using simple statistical methods that were integrated into the tool. The results were directly visualized via spider diagrams during the interviews. Later, the data were exported into an Excel table that exhibited the ratings of each individual. The absolute frequencies of the selected sustainability goals and the frequencies per group were extracted from the raw data. Furthermore, the average ratings of the implementation of the respective goals for both the entire sample and for each group were calculated in the Excel spreadsheet. The qualitative data from the verbal comments were assigned according to the sustainability goals, and congruencies and differences were identified. Since the sustainability goals were formulated beforehand, we followed a deductive category application [26].

### 3. Results

#### 3.1. Absolute Frequency of the Selected Sustainability Goals

In the quantitative section of our results, overall, the tool users selected 35 different sustainability goals (see also Table A1 for a complete overview). In all groups, the goal 'animal welfare' was selected most often (15 times). The next most frequent goals were 'full utilization of biomass' (meaning that both eggs and meat are eaten) (13 mentions) and 'species conservation' (10 mentions). Thus, the three most frequently mentioned goals all belonged to the environmental dimension of sustainability. 'Future viability' was ranked fourth (nine mentions) and was the first goal in the social dimension. Economic goals, such as 'regional economic effects' (six mentions), 'commercial quality' (five mentions), and 'operating efficiency' (four mentions), were selected considerably less often.

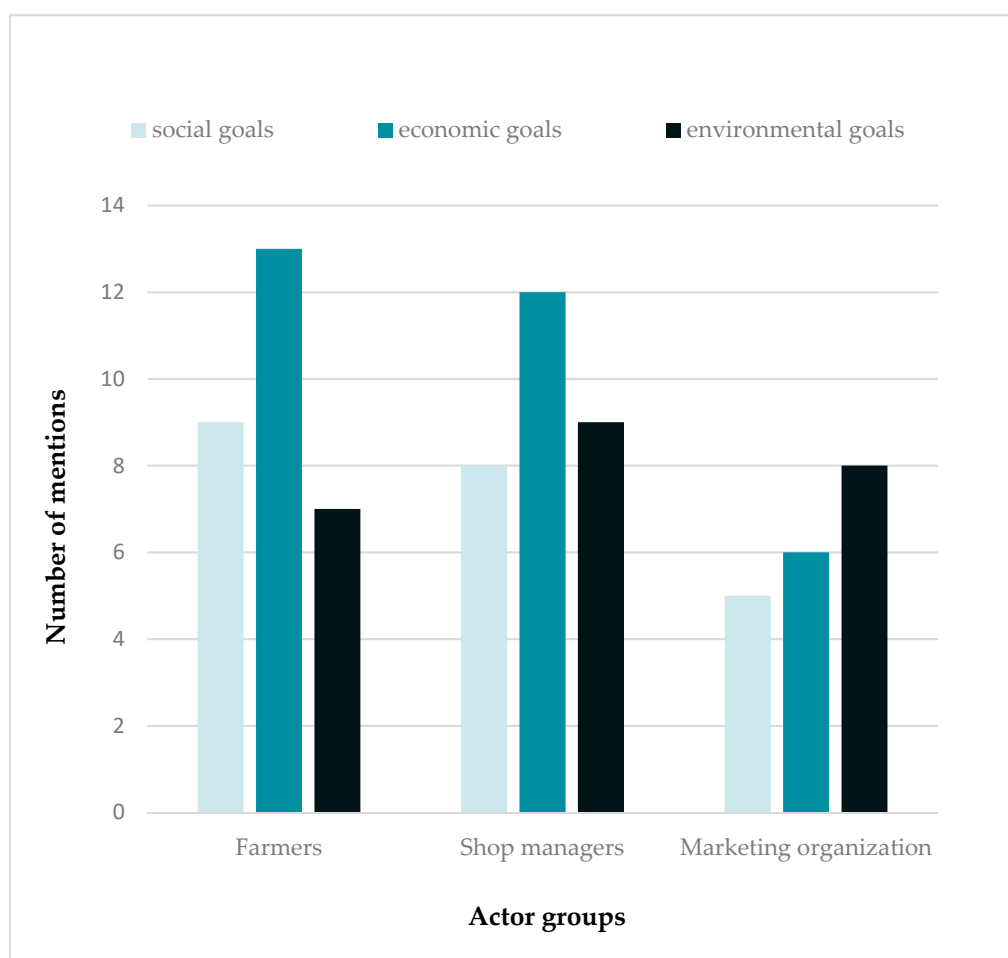
#### 3.2. Perceived Implementation of the Selected Sustainability Goals

