

Public Images of Dairy Farms among Urban Dwellers in Bogotá, Colombia

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Received June 2019, accepted September 2019, available online October 2019

ABSTRACT

This study explores the public images of dairy farms among urban dwellers in Bogotá, Colombia. For the study, designed as an explorative case study, 30 participants were interviewed using a triangulated research method including a word association task, a drawing exercise, and a semi-structured interview. Public images reflected traditional dairy farms and were constructed through personal experiences with peasants and traditional manors. Product choice was based on health and hygiene, associated with modern dairy farms. Yet, modernization was argued to threaten animal welfare, the environment, and peasant livelihoods. To ensure socio-cultural sustainability, traditional production systems need to be better integrated into the modernization process.

Keywords: *Socio-technical imaginaries; sustainable intensification; dairy production systems; Colombia*

1 Introduction

Because of population growth and higher per capita income in developing countries and increased biomass production for the bio-economy, global demand for animal products is expected to double by 2050 (OECD et al., 2018). The largest increases in the consumption of animal production are foreseen in Asia, Latin America, and the Caribbean (FAO, 2018). With regard to dairy products, it is expected that their consumption in developing countries will increase on average 2.1% per year (from 20.2 kg/capita in the period 2014-16 to 21.4 kg/capita in 2026) (OECD et al., 2018). This can, among others, also be observed in Colombia (OECD/FAO, 2019).

Colombia has approximately 395,000 milk-producing units, of which 81% correspond to small producers, generating 37% of the national production (FEDEGAN, 2014; ICA, 2018). To meet the growing demand for milk and milk products and to improve the competitiveness of the dairy sector, for both the domestic and international markets, a “sustainable” intensification of milk production is planned and sought after by the food industry and government (CNL, 2010; DNP, 2010; Rao et al., 2015). Intensification will, for example, be done through improving the productivity of primary producers (e.g., supporting the use of (agro)-silvo-pastoral systems), technological modernization, promoting associative schemes, vertical and horizontal integration, and developing productive conglomerates in areas with competitive advantages for the production and processing of milk (DNP, 2010; CNL, 2010).

In countries with long histories of technological intensification (above all developed countries), associated production methods are objected to by society and lead to protests and rejection (Boogaard, 2009; Horlings and Hinssen, 2014; Hejne, 2019; Rovers et al., 2019). These objections also extend to “sustainable” intensive production practices (Horlings and Hinssen, 2014). Protests mainly focus on the ethical dimension that animal production systems entail (WBA, 2015; Vinnari et al., 2017). It is anticipated that social dilemmas around intensive animal production systems will rise in newly industrializing countries, too (Fraser, 2014; von Keyserlingk and Hötzel, 2015; Yunes et al., 2017). In Colombia, a study has already shown that consumers would be willing to pay more for environmentally and animal welfare friendly production methods (Charry and Burkart, 2017). It is therefore necessary to identify socially acceptable forms of animal production that can be translated into culturally sensitive, tailor-made solutions (von Keyserlingk and Hötzel, 2015). Research into socio-culturally sustainable dairy production systems in Colombia, however, has not been conducted to date.

Socio-technical imaginaries among urban dwellers of dairy production systems in Colombia

We frame this rising societal awareness around the future of dairy production in Colombia with the concept of “socio-technical imaginaries,” which means the “*collectively imagined forms of social life and social order reflected in the design and fulfilment of nation-specific scientific and/or technological projects*” (Jasanoff and Kim, 2009, p. 120). Thus, the values, norms, and institutions related by people to food production, for example, have an important role to play in the design and implementation of sustainable forms of agricultural production by science and politics (Jasanoff, 2005). How well an innovation fits to a specific culture thus depends on the congruence between the socio-technical imaginaries and the actual innovation (Pfotenhauer and Jasanoff, 2017). With regard to milk production, several studies have already shown that the socio-technical imaginaries and intensive dairy production methods diverge. Wellbrock and Knierim (2017) showed that the use and handling of bobby calves can lead to disputes between farmers and non-farmers. In Brazil, it was shown that people rejected farming practices such as cow-calf separation (Hötzel et al., 2017). In addition, Cardoso et al. (2019) showed that laypersons, advisors, and dairy farmers all had diverging images of ideal dairy farms.

To understand how socio-technical imaginaries can divert from actual innovation practices, it is necessary to understand how socio-technical imaginaries are created. Images are defined as perceptions, attitudes, and feelings toward a certain object (Helmle, 2010). The type of image a person has about dairy production systems and dairy farmers arguably depends on the type of knowledge acquired and the learning route through which information is acquired (Petty et al., 2005) as well as the frame of reference used to embed the acquired information (Te Velde et al., 2002).

The aim of this study was thus to explore the public images of dairy farming among urban dwellers in the capital Bogotá in order to find out what type of dairy production systems are culturally sensitive and socially acceptable in Colombia. As it is the first kind of this study in Colombia, we aimed to contribute to the identification of socio-technical imaginaries in the dairy sector suitable for sustainable intensification and to generate more differentiated socioeconomic research objectives. To this end, the following research questions were addressed:

- a) What do urban dwellers in Bogotá associate with the word “dairy farm?”
- b) How do urban dwellers in Bogotá imagine a dairy farm to look like?
 - a. According to urban dwellers in Bogotá, what function does the dairy farmer have on the farm?
- c) Which learning routes are used by urban dwellers in Bogotá to obtain information about dairy farming in Colombia?
- d) What norms and values do urban dwellers in Bogotá use to embed information on dairy production in Colombia?

