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Agri-food in search of sustainability: cognitive, interactional and material framing

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Abstract

The agri-food sector is under pressure to move towards sustainability and broad socio-technical changes are needed. In such encompassing innovation processes that concern the whole agri-food chain, actors with different institutional backgrounds are confronted with each others interests, ideas and perspectives. Framing, then, may both support and hinder the alignment of actors and interests. In this paper we investigate how framing occurs in multi-actor innovation projects and how it facilitates or hinders the continuity of these projects. We first review the broad literature on framing, which leads to a typology of three levels of framing: face-to-face interaction (between individuals), global discourse (within society) and localised collective (in projects). In addition, we add a third category to the traditional distinction between 'cognitive' and 'interactional' framing. We argue that in socio-technical innovations also 'material' framing occurs. In an empirical case study, based on in-depth interviews and document analysis of the Roundel project (2004-2010), a Dutch innovation project aimed at sustainable egg production and marketing, we trace and analyse these different forms of framing. The project survived several critical episodes, due to changes in framing. Our study yields general lessons about framing in complex innovation projects, both conceptual and practical.

Keywords: system innovation, transition, framing, agri-food chain

1. Agricultural innovations towards sustainability

Since the 1950s the agricultural sector in industrialized countries has grown dramatically (FAO, 2011; Pretty, 2008; Pretty *et al.*, 2010). Increasingly, this growth has been challenged by environmental problems, such as emissions of polluting substances to the air, soil and groundwater (Bos *et al.*, 2003), and by societal concerns about nature conservation, animal well-being and quality and safety of food products (Bekke and De Vries, 2001).

The economic conditions for the agricultural sector have changed as well. Due to globalization, for example, consumers can now choose between many food products from all over the world, and they have higher demands regarding quality, traceability and environmental friendliness of products and processes (Ruben *et al.*, 2006). According to some scholars, it is no longer the producer, but the consumer who determines the rules of production and marketing of food (Bekke and De Vries, 2001). As the agricultural sector is facing a lot of technical, economic, socio-political and ecological challenges, innovations are seen as inevitable (De Groot, 2003; Werrij, 2007). Given the concerns related to animal welfare, biodiversity and environmental problems (Beers *et al.*, 2010), the interest in sustainable practices is increasing (Pretty, 2008). Furthermore, innovations in the agricultural sector are needed to maintain the 'license to produce' (social problem), the 'license to operate' (policy problem) and the 'license to deliver' (market problem) (Veldkamp *et al.*, 2008).

Various conditions hinder the agricultural sector to move in a sustainable direction. In the first place, there is no precise definition of what sustainable agriculture will comprise, despite the plethora of studies about the future of the planet in relation to food production (e.g. Kloppenburg jr. *et al.*, 2000; Nousiainen *et al.*, 2009). As Francis and Hildebrand (1989: 4) state: 'everyone assumes that agriculture must be sustainable. But we differ in the interpretations of conditions and assumptions under which this can be made to occur.' There is no agreement about how to operationalize and measure 'sustainability' (Nousiainen *et al.*, 2009). Indeed, sustainable development is an umbrella term covering many aspects, and is filled in by various activities and practices (Van Lente and Van Til, 2008). So, there are many interpretations but not a consensual view on what a sustainable agricultural sector should look like.

Furthermore, the agri-food sector is complex and involves different kinds of actors who produce, process or distribute food and agricultural products. As the agri-food

sector consists of complex chains, coordinating change is a daunting task. The actors are interdependent, so if something changes in one part of the chain, it will affect the other parts as well. This condition compels innovation to take account of the different interests and ideas; that is, the change should be systemic.

Inspired by the systems perspective (Smits, 2002), many innovation experiments are being conducted, in particular in the Dutch agri-food context, in which multiple actors are involved. These actors often are interdependent and comprise knowledge institutes, governments, farmers, businesses, intermediary organizations and societal organizations. In interaction actors with different institutional backgrounds are confronted with each other's interests, ideas and perspectives. The experiences thus far are mixed: the innovation experiments are promising in principle, but also encounter many pitfalls and clashes of conflicting interests and perspectives (Klerkx and Leeuwis, 2009).

In this paper we will investigate a particular phenomenon that seems to stimulate or hinder innovation experiments in settings of interdependent stakeholders with conflicting interests, visions and ambitions: the notion that actors in their perception and interactions are enabled and constrained by 'framing'. As the social sciences have stressed in various ways and with different terms, framing is needed to guide perception and enable interactions; in this sense framing processes are part and parcel of any social system. Due to different frames, actors will perceive the world and its exigencies differently, and respond differently. Due to different frames, therefore, the required alignment between the many stakeholder parties can be thwarted. Correspondingly, when frames change, new forms of alignment may be established. Therefore, our research question is: how does framing occur between actors of the agri-food value chains and how does framing facilitate or hinder innovation in complex multi-actor settings?