In addition to choosing the most important sustainability goals, the participants also rated their perceived degrees of implementation of these goals (see also Table A1). A scale from one to ten was used, where 1 = no implementation, and 10 = full implementation. 'Animal welfare' (9.5) exhibited

the highest average rating, followed by ‘full utilization of biomass’ (8.7), ‘interest and demand’ (8.7), ‘species conservation’ (8.6), and ‘closed ecological cycle’ (8.4). Furthermore, it was notable that economic goals such as ‘future viability’ (6.7), ‘commercial quality’ (5.6), ‘operating efficiency’ (5.0), and ‘competitiveness’ (4.3) were assigned rather low ratings.

### 3.3. Goals According to the Sustainability Dimension and Actor Group

Relating the goals to the different dimensions of sustainability for each actor group revealed different foci (see Figure 1)—farmers and shop managers chose a wide range of different sustainability goals, most frequently from the economic dimension. In contrast, the marketing employees selected a smaller variety of goals, with a light emphasis on the environmental sustainability dimension.



**Figure 1.** Selection of actor groups’ goals according to the sustainability dimensions (n = 20).

### 3.4. Common Sustainability Goals of All Groups

A comparison of the overlapping sustainability goals and the ratings of the different groups provided further insight into the production side of the value chain (see Figure 2). We found congruency in the ten goals, meaning that at least one person from each group chose them. A consensus among the three actor groups was shown, for example, on the implementation of ‘animal welfare’ and ‘regional economic effects’. The shop managers and farmers rated the goals ‘commercial quality’ and ‘species conservation’ similarly high, but these goals were rated considerably lower by the marketing organization. The shop managers and marketing employees shared a similar opinion of the goal ‘continuous purchases’, while the farmers rated this goal higher. In contrast, ‘interest and demand’



was rated far higher by the shop managers, while the farmers and marketing organization equally rated this goal lower. The same result was found for the ‘conservation of genetic resources’.



Figure 2. Common sustainability goals and the average degree of their implementation (n = 20).

### 3.5. Common Sustainability Goals Between Two Actor Groups of the Value Chain

In addition to the common goals that all actor groups in the value chain shared, there were also common goals between two actor groups. The shop managers and marketing employees shared 14 sustainability goals. For seven of these goals, the implementation was similarly rated. On average, the marketing group rated the implementation of the goals ‘commercial quality’, ‘future viability’, ‘conservation of genetic resources’, and ‘species conservation’ considerably lower than the shop managers. The shop managers and farmers had 21 common goals, but there was large variation regarding the rating of the implementation. The farmers rated the economic factors, such as ‘diversification of the farm structure’, ‘additional jobs’, or ‘continuous purchases’, considerably higher. On the other hand, the shop managers were more optimistic about goals such as ‘interest and demand’, ‘solidarity with the farmer’, ‘operating efficiency’, ‘personal fulfillment’, and the ‘conservation of genetic resources’. The farmers and the marketing organization selected 13 common goals. Notably, some of the economic goals were rated very similarly (e.g., ‘interest and demand’, ‘regional economic effects’, and ‘economic cycle’). The other economic goals were rated significantly lower by the marketing organization (e.g., ‘commercial quality’, ‘future viability’, and ‘continuous purchases’). In contrast, the implementation of the ‘conservation of genetic resources’ goal was rated much lower by the farmers.