The paper is structured as follows. First, an overview of the research methodology is provided. Then the paper proceeds to the result. Finally, the significance of the results for the socio-cultural sustainability of dairy production systems is discussed, concluding that traditional production systems need to be better integrated into the modernization process.

2 Research Methodology

In this research, socio-technical imaginaries of urban dwellers are studied by looking at the underlying learning routes and frames of reference. These objects of study all fall into the epistemology of social constructivism, as they need to be embedded and understood in the social and cultural context in which they occur. The study therefore follows a qualitative approach.

Research Design and Sampling Method

The study was designed as an explorative case study and was not meant to be representative for the urban population of Colombia. As a case, the district Usaquén in Bogotá was chosen. Usaquén is characterized by residents of the middle and upper class (social strata¹ 4–6) and has a population of about 450,000 people. Usaquén was deliberately chosen because of (a) easy accessibility, (b) economic conditions comparable to European levels, and (c) following the assumption that moral and ethical concerns about production methods arise with increasing prosperity and the ability to choose certain food items over others (Fraser, 2008).

In total, 30 participants were interviewed and sampled using theoretical sampling. This means that sampling stopped once the theory was established and no new information was added (Flick, 2009). Participants were approached in semi-public parks and at social gatherings.

Research Methods

To conduct this research, a triangulated research method was chosen. To answer research question one, participants were asked to complete a *free word association task* using the cue “dairy farm” (finca lechera). Through this method, a comprehensive sample of retrieval cues was obtained (Weller, 1998). The researcher started the exercise by saying, “If you hear the word dairy farm, which associations will come immediately to your mind?” Then, the cues of the interviewee were noted. In addition, the answers were recorded using a digital voice recorder in order not to lose important information because of the writing process.

To answer research question two, the participants were asked to complete a drawing exercise. To this end, the participants were given a sheet of paper with a cow on it (see Figure 1).

¹Socioeconomic stratification in Colombia categorizes housing units on a scale of one to six according to their physical characteristics, immediate surroundings, and rural or urban context. It was implemented for assigning differential public utility rates to different strata, enabling higher strata (five and six) to pay higher rates and subsidize the costs for lower strata (one, two, and three) (DANE, n.d.).

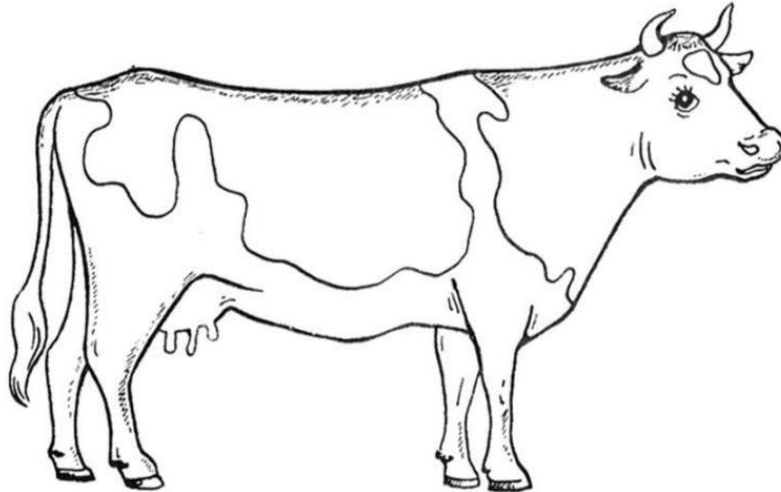


Figure 1. Material for the drawing exercise.

The interviewer instructed the participants as follows: “Please draw what the farm on which this cow lives looks like. Just draw her surroundings as you imagine them.” While drawing, the participants were encouraged to explain what they were drawing (*Is the cow outside? What is this?*). Also, the participants were asked whether the image they drew was what they wished for or whether this was their actual perception of a dairy farm. Next, the participants were given a small figure representing a farmer. They were asked to move the figure around the farm and to explain the functions and tasks of the farmer on the dairy farm. With this exercise, insights into ideas, expressions, and feelings that cannot be expressed in words were retrieved (Oster and Gould Crone, 2004). Conversations between the researcher and participant that occurred while drawing were also recorded using a digital voice recorder.

Third, a *semi-structured interview* with 15 closed- and open-ended questions was conducted to obtain information about learning routes and frames of reference (research questions three and four). Closed-ended questions required yes/no answers, ranking tasks as well as multiple-choice answers. Open-ended questions complemented the closed-ended questions by asking for details about the answers given (e.g., *Why? Can you please explain?, etc.*). Also here, a digital voice recorder was used to record the conversations and answers.

Ethical considerations

The participants engaged voluntarily with the interviewer. Before commencing the interview, the participants were debriefed on the purpose of the study and asked for their oral consent to proceed with and record the interview. The information was treated anonymously and the participants will receive a summary of the research results.

Data analysis

Free word associations and open-ended questions in the semi-structured interviews were analyzed using interpretative content analysis (Flick, 2009) whereby cues were clustered and categorized. The closed questions in the interviews were analyzed using descriptive statistics with the help of Excel. The drawings were described and compared for similarities and divergences with reference to color and content. The conversations held with the participants while drawing were transcribed and the answers categorized using interpretative content analysis.

3 Results

In total, 30 interviewees were questioned in the district of Usaquén, Bogotá. Out of the 30 respondents, 17 were females and 13 were males. The average age was 48, with the youngest participant being 21 years old and the oldest participant 73. As anticipated, the majority of the participants belonged to the middle (social stratum 4, n=11), upper-middle (social stratum 5, n= 10), and upper class (social stratum 6,

One of the youngest participants (24 years) remarked that he had both images in his head when reflecting on the word dairy farm.