### 3.6. Detailed Perception of the Sustainability Goals

The qualitative results that originated from the verbal comments of the tool users were directly or indirectly connected to the sustainability goals. Most of the comments that were brought up during the tool application were in reference to the economic goals, for example, how 'continuous purchases' could be accomplished or how the commercial quality could be increased. In general, the participants reported that egg sales went well. Two shop managers criticized that they were repeatedly supplied incorrectly with eggs, and as a result, they were not able to fulfill the demands of their customers for eggs from dual-purpose chickens. To accomplish continuous purchases, the shop managers mainly stated that new customers were not aware of the difference between eggs from dual-purpose chickens and organic eggs. Once the customers were informed about the specifications of eggs from dual-purpose chickens, they quickly became regular customers. However, the shop managers' capacities to communicate with the uninformed customers were limited due to time constraints. The actors in all of the participating groups identified low sales of dual-purpose meat as crucial for the sustainability of the overall initiative. In this context, the shop managers criticized the idea that informing customers about the advantages of dual-purpose products was their responsibility because there was a lack of concise advertising material. Several participants from the shop manager and farmer groups pointed to the need for short, striking, and easily understandable advertising messages. Furthermore, the shop managers often expressed that they were not able to rate the degree of implementation of some goals that they found important because they lacked information. The low average rating of the commercial quality of dual-purpose products by the marketing representatives was surprising for an actor of the same group but also for two shop managers. One shop manager noted that the marketing organization should be able to influence the quality of the products. Another was very convinced of the quality, as quality was the most important criterion for the incorporation of a product in the shop's assortment.

Only a few of the verbal comments were related to the environmental goals. The low sales of dual-purpose meat were mentioned by all the actor groups, which contradicted the high rating that the full utilization of biomass accomplished. A participant from the marketing group noted that environmental sustainability could be considered critically as the feed conversion ratio was much lower than that of hybrid breeds. The verbal comments furthermore revealed diverging opinions on the goal of climate protection. A farmer assumed short transport distances and low emissions due to the regional character of the initiative. In contrast, a marketing representative estimated the emissions as being higher than those of mass production because of lower scale effects.

The only common social goal of all three actor groups was 'future viability'. The large difference regarding this goal prompted different reactions. A shop manager stated optimism about the future of dual-purpose products because of a perceived growing awareness by customers. One marketing representative, however, was surprised about the high average rating of the shop manager because meat sales were low.

Other social sustainability goals were also commented on, even though they were not chosen by all three groups. The large difference in the rating of the 'solidarity with the farmer' goal by the farmers and shop managers induced different thoughts. One shop manager concluded that the low rating by the farmers must mean that dual-purpose chicken farming was not viable. A farmer, on the other hand, criticized that their share of the retail price was low, even though they bore the cost of alternative production. The goals 'consensus among actors' and 'exchange between actors' were only picked twice overall. However, more than half of the shop managers expressed that they were not able to rate the degree of implementation of some goals that they found important but lacked the according appropriate information. Adding to this thought, the actors from all groups verbally wished for an increased exchange between the different groups.



## 4. Discussion

### 4.1. Communication and Marketing

Although awareness of the killing of day-old chicks is increasing, alternatives to prevent this practice are not well known [19,20]. Accordingly, our interviewed shop managers repeatedly pointed out the necessity of explaining to customers what distinguishes dual-purpose chicken products from other organic eggs or chicken meat. Other scholars have confirmed this need, since they found that providing large amounts of information to consumers is necessary to understand both the problematic practices of the prevailing system and the alternatives, such as dual-purpose chicken products [19,20]. Clear marketing of the innovative sustainability attributes of a product—in our case, dual-purpose meat and eggs—is particularly important, since the consideration of aspects such as animal welfare is not visible from the product's appearance, compared to a mainstream product [27]. The most often selected sustainability goals were 'animal welfare', 'full utilization of biomass', and 'species conservation'. Thus, the overall high rating of the perceived implementation of these goals (between 8.6 and 9.5 out of ten) provides a common ground regarding the environmental aspects of sustainability. Several studies have shown that consumers are increasingly interested in local food and animal welfare and claim that they are willing to pay more for these products [28–31]. However, Verbeke [22] argued that the sole focus on animal welfare as a distinctive feature is not sufficient for a product. Rather, animal welfare should be embedded into a broader concept of quality and sustainability. This embeddedness was the case for our initiative, since the actors' sustainability goals went far beyond the animal welfare issue, and the initiative had a strong focus on regionality. Hence, the goals that we identified in our interviews were suitable for addressing the latest consumer trends with the corresponding marketing strategies. Participants from both the farmer and shop manager groups suggested more concise marketing that summarizes the main advantages of the products but does not overwhelm the consumer. This idea is in line with research results claiming that product information and labeling are important for building trust in a product [19], but information overload should be avoided [22].