The participants specified *activities carried out on the farm* (11/30). These *activities* included milking cows (at five in the morning and at three in the afternoon), cleaning the cows' udder, getting up early, working, taking care of animals, and feeding animals. It was also mentioned that working on a dairy farm meant a seven-day, around-the-clock job. Correspondingly, the participants mentioned that farms are divided into different *working zones* (7/30). They mentioned *zones* where the cows are milked, zones where the cows are fed, zones where the cows sleep at night, zones where the health of the cows is checked, and zones where the cows are handled.

The participants also associated the *infrastructure* surrounding the milk production on the farm with the cue dairy farm. Five participants thus referred to *milk churns*, which are used to store the milk until collected by *tanks of large milk-processing enterprises*. Along this line, four participants mentioned *milk products* such as raw milk, cheese, yoghurt, and kumis (a popular fermented dairy product).

3.2 Mental images of dairy farms among urban dwellers of Bogotá

When visualizing the dairy farm, out of the 30 participants, 26 drew the cow in an outdoor space with the idea that cows would be taken to stables at night to sleep. The majority of these participants thought that this image depicted the reality: *"Yes, they are outside. The family of my husband has cows. They have certain hours for grazing (...)"* (Interviewee 19, Figure 3). Others referred to childhood memories: *"Some cows can be outside. Well, this is how the milk farm of my grandparents on the Caribbean coast was like. They did not produce much but sold milk"* (Interviewee 14). Others indicated that seeing the cow outside is their preferred form of milk production, but that they are aware that other forms exist with no outdoor access as well: *"The idea is that they are in a rural environment, meaning completely natural, not technified. Because you know there are also farms ... how are they called? They have very little space to develop. I do not agree with that style. They need to have a positive environment with a lot of grass, with a lot of sky so they feel tranquil and so they can produce their milk well"* (Interviewee 8).



Figure 3. Cow outdoors.

Two participants drew the cow half indoors and half outdoors, indicating the two distinct forms of dairy production systems in Colombia: *"Here, the cow is grazing, that is a lot more amiable. This is the artisanal form. The other one is the industrial form which I have seen in documentaries (...)"* (Interviewee 3, Figure 4).

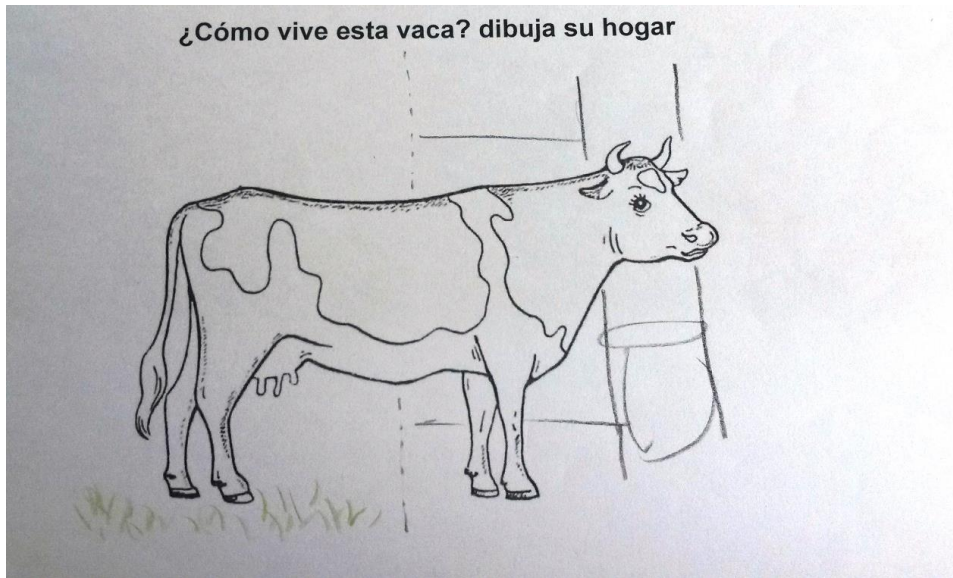


Figure 4. Cow half indoors, half outdoors.

Two further participants indicated that cows are housed indoors. One participant explained: "(...) There is a big roof. Here, they give them food, also salt, water which normally has to be running; the floor is concrete, it is not grass; outside it is grass" (Interviewee 1, Figure 5). The other explained: "Here is the stable, here is the water where they can drink, here is the grass where they can eat, and here is an area where they can breathe fresh air. The cow is inside" (Interviewee 27).

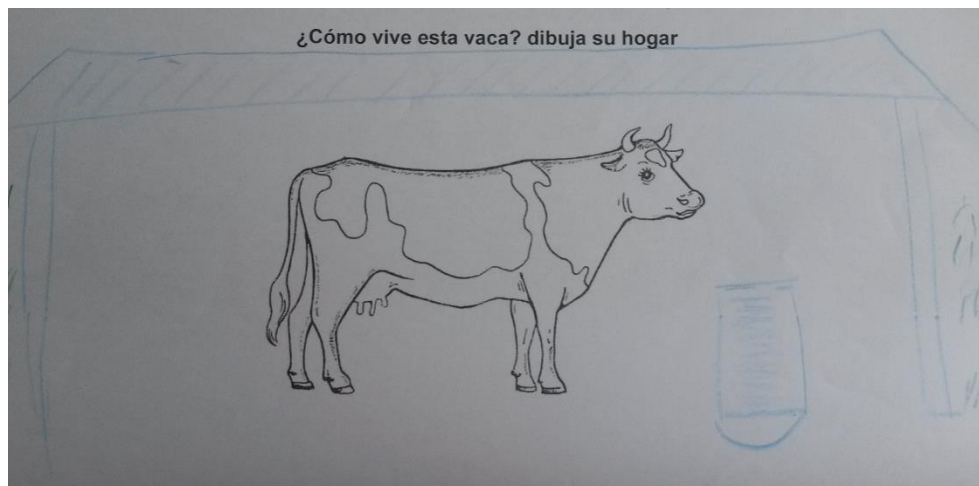


Figure 5. Cow indoors.

After finishing the drawing, the participants were given a small figure in the form of a farmer and they were asked to explain what functions and tasks the farmer has on the farm. Here, it was interesting to see that the participants distinguished the owner of the farm from the person that handled the cows. As a result, the functions associated with the figure were those of the farm worker and not of the farm owner. One participant described this as follows: "In the morning, he asks the owner of the farm or of the cow how many times he can milk the cow, how many bottles of milk he needs (...). The patron asks if he cut the grass, if he fed the cow, if he gave her water, salt, if she has ticks." So, there are workers and owners? "Exactly, this farm has an owner and people who milk the cows on demand. The owner comes to the farm about once a week and stays for two days" (Interviewee 12).

The functions and tasks that are associated with the farmer figure can be divided into two categories: one is *animal-centered functions and tasks* and the other is *resource-centered functions and tasks*. Other functions (as for example entrepreneurial or business-related functions) were not mentioned in connection with the farmer figure.

Similar to the word associations mentioned in the first tasks, the participants described the animal-centered functions and tasks as milking the cows, feeding and watering the cows, and administering vaccinations and medications. The response of Interviewee 5 summarizes this well: *“The worker, first of all, needs to milk the cows in the morning hours and in the afternoon so the cow does not get mastitis, because mastitis is an illness that will get worse so he cannot stop. Also, he needs to look out for cows that will deliver their calves and he needs to set them aside and do everything that is necessary. Next to this is the feeding and other activities: giving her salt and other nutrients. What else ... he needs to take care of her health”* (Interviewee 5). Furthermore, the participants highlighted that the cows need to be cared for emotionally: *“(He) needs to be a person that loves animals, a positive person* (Interviewee 8) and *“(…) play them music, calm them, take care of them as if they were pets”* (Interviewee 1). With regard to the resource-centered activities, the tasks and functions were described as taking care of the pastures, checking the fences, moving the cows, and checking the gates: *“He needs to take care of the grass, that it is green and good, he needs to protect the cows, he needs to check if the gates are closed or open, and check whether the cows are healthy”* (Interviewee 2).

Learning routes

Out of all the participants, 21 indicated that they had thought consciously about the production of cows' milk before and 25 participants had visited a dairy farm before. Of these, six participants indicated that they had visited the farm of family members, either in the past or today, and two indicated owning a farm. One participant thus stated: *“On the family farm, there are milk cows. It is something very beautiful. If they treat them with love and care, they give you products of very high quality”* (Interviewee 19). Also, the participants referred to visits to smallholder farms. Large industrial farms were not visited: *“Small farms are beautiful, peaceful, and familiar. I never visited a big industrialized farm”* (Interviewee 17). Along this line, another two participants stated having good images of smallholder farms but bad images of industrial farms: *“My grandparents had a farm. It was very beautiful, familiar, and the animals were well looked after. New industrialized farms are very impersonal; they do not take good care of the cows”* (Interviewee 15). Eight participants reported positive images of their farm visits, which also included visits to farm shows and demonstrations. They described their images as *marvellous, cool, very nice, very interesting*, and as *I like it!* (Interviewees 5, 12, 15, 16, 24, and 28). Three participants, however, did not like their visit to a farm: *“The fields are difficult to walk on, it smells bad, there are lots of flies, shit, you get kicked, it is not a relaxing space. There is a romantic image, but the reality is different”* (Interviewee 18). Five participants limited their description to the site where they saw a farm and one participant stated: *“It does not interest me”* (Interviewee 9). The remaining four participants did not describe their impressions.

To inform themselves about dairy production, the participants used a mean of three different sources, with one source being the lowest number of information channels and five sources the highest number of information channels. The most frequently mentioned source of information (18/30) was personal experience, followed by television (16/30), friends and colleagues (8/30), the internet (7/30), and official sources (6/30). Other sources included the press (4/30), scientific papers (4/30), public fairs (3/30), and the radio and commercials (1/30 each).

The participants were asked to rank the importance of their sources of information. The ranking showed that personal experience, the radio, and scientific papers were considered the most important sources of information. These sources were followed by friends and colleagues (median 1.5). Television, newspapers, fairs, and commercials all received a median score of 2. Official sources ranked second to last with a median of 2.5 and the internet last with a median of 3.

Looking at the credibility of these sources, personal experience and official sources received the highest score (median 1). Scientific papers followed with a median score of 1.5. Then, television, newspapers, the radio, friends and colleagues, fairs, and commercials followed (median 2). The least credibility was given to the internet (median 3). Six participants remarked that the ranking was difficult and that credibility always depended on the individual source.

Frames of reference

All participants mentioned consuming milk or milk products. Supermarkets were the most frequented place to buy milk or milk products (26/30), but specialized shops, such as shops of the milk company Alpina (13/30), small neighborhood shops (8/30), and farmers' markets (5/30) were also considered. Four participants also mentioned receiving milk directly from a farm. These participants owned a farm or had relatives with farming activities.