### 4.2. Improvements to the Value Chain Regarding Sustainability

It became obvious that the actors along the value chain had different perceptions of the sustainability goals and the degree of their implementation. Although we only involved three actor groups in our case study, 35 different sustainability goals belonging to different dimensions were selected. This outcome proves, on the one hand, the complexity of sustainability and indicates that the people involved in the innovation judge sustainability differently. On the other hand, it shows that the interviewees were able to identify sustainability problems around poultry production in general and the practice of killing of day-old chickens, as well as devising goals to improve this situation. The variety of selected sustainability goals is in line with the description of sustainability as a wicked problem, which does not have only one 'true' solution. Furthermore, the tool application showed that the actors had normative competence in the sense of the ability to identify the virtues that are necessary to overcome a sustainability problem [3]. The normative competence was especially demonstrated when the users explained the reasoning for their goal selection. During the rating of the degree to which the selected sustainability goals were already achieved, the tool users also showed their action competence in terms of leaving a passive position and taking active responsibility for sustainability goals [3]. For instance, the shop managers proposed or had already implemented several measures to improve the goal of continuous purchases by regular clients of dual-purpose products. They were very active in informing customers about the special characteristics of the product or even placing the eggs from dual-purpose chickens in a more prominent position on the shelves, compared to other organic eggs. The ratings of the sustainability goals often differed considerably between the actor groups. The implementation of environmental goals, for example, was often rated higher than the implementation of economic goals. However, economic goals were frequently discussed, which might suggest a trade-off between economic goals and other dimensions. Especially in the context of corporate sustainability, business-related goals

often clash with sustainability goals [3]. Sulewski et al. [32] provided another possible explanation. The authors argued that realizing sustainability in all dimensions is difficult. Achieving a high level of sustainability in one dimension usually means lower sustainability in another dimension. Block et al. [3] also argued that, due to its complexity, sustainability can never be fully achieved. All solutions to sustainability issues are only provisional because sustainability is only a normative concept, describing the world how it should be.

In complex innovation processes, far more actor groups are involved, possibly resulting in even more goals and more differences in their perceptions with regard to sustainability [3]. The tool helps to structure the selection of goals and the respective ratings in a standardized fashion. To be able to capture the sustainability goals and render them comparable is particularly important, since human needs and the according actions constantly change, also making the factors that influence sustainability unstable [3]. Hence, a strength of the tool is that another application over the course of time can also illustrate whether the sustainability goals have changed. In general, the tool can visualize existing sustainability goals at a minor cost and with minimal effort to directly compare individuals and actor groups. Displaying the congruencies and differences in the selection and ratings of sustainability goals fostered thinking processes among the users. For example, the observation of a large difference in the rating of the goal 'solidarity with the farmer' first surprised a shop manager and then made her rethink her previous perception regarding the economic viability of the initiative for the farmers. The task of rating the degree of implementation of the sustainability goals confronted the users with their existing knowledge about the actions to achieve the respective goals. The tool is therefore useful for identifying differences in individual competencies related to both the norms and actions that cause the users to reconsider their previous perceptions. A constant reflection of the individual incomplete knowledge and goals in the light of the community of all of the involved actors, followed by renegotiations of these goals, is described as crucial to addressing sustainability issues [3]. Since the tool can provide a basis for the identification of potential conflicts and the harmonization of goals, it seems to be suitable for breaking down complex issues, like striving for sustainability, and for providing a more practical and solution-oriented approach to it. The tool application helped identify further areas of action, such as a need for more exchange among the actors and better information flows, improved marketing, and optimized logistics along the value chain.