When purchasing milk or milk products, 21 out of the 30 interviewees mentioned paying the most attention to health attributes. Specifically, lactose-free (3) or low fat (2) products were chosen or those products were recommended by a doctor (1). According to 14 interviewees, price was a further item of attention when purchasing a milk product, as well as organic production (8), animal welfare (3), and traditional production methods (2). None of the participants paid attention to fair trade attributes. In turn, five participants mentioned looking for specific brands (such as Alpina, Alqueria, and Colanta), three participants mentioned the taste of the product as a selection criterion, and two more mentioned the quality (1) and the presentation (1) of the product.

Interestingly, when asked to rank the attributes hygiene, taste, price, animal welfare, producer welfare, and environment according to their importance, *price* was the least important attribute for all the participants (average and median 2). One participant, however, stated: *“Price is very important, because it determines how many people can afford to consume it”* (Interviewee 21, social stratum 3). *Hygiene*, in turn, was the most important attribute (average 5; median 6): *“Hygiene is the most important; the price does not matter so much”* (Interviewee 27). *Environment* and *animal welfare* both ranked second in importance (average and median 4), while third place was shared by *taste* (average 4, median 3) and *producer welfare* (average and median 3). Interestingly, six participants were rather critical of their ranking. One interviewee thus stated: *“I think more about myself than about the production”* (Interviewee 13) and *“One never thinks about the animal, the producer, or the environment. The reality is that one thinks about the presentation, the quality, the taste; very few times one pays attention to the producers”* (Interviewee 5). Still another interviewee commented: *“The first three, hygiene, taste, and price, are more to think about the welfare of the consumer. (...) For me, it is very difficult to put animal welfare, because I find it a little ambiguous. The exploitation of this type of food is very difficult; they really sacrifice animal welfare. If I put those three at the beginning, milk production has to end. It is the same with prioritizing the environment”* (Interviewee 3).

The majority of the interviewees (17/30) stated that the milk production system in Colombia does not conform to their own values and norms. Within this group of interviewees, clusters of reference values were *care for the animals* (mentioned 11 times), *care for the environment* (mentioned four times), and *rurality* (mentioned three times). With regard to care for the animals, interviewees mentioned values such as freedom, humane treatment, respect, right to live, and care. As one interviewee remarked, *“(...) There is a topic that I find very horrible. The poor cows that spend all their lives in a pregnant state, spending all their lives extracting milk, and for us it is a liquid full of hormones. And to keep them pregnant, they fill them with hormones. The life of the cow is to have children. It's horrible!”* (Interviewee 18). A further interviewee remarked, *“[The current dairy production system is not congruent with my values], because they only worry about the income generated by milk, but not about the welfare and food of the animals”* (Interviewee 20). With regard to care for the environment, the interviewees mentioned values such as naturalness and conservation and rejected current dairy production practices in Colombia: *“(...) everything is contaminated; animals are mistreated; farmers don't take much care of the animals”* (Interviewee 10). Last, with regard to rurality, the interviewees mentioned peasants and rural areas. Here, the interviewees also remarked that the current production practices did not conform to their values and norms: *“(...) the commercial system, the majority does not know the production. It is in a disequilibrium, unjust. It is a crisis; everyone is going to lose”* (Interviewee 25). Along the same line, another interviewee stated, *“They do not value the work of the peasants (...)”* (Interviewee 19).

Nine other interviewees, in turn, argued that the current milk production system does conform to their norms and values. Here, a distinction could be made between those referring to the traditional milk production system (2) (*“Milk production in Colombia is still artisanal. The sale and production of milk are not so intensified”* (Interviewee 13)) and those interviewees referring to the modern milk production system (7). Similar to the interviewees rejecting the current production system in Colombia, the two interviewees valuing the traditional milk production system used values such as *care for the animals* and *care for the environment* as reference values. They remarked: *“There is no mistreatment of animals, no abuse of the environment”* (Interviewee 13) and *“Respect for the farmer, the way they feed the cows, respect for the animals”* (Interviewee 14). The seven interviewees that agreed with the modern production system used value clusters such as *purity* (6) and *modernity* (2) to compare the production to their own norms and values. With regard to purity, the interviewees mentioned cleanliness (2), without contamination (1), pure milk (1), and quality (2). With regard to modernity, two interviewees referred to modern technologies. As Interviewee 15 explains: *“Yes, it's very clean, technified, and they produce a lot of milk.”* Another interviewee stated: *“More and more milk is required to be free of microorganisms and each time procedures are invented to maintain nutrients”* (Interviewee 21).

Four further interviewees responded that they did not know whether the current milk production system in Colombia conforms to their values and norms. One interviewee, for example, mentioned not knowing enough about milk production (Interviewee 4). Another said, *“Well ... I don't know how to answer you. One can think one thing and not be certain. I'll explain: If you think that technified farms are the best, maybe those farms don't think about the environment and only about their production. (...) I suppose the small farms, the small farmers who have three to five cows, they don't have the money to vaccinate well, for lack of resources they don't have the best water, the best health for the cows. Then it cannot be any of them. It is not easy to say which is better”* (Interviewee 2).

Regardless of whether the current production system was thought to be congruent with the norms and values of the interviewees, 22 participants stated that they would like to see changes to the current production system. The majority of the interviewees (10/22) mentioned welcoming change that would improve the protection of the environment by reducing the use of chemicals and turning toward organic food production. Nine out of the 22 interviewees stated that they would like to see improvements in the situation of smallholder farmers. They remarked that smallholders should receive higher prices for their milk, more education, and help in modernizing their production: *“I don't know much about that, but I'd like the prices to change. The production of milk in Colombia is that of the large land owners, not of the smallholders. I would like the little producers in the chain to receive good salaries for that”* (Interviewee 13). A further six participants wanted to see production with more respect for the animals, dignity, and good care as well as keeping the animals outdoors. Also mentioned six times was the desire for neutral control mechanisms that would supervise the production process and guarantee quality, hygiene, and taste: *“Lately I've seen the wateriest milk. I don't know if they have all the hygiene controls they want. More control of quality, hygiene, taste, nutrients”* (Interviewee 14) as well as higher milk prices for the consumer: *“Let it be at a more affordable price so that all social classes can consume (milk). The people of strata 1 and 2 cannot buy milk for the price”* (Interviewee 21, socio-economic stratum 3) and higher milk prices for producers.

Seven more participants mentioned not knowing whether they would like to see changes. One interviewee explained: *“Actually, I've seen some documentaries. I don't know how Alpina produces, for example. They don't make public how they produce. Maybe I'm also a little ignorant. They don't make public how they treat animals, the environment. But I think they have to use less chemicals, less sweeteners in the milk”* (Interviewee 7). Only one interviewee, who was also in favor of the current production system, did not want to see any changes.

4 Discussion

To meet the increasing demand for dairy products in Colombia, the government and food industry aim to intensify production sustainably. However, as experiences in countries with long histories of intensive dairy production have shown, intensification comes along with societal concerns and protests, undermining the social sustainability of intensive production systems (Horlings and Hinssen, 2014; Hejne, 2019). These developments are also expected for countries with recent intensification efforts (von Keyserlingk and Hötzel, 2015). The aim of this study was therefore to explore the socio-technical imaginaries of urban dwellers in Colombia in order to find out whether these conform to or diverge from current dairy farming practices. To this end, we employed a triangulated research method, including a word association task, a drawing exercise, and a semi-structured interview.

Word associations and the drawing exercise suggest a public image representing traditional production systems

The word association task revealed that most participants associated cows, rural areas, and traditional production systems, such as peasant farms and traditional manors, with the cue dairy farms. Correspondingly, 26 participants depicted the cow in an outdoor space and the farming figure with laborer tasks and functions during the drawing exercise. Some participants stated that, next to their drawings, they were also aware of industrial-style farms, but that their image of a dairy farm did not conform to this type of farm. The results are thus in line with previous studies in countries with long traditions of intensification as well as ongoing intensification activities. Kühl et al. (2019) mentioned that consumers in Germany preferred images of outdoor access for cows and rejected indoor housing systems. Similarly, Boogaard et al. (2011b) showed that people in the Netherlands favor extensive outdoor dairy production systems over indoor production systems because of their perceived naturalness. Also in the U.S., Cardoso et al. (2018) found that consumers preferred outdoor access for cows; however, here, access to indoor areas was envisioned to escape heat.

Personal experience with smallholder dairy production is the most common learning route

The results suggest that traditional dairy production systems are much better known among the participants. The strong acquaintance with traditional dairy production systems is based on the fact that information and knowledge about this type of production system was often generated through personal experience and stories from friends and family. Out of the 30 participants, 25 mentioned having visited a peasant farm before. Six participants even mentioned having a dairy farm in the family and two participants owned a farm themselves. None of the participants had ever visited an industrial dairy farm and information was said to have been obtained from television. Following the elaboration likelihood model (ELM) (Petty et al., 1983; Petty et al., 2005), personal experience falls into the central learning route, which entails a careful consideration of actual product properties and which is much more robust to change than peripheral learning routes, which are based on social cues such as advertisements, choices of peers, and attractiveness of people (Leeuwis, 2004; Petty et al., 2005). Similar to previous studies, which have shown that information about animal production systems is obtained through a mix of central and peripheral learning routes (Wellbrock, 2008), the participants in this study also used a mix of learning routes, mostly personal experiences, friends and family, and the media. Following Del Guidice and Pascucci (2010), the study thus suggests that learning routes may be highly important for the acceptance or rejection of a specific food or production system.

Norms and values associated with dairy products and dairy production methods diverge

As in countries with a long tradition of intensification, the participants mostly purchased milk products at the supermarket. While purchasing their products, they paid the most attention to attributes such as health and hygiene. These results are in line with the findings of Cardoso et al. (2019), indicating that laypersons pay the most attention to product quality and not production quality. They further showed that laypersons associated technological advances with product quality improvement, an aspect that was also evident among the people in this study. The urban dwellers in this study thus show a similar ambivalence as described by Boogaard et al. (2011a): participants reject the exploitation of nature and loss of tradition, but welcome technological progress and efficiency. The results therefore propose that, also in countries with recently intensifying dairy production systems, consumers already show a typical attitude-behavior gap (Terlau and Hirsch, 2015). Similar to the “meat paradox” (Oleschuk et al., 2019), we can arguably speak of a “milk paradox” in Colombia. Traditional dairy production is supported by urban dwellers, but the end-product that is sought after is produced by modern production systems.

Socio-technical images are not congruent with the modernization process

The results support the claim of von Keyserlingk and Hötzel (2015): concern for animal welfare is rising in emerging economies, too. More than half of the participants indicated that modern production systems contradict their norms and values, because they do not ensure care for the animals, protection of the environment, and support for the livelihoods of peasants. The socio-cultural sustainability of animal production systems can be defined as the “best” combination between modernity, traditions, and naturality in a given social and cultural context in which the production system functions (Boogaard et al., 2011b). Following Pfothenauer and Jasanoff (2017), the results suggest that the current modernization efforts in Colombia do not fit to the specific culture of the country, hence causing divergence between socio-technical imaginaries and actual modernization processes. Arguably, these divergences will negatively affect the social sustainability of intensive dairy production systems in the long run.