#### 4.3. Broader Context

This tool helps to translate global goals, such as sustainable production and consumption, to the regional level, following the idea of Reed et al. [2] to contextualize sustainability with regional circumstances from the bottom up. However, the relevance of alternatives to the killing of day-old chicks could soon go beyond the regional level, since the governments of Germany and the Netherlands plan to abolish the prevailing practice. Such an external development might require the reassessment of the dual-purpose chicken approach in a broader context that exceeds a community-based understanding [2]. Krautwald-Junghanns et al. [21] doubted that a large-scale application of the dual-purpose chicken approach was feasible due to the high costs of the fattening of male chickens. However, in personal communication, the marketing organization reported that farmer networks from other parts of Germany were interested in establishing their own dual-purpose chicken initiative, requesting consultancy. This fact suggests that, for now, an upscaling of the dual-purpose chicken approach might only occur through the emergence of a number of individual, regional networks. Our results could be used as a basis by such interested networks in terms of attaining an overview of the different aspects of sustainability that such an approach could consider. The perceived degree of implementation that also became visible throughout the tool application and the respective verbal comments might also indicate the sustainability goals that are easier to achieve and those that would require more effort.

#### 4.4. Discussion of the Shortcomings of the Tool and Its Application

The ratings of the goals are value based and are thus highly subjective. Gibbs [33] argued that simply naming the sustainability goals of a company did not capture how and to what degree the goals were achieved in practice. Consequently, after the selection of sustainability goals and subjectively rating if they were achieved, an indicator-based assessment could follow. In particular, the shop managers often stated that they were not able to fully rate the implementation of goals because they lacked the necessary knowledge. On the one hand, this knowledge gap might bias their ratings. On the other hand, the identification of the existence of these information asymmetries is also a benefit of the tool, as the application of the tool made it apparent that more exchange between the actor groups would be desirable.

This aspect leads us to a shortcoming of the tool application. The interviews were conducted individually and consecutively, meaning that each participant saw a slightly different spider diagram after entering their data. Additionally, as more people participated, the diagrams became more interesting. Nevertheless, the tool already stimulated the second user to discuss the goals 'species conservation' and 'future viability' with the interviewer, as these ratings differed from those of the first user. Furthermore, it was possible to identify commonalities from the verbal comments, even though none of the interviewees saw exactly the same diagram. For future applications of the tool, it would be desirable to bring together representatives of all of the actor groups in a workshop. In this format, all the participants could enter their data and directly see and discuss the final result. A repetition of the application at a later date with the same users would also allow for the determination of whether the sustainability goals and their implementation changed over time. The ability to compare sustainability goals at different points in time is therefore a strength of the tool that has not yet been tested. Furthermore, some of the collected sustainability goals could be summarized and the total set reduced to simplify the choice for the participants.

In our study, we focused on the on-farm production, distribution, and retail components of the value chain. External actors, such as consumers, were excluded due to the low degree of knowledge of the dual-purpose chicken concept. Other internal actors, such as hatchery operators, were also not included in this study. To achieve system transformation toward more sustainable poultry production, more actor groups, in addition to the three actor groups included in this study—farmers, marketing organization, and shop managers—must adapt their behaviors and work processes. Consumers must value the sustainability efforts of initiatives such as the one presented in our case study, and actors such as hatchery operators must adapt their supplies to dual-purpose breeds [12]. To manage complex sustainability problems, it is necessary to include both internal and external actors [3]. Thus, it would be interesting to expand the tool application to all of the relevant groups in further research.

## 5. Conclusions

The selection and rating of sustainability goals is based on actors' values, which makes the results subjective compared to the results of indicator-based sustainability assessments. However, we conclude that the tool is suitable for building a common basis for different actor groups belonging to an innovation network. Although many different goals existed along the investigated value chain, the tool automatically visualized the common goals. The environmental results were rated as being the most important for the added value of the initiative. These aspects should be marketed concisely and transparently to enable consumers to distinguish dual-purpose chicken products from other organic products without becoming overloaded by product information. The economic sustainability goals were not selected very often, and the degree of their implementation was rated comparatively low. However, the users often addressed these goals verbally throughout the tool application. This finding suggests that profitability still plays an important role in the sustainability of the dual-purpose chicken initiative, as well as that there might be trade-offs between different sustainability dimensions. At the same time, differences regarding the implementation of the goals prompted thinking processes and discussions on the respective aspects. These discussions also defined fields of action for the

involved actors; the tool application indicated an information gap between producers and retailers, which made it difficult for shop managers to promote the advantages of dual-purpose production. Furthermore, the need for steering the value chain became apparent. This need concerned aspects such as logistic inefficiencies and information asymmetries among actors. The marketing organization could be the key actor for improving the marketing of the sustainability aspects. This actor could also provide information between the main actor groups to foster goal congruency and optimize a steady supply for shops. The results of the tool could be used for this necessary next step. Furthermore, for innovation network managers—in our case, the marketing organization—we recommend repeating the tool application at different points in time. Standardizing data collection enables managers to compare how sustainability goals and the perception of achievement develop during an innovation or implementation process, which might deliver additional clues on how to adjust the value chain. The dual-purpose initiative has been acting on the local level so far, but other farmers might be interested in adopting the approach. Such interested actors could use our results as an orientation toward which sustainability goals could exist, which have been reached more quickly and which are marketable. Overall, our results showed that the tool is useful for dealing with wicked problems, such as sustainability. The tool application reduces complexity by breaking down a sustainability-related issue into concrete goals and, hence, delivering a solution-oriented basis for the involved actors. The tool application also proved to be useful for elaborating whether the involved actors possess normative and action competencies to address sustainability issues. Since the tool is easily adaptable to other issues, it might be an appropriate tool for both academia and practitioners to manage decision processes for other substantial problems of high complexity.

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## Appendix A

**Table A1.** Overview of all sustainability goals.

Sustainability Goal	Sustainability Dimension	Absolute Number of Mentions	Average Degree of Perceived Implementation
Animal welfare	environmental	15	9.5
Complete utilization	environmental	13	8.8
Species conservation	environmental	10	8.6
Future viability	social	9	6.7
Conservation of genetic resources	environmental	7	7.6
Closed ecological cycle	environmental	7	8.4
Regional economic effects	economic	6	7.3
Commercial quality	economic	5	5.6
Operating efficiency	economic	4	5
Involvement of local actors	social	4	8.3
Solidarity with the farmer	social	4	6.3
Sovereignty of farmers	environmental, social	4	5.3
Implementation of alternative approaches	economic	4	8.5

Table A1. Cont.

Sustainability Goal	Sustainability Dimension	Absolute Number of Mentions	Average Degree of Perceived Implementation
Independence	social	4	6
Continuous purchase	economic	4	7.5
Consumer acceptance	economic	3	4.3
Diversification of the farm structure	economic	3	7.7
Interest and demand	economic	3	8.7
Competitiveness	economic	3	4.3
Climate protection	environmental	3	6
Condition of soil, water balance and climate	environmental	3	7.3
Willingness to pay a premium	economic	2	7.5
Exchange between actors	social	2	7.5
Durability	environmental, social	2	5.5
Taste/aesthetics	social	2	5.5
Consensus among actors	social	2	8
Economic circle	economic	2	5.5
Personal fulfillment	economic	2	5
Additional jobs	social	2	7.5
Revaluation	economic	1	8
Diversification of production	economic	1	8
Efficient management	economic	1	4
Habitat conservation	environmental	1	5
Cost coverage	economic	1	3
Additional income opportunity	social	1	2
Hedging	social	0	-
Diversification personnel structure	social	0	-
Introduction of improvements	economic	0	-
Use of local resources	environmental	0	-
Fusion of activities	social	0	-
Joint activities	social	0	-
Financial surplus	economic	0	-
Horizontal expansion	economic	0	-
Resource sufficiency	environmental	0	-
Vertical expansion	economic	0	-
Financial provision	social	0	-
Product condition/ durability	economic	0	-