Although the study is neither meant to be representative nor can the results be generalized to the wider population, it arguably shows that the current modernization of the dairy sector in Colombia is not socio-culturally sustainable. To achieve higher congruence between socio-technical imaginaries and real dairy farming practices, further studies are necessary to identify how to incorporate traditional production methods into the modernization process.

Acknowledgements

This study was undertaken with financial support of the University of Hohenheim (SEED Grant). Furthermore, this work was carried out as part of the CGIAR Research Program on Livestock. We thank all donors who globally support our work through their contributions to the CGIAR System. The views expressed in this document may not be taken as the official views of these organizations.

References

Boogaard, B. K. (2009). The socio-cultural sustainability of animal farming: an inquiry into social perceptions of dairy farming in the Netherlands and Norway. Wageningen University, Wageningen.

- Boogaard, B. K., Bock, B. B., Oosting, S. J. , Wiskerke, J. S. C., and van der Zijpp, A.J. (2011a). Social acceptance of dairy farming: The ambivalence between the two faces of modernity. *Journal of Agricultural and Environmental Ethics*, **24**: 259-282. <https://10.1007/s10806-010-9256-4>.
- Boogaard, B. K., Oosting, S. J., Bock, B. B., and Wiskerke, J.S. (2011b). The sociocultural sustainability of livestock farming: an inquiry into social perceptions of dairy farming. *Animal: An international journal of animal bioscience*, **5**: 1458-1466. <https://10.1017/s1751731111000371>.
- Cardoso, C. S., von Keyserlingk, M. A. G., Hötzel, M. J., Robbins, J., and Weary, D.M. (2018). Hot and bothered: Public attitudes towards heat stress and outdoor access for dairy cows. *PLOS ONE*, **13**: e0205352. <https://10.1371/journal.pone.0205352>.
- Cardoso, C. S., von Keyserlingk, M. A. G., and Hötzel, M.J. (2019). Views of dairy farmers, agricultural advisors, and lay citizens on the ideal dairy farm. *Journal of Dairy Science*, **102**: 1811-1821. <https://doi.org/10.3168/jds.2018-14688>.
- Charry, A., Burkart, S. (2017). Disposición a pagar por carne de res con menor huella ambiental y bienestar animal en Cali. Centro Internacional de Agricultura Tropical (CIAT), Cali, Colombia. <https://cgspace.cgiar.org/handle/10568/89186>.
- CNL. (2010). Acuerdo de competitividad de la cadena láctea colombiana. C. N. Lácteo. Bogotá. http://www.cnl.org.co/index.php?option=com_remository&Itemid=108&func=startdown&id=643.
- DANE. (2009). Encuesta sobre el volumen de leche captada por la microempresa para la elaboración de alimentos–EMLAC. En 14 municipios de la provincia de Valle de Ubaté y Chiquinquirá. P. Dirección de Regulación, Estandarización y Normalización. Colombia. https://www.dane.gov.co/files/investigaciones/boletines/emlac/Resultados_Emlac_2009.pdf.
- DANE. n.d. La estratificación socioeconómica en el régimen de los servicios públicos domiciliarios. Grupo de Estratificación Socioeconómica. Dirección Geoestadística DANE. https://www.dane.gov.co/files/geoestadistica/Estratificacion_en_SPD.pdf (Accessed 03.09.20019).
- Del Guidice, T., Pascucci, S. (2010). The role of consumer acceptance in the food innovation process: Young consumer perception of functional foods in Italy. *International Journal on Food System Dynamics*, **2**: 111-122. <https://doi.org/10.18461/ijfsd.v1i2.123>.
- DNP. (2010). Documento Conpes 3675. Política nacional para mejorar la competitividad del sector lácteo colombiano. Bogotá.
- FAO. (2018). FAO's role in livestock and the environment. <http://www.fao.org/livestock-environment/en/> (Accessed 29.03.2019).
- FEDEGAN. (2014). Plan de Desarrollo Ganadero 2014-2019. F. C. d. Ganaderos. Bogotá, Colombia.
- Flick, U. (2009). Sozialforschung. Methoden und Anwendungen. Ein Überblick für die BA-Studiengänge. Rowohlt Verlag GmbH, Hamburg, Germany.
- Fraser, D. (2008). Understanding Animal Welfare. The science in its cultural context. Wiley-Blackwell.
- Fraser, D. (2014). The globalisation of farm animal welfare. *Rev. Sci. Technol.*, **33**: 33-38.
- Hejne, D. (2019). Umbau der Geflügelhaltung - Verbrauchermeinungen zur tiergerechten Masthähnchenhaltung. Berichte über Landwirtschaft. *Zeitschrift für Agrarpolitik und Landwirtschaft*, **97**. <http://dx.doi.org/10.12767/buel.v97i1.235>.
- Helmle, S. (2010). Images der Landwirtschaft - ein Strukturgleichungsmodell. In: S. Helmle (ed.) Selbst- und Fremdwahrnehmung der Landwirtschaft: 1-14. Margraf Publishers GmbH, Weikersheim, Germany.
- Horlings, L. G., Hinssen, J. P. (2014). Sustainable innovation in intensive animal husbandry; policy and public protests towards a mega-farm in the Netherlands (Innovation Sustainable Dans L'Élevage Animal Intensif; Politique Et Manifestations Publiques Envers Une Méga-Ferme Aux Pays-Bas).
- Hötzel, M. J., Cardoso, C. S., Roslindo, A., and von Keyserlingk., M. A. G.(2017). Citizens' views on the practices of zero-grazing and cow-calf separation in the dairy industry: Does providing information increase acceptability? *Journal of Dairy Science*, **100**: 4150-4160. <https://doi.org/10.3168/jds.2016-11933>.
- ICA. (2018). Censo pecuario nacional – 2018 [Base de datos]. <http://bit.do/eMZbV> (Accessed 17.04 2019).
- Jasanoff, S. (2005). Technologies of humility: citizen participation in governing science. In: Bogner, A. and Torgersen, H. (eds.) Wozu Experten?: 370-389. VS Verlag für Sozialwissenschaften.
- Jasanoff, S., Kim, S.-H. (2009). Containing the atom: Sociotechnical imaginaries and nuclear power in the United States and South Korea. *Minerva*, **47**: 119.

- Kühl, S., Gauly, S. and Spiller, A. (2019). Analysing public acceptance of four common husbandry systems for dairy cattle using a picture-based approach. *Livestock Science*, **220**: 196-204. <https://doi.org/10.1016/j.livsci.2018.12.022>.
- Leeuwis, C. (2004). *Communication for Rural Innovation: Rethinking Agricultural Extension*. 3rd ed. Blackwell Science Ltd., Oxford, UK.
- OECD, Food, and Agriculture Organization of the United Nations. (2018). *OECD-FAO Agricultural Outlook 2018-2027*.
- OECD/FAO. (2019). *OECD-FAO Agricultural Outlook (Edition 2018)*. OECD Agriculture Statistics (database). <https://doi.org/10.1787/d4bae583-en>.
- Oleschuk, M., Johnston, J., and Baumann, S. (2019). Maintaining meat: Cultural repertoires and the meat paradox in a diverse sociocultural context. *Sociological Forum* 0. <https://10.1111/socf.12500>.
- Oster, G. D., Gould Crone, P. (2004). Using Drawings in Assessment and Therapy: A Guide for Mental Health Professionals. In: G. D. Oster, Gould Crone, P. (eds.) *Drawings in the diagnostic process*: 71-140. Brunner & Routledge, New York, USA.
- Petty, R. E., Cacioppo, J. T., and Schumann, D. (1983). Central and peripheral routes to advertising effectiveness: The moderating role of involvement. *Journal of Consumer Research*, **10**: 135-146.
- Petty, R. E., Cacioppo, J. T., Strathman, A. J., and Priest, J. R. (2005). To think or not to think. In: M. C. G. T.C. Brock (ed.) *Persuasion: Psychological Insights and Perspectives*: 81-116. Sage Publications Inc., California.
- Pfotenhauer, S., Jasanoff, S. (2017). Panacea or diagnosis? Imaginaries of innovation and the 'MIT model' in three political cultures. *Social Studies of Science*, **47**: 783-810. <https://10.1177/0306312717706110>.
- Rao, I. M. et al. (2015). LivestockPlus: The sustainable intensification of forage-based agricultural systems to improve livelihoods and ecosystem services in the tropics. *Tropical Grasslands-Forrages Tropicales* 3: 59-82. [https://doi.org/10.17138/tgft\(3\)59-82](https://doi.org/10.17138/tgft(3)59-82).
- Rovers, A., Brümmer, N., Saggau, D., and Christoph-Schulz, I. (2019). Wahrnehmung der Schweinehaltung – Ergebnisse aus Gruppendiskussionen mit Bürgern in Deutschland. *Berichte über Landwirtschaft. Zeitschrift für Agrarpolitik und Landwirtschaft*, **97** (1): 1-15. <http://dx.doi.org/10.12767/buel.v97i1.229>.
- Te Velde, H., Aarts, N., and Van Woerkum, C. (2002). Dealing with ambivalence: Farmers' and consumers' perceptions of animal welfare in livestock breeding. *Journal of Agricultural and Environmental Ethics*, **15**: 203-219. <https://10.1023/a:1015012403331>.
- Terlau, W., Hirsch, D (2015). Sustainable consumption and the attitude-behaviour-gap phenomenon - Causes and measurements towards a sustainable development. *International Journal of Food System Dynamics*, **6**: 159-174. <https://doi.org/10.18461/ijfsd.v6i3.634>.
- Vinnari, M., Vinnari, E., and Kupsala, S. (2017). Sustainability matrix: Interest groups and ethical theories as the basis of decision-making. *Journal of Agricultural and Environmental Ethics*, **30**: 349-366. <https://10.1007/s10806-017-9670-y>.
- von Keyserlingk, M. A. G., Hötzel, M. J. (2015). The ticking clock: Addressing farm animal welfare in emerging countries. *Journal of Agricultural and Environmental Ethics*, **28**: 179-195. <https://10.1007/s10806-014-9518-7>.
- WBA, W. B. d. B. (2015). *Wege zu einer gesellschaftlich akzeptierten Nutztierhaltung*. Gutachten. Berlin.
- Wellbrock, W. (2008). *The Knowledge of Organic Animal Product Consumers about the Difference between Organic and Conventional Animal Production*. MSc Thesis, Wageningen University, Wageningen.
- Wellbrock, W., Knierim, A. (2017). Rural realities versus virtual constructs. The case of bobby calves in the dairy industry. *RuralGeo2017: New Rural Geographies in Europe: actors, processes, policies*, Braunschweig.
- Weller, S. C. (1998). Structured Interviewing and Questionnaire Construction. In: H. R. Bernard (ed.) *Handbook of Methods in Cultural Anthropology*: 365-409. Altamira Press, Walnut Creek, CA.
- Yunes, M., von Keyserlingk, M. A. G., and Hötzel, M. J. (2017). Brazilian citizens' opinions and attitudes about farm animal production systems. *Animals*, **7**: 75. <https://doi.org/10.3390/ani7100075>.