## References

- van den Heiligenberg, H.A.R.M.; Heimeriks, G.J.; Hekkert, M.P.; van Oort, F.G. A habitat for sustainability experiments: Success factors for innovations in their local and regional contexts. *J. Clean. Prod.* **2017**, *169*, 204–215. [[CrossRef](#)]
- Reed, M.S.; Fraser, E.D.G.; Dougill, A.J. An adaptive learning process for developing and applying sustainability indicators with local communities. *Ecol. Econ.* **2006**, *59*, 406–418. [[CrossRef](#)]
- Blok, V.; Gremmen, B.; Wesselink, R. Dealing with the Wicked Problem of Sustainability in advance: The Role of Individual Virtuous Competence. *Bus. Prof. Ethics J.* **2016**, *34*, 297–327. [[CrossRef](#)]
- Geels, F.W.; Schot, J. Typology of sociotechnical transition pathways. *Res. Policy* **2007**, *36*, 399–417. [[CrossRef](#)]
- Klerkx, L.; Aarts, N.; Leeuwis, C. Adaptive management in agricultural innovation systems: The interactions between innovation networks and their environment. *Agric. Syst.* **2010**, *103*, 390–400. [[CrossRef](#)]
- Orenstein, D.E.; Shach-Pinsley, D. A Comparative Framework for Assessing Sustainability Initiatives at the Regional Scale. *World Dev.* **2017**, *98*, 245–256. [[CrossRef](#)]
- Hatt, S.; Artru, S.; Brédart, D.; Lassois, L.; Francis, F.; Haubruge, É.; Garré, S.; Stassart, P.M.; Dufrière, M.; Monty, A.; et al. Towards sustainable food systems: The concept of agroecology and how it questions current research practices. A review. *Biotechnol. Agron. Soc. Environ.* **2016**, *20*, 215–224.
- Berthet, E.T.; Hickey, G.M. Organizing collective innovation in support of sustainable agro-ecosystems: The role of network management. *Agric. Syst.* **2018**, *165*, 44–54. [[CrossRef](#)]

9. Sonoda, Y.; Oishi, K.; Chomei, Y.; Hirooka, H. How do human values influence the beef preferences of consumer segments regarding animal welfare and environmentally friendly production? *Meat Sci.* **2018**, *146*, 75–86. [[CrossRef](#)] [[PubMed](#)]
10. Vecchio, R. European and United States farmers' markets: Similarities, differences and potential developments. In Proceedings of the A Resilient European Food Industry and Food Chain in a Challenging World, Chania, Crete, Greece, 3–6 September 2009.
11. Grunert, K.G.; Sonntag, W.I.; Glanz-Chanos, V.; Forum, S. Consumer interest in environmental impact, safety, health and animal welfare aspects of modern pig production: Results of a cross-national choice experiment. *Meat Sci.* **2018**, *137*, 123–129. [[CrossRef](#)] [[PubMed](#)]
12. Hörisch, J. How business actors can contribute to sustainability transitions: A case study on the ongoing animal welfare transition in the German egg industry. *J. Clean. Prod.* **2018**, *201*, 1155–1165. [[CrossRef](#)]
13. Ortega, D.L.; Wolf, C.A. Demand for farm animal welfare and producer implications: Results from a field experiment in Michigan. *Food Policy* **2018**, *74*, 74–81. [[CrossRef](#)]
14. Spoelstra, S.F.; Groot Koerkamp, P.W.G.; Bos, A.P.; Elzen, B.; Leenstra, F.R. Innovation for sustainable egg production: Realigning production with societal demands in The Netherlands. *Worlds Poult. Sci. J.* **2013**, *69*, 279–298. [[CrossRef](#)]
15. Willer, H.; Schaack, D.; Lernoud, J. Organic Farming and Market Development in Europe and the European Union. In *The World of Organic Agriculture: Statistics and Emerging Trends 2019*; Willer, H., Lernoud, J., Eds.; FiBL: Frick, Switzerland; IFOAM: Bonn, Germany, 2019; ISBN 978-3-03736-119-1.
16. European Commission. *Special Eurobarometer 229/Wave 63.2—TNS Opinion & Social: Attitudes of Consumers towards the Welfare of Farmed Animals*; European Commission: Brussels, Belgium, 2005.
17. Karcher, D.M.; Mench, J.A. Overview of commercial poultry production systems and their main welfare challenges. In *Advances in Poultry Welfare*; Elsevier: Amsterdam, The Netherlands, 2018; pp. 3–25, ISBN 978-0-08-100915-4.
18. Leenstra, F.; Munnichs, G.; Beekman, V.; van den Heuvel-Vromans, E.; Aramyan, L.; Woelders, H. Killing day-old chicks? Public opinion regarding potential alternatives. *Anim. Welf.* **2011**, *20*, 37–45.
19. Brümmer, N.; Christoph-Schulz, I.; Rovers, A.-K. Consumers' Perspective on Dual-purpose Chickens as Alternative to the Killing of Day-old Chicks. *Int. J. Food Syst. Dyn.* **2018**, *9*, 390–398.
20. Gremmen, B.; Bruijnis, M.R.N.; Blok, V.; Stassen, E.N. A Public Survey on Handling Male Chicks in the Dutch Egg Sector. *J. Agric. Environ. Ethics* **2018**, *31*, 93–107. [[CrossRef](#)]
21. Krautwald-Junghanns, M.-E.; Cramer, K.; Fischer, B.; Förster, A.; Galli, R.; Kremer, F.; Mapesa, E.U.; Meissner, S.; Preisinger, R.; Preusse, G.; et al. Current approaches to avoid the culling of day-old male chicks in the layer industry, with special reference to spectroscopic methods. *Poult. Sci.* **2018**, *97*, 749–757. [[CrossRef](#)]
22. Verbeke, W. Stakeholder, citizen and consumer interests in farm animal welfare. *Anim. Welf.* **2009**, *18*, 325–333.
23. Diehl, K. Sustainability assessment of agro-ecological innovations at territorial and value chain scale. In Proceedings of the 12th European IFSA Symposium on Social and Technological Transformation of Farming Systems: Diverging and Converging Pathways, Newport, UK, 12–15 January 2016.
24. Diehl, K.; König, B. Integrating sustainability at the front end of system innovations in agriculture using a triple-helix approach. In Proceedings of the 13th European IFSA Symposium on "Farming Systems: Facing Uncertainties and Enhancing Opportunities", Chania, Crete, Greece, 1–5 July 2018.
25. Elo, S.; Kyngäs, H. The qualitative content analysis process. *J. Adv. Nurs.* **2008**, *62*, 107–115. [[CrossRef](#)]
26. Mayring, P. Qualitative Content Analysis. *Forum Qual. Soc. Res.* **2000**, *1*. Available online: <http://www.qualitative-research.net/index.php/fqs/article/view/1089/2385#gciit> (accessed on 9 July 2019).
27. Binnekamp, M.H.A.; Ingenbleek, P.T.M. Market barriers for welfare product innovations. *NJAS-Wagening. J. Life Sci.* **2006**, *54*, 169–178. [[CrossRef](#)]
28. Hempel, C.; Hamm, U. Local and/or organic: A study on consumer preferences for organic food and food from different origins: Consumer preferences for local and/or organic food. *Int. J. Consum. Stud.* **2016**, *40*, 732–741. [[CrossRef](#)]
29. Vanhonacker, F.; Verbeke, W. Public and Consumer Policies for Higher Welfare Food Products: Challenges and Opportunities. *J. Agric. Environ. Ethics* **2014**, *27*, 153–171. [[CrossRef](#)]
30. Heise, H.; Theuvsen, L. What do consumers think about farm animal welfare in modern agriculture? Attitudes and shopping behaviour. *Int. Food Agribus. Manag. Rev.* **2017**, *20*, 379–399. [[CrossRef](#)]



31. Toma, L.; Stott, A.W.; Revoredo-Giha, C.; Kupiec-Teahan, B. Consumers and animal welfare. A comparison between European Union countries. *Appetite* **2012**, *58*, 597–607. [[CrossRef](#)]
32. Sulewski, P.; Kłoczko-Gajewska, A.; Sroka, W. Relations between Agri-Environmental, Economic and Social Dimensions of Farms' Sustainability. *Sustainability* **2018**, *10*, 4629. [[CrossRef](#)]
33. Gibbs, D. Sustainability Entrepreneurs, Ecopreneurs and the Development of a Sustainable Economy. *Greener Manag. Int.* **2006**, *2006*, 63–78. [[CrossRef](#)]



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