We first discuss the notions of 'frame' and 'framing' based on a literature study. Our main argument is that in socio-technical changes like in agri-food innovations not only the well-known categories of cognitive and interactional frames are important, but also a category that we label as 'material frames'. Then we delineate our method to study framing in innovation processes and introduce our case study, the Roundel project, which is about a new way of egg production and marketing. In the results section we compare and analyse instances of framing. The paper concludes with a reflection on the importance of understanding framing in systemic innovations in the agri-food value chain.

2. Conceptual reflections on framing

This study should be placed in an interpretative or social constructionist tradition, studying the co-existence of multiple, socially constructed realities which are historically and culturally specific (Berger and Luckmann, 1966). The concept of framing already has a long tradition, or put more precisely, several traditions. It originates from cognitive psychology (Bartlett, 1932) and anthropology (Bateson, 1972). Starting with Bartlett's schema theory of memory (Bartlett, 1932), cognitive psychologists define frames as cognitive structures in our memory that can help to organize and interpret new experiences. In the work of Bateson (1972) on (meta-)communication, framing is about the understanding of ongoing interaction by focussing on the exchange of cues. His example is the play between two boys, which becomes rougher and ends as a fight. According to Bateson, the ambiguity of how to interpret ongoing interactions – in this example whether the roughness is 'play' or 'fight' – creates the need for framing.

In later studies, framing has also been used in, for example, sociology (Benford and Snow, 2000; Goffman, 1974), artificial intelligence (Minsky, 1975), psychology (Levin *et al.*, 1998), policy studies (Hajer, 1995; Schön and Rein, 1994), communication studies (Bryant and Miron, 2004; Entman, 1993; Tannen, 1993), management studies (Creed *et al.*, 2002) and conflict and negotiation studies (Lewicki *et al.*, 2003). According to Dewulf *et al.* (2009: 156) 'the smorgasbord of approaches differs conceptually, ontologically and methodologically'. The common denominator between these different framing traditions, according to Weick (1995), is that a frame is a 'sense making device'.

A useful overview is provided by Rein and Schön (1996), who describe four distinct (but mutually compatible) meanings of 'frame', which cover a broad spectrum of framing research: (1) as an underlying structure giving regularity to events as they unfold over time; (2) as setting a boundary, like in framing a picture, focusing on what is inside the frame; (3) as a schema of interpretation; and (4) as strong and generic narratives that guide both analysis and action in practical situations. The first meaning hints to a lack of adaptability to events as they unfold over time. This emphasizes the constraining force of frames. For instance, a specific frame of a problem will point to specific 'reasonable' solutions and obscure other possible solutions (Benford and Snow, 2000). The same holds for the second description; by leaving some parts outside the frame, extra attention is given to the elements that are in the (picture) frame. Related to this, Beers *et al.* (2010) point to the fact that framed images can have a large, partly unwanted influence because they

necessarily simplify complex real-world phenomena. The third meaning points to the enabling properties of frames. Schemes of interpretation make events meaningful, can organize experience and guide action, whether individual or collective (Davidson, 1985). Finally, the fourth meaning treats frames as strong and generic narratives that guide both analysis and action in practical situations. Such narratives tell what the problems are, what needs fixing and how it might be done. An example is the frame of a disease that requires cure or quarantine (Rein and Schon, 1996). Frames, thus, enable certain lines of action while constraining other types of action.

A typology of framing

One of the critiques on framing perspectives is that it is 'often lacking conceptual precision in its delineation of constituent elements and processes' (Steinberg, 1999: 738). As a first step towards more precision, we suggest a typology of framing on the basis of three different levels of social dynamics, where frames reside and operate in distinct ways (Figure 1). This typology also allows us to review the various strands of framing research.

Many studies of framing are at the level of *face-to-face interaction*. They investigate how individual frames develop over time; they consist of deep beliefs as well as more flexible schemes for understanding the world around us. Such individual frames are characterized by the psychological concept of 'schema', which is defined by Entman (1993: 53) as 'mentally stored clusters of ideas that guide individuals' processing of information'. In the tradition of symbolic interactionism, schemata are interpretive frameworks that help to make sense of a situation (Goffman, 1974).

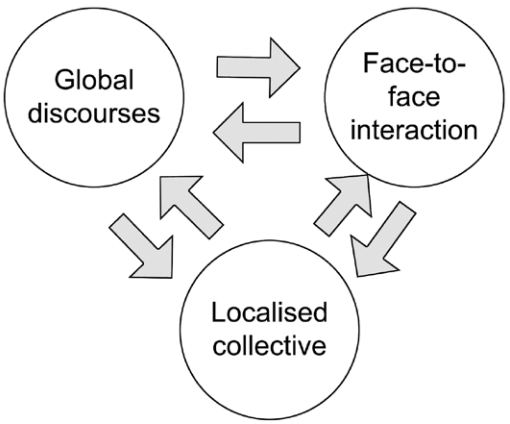

Figure 1. A typology of framing.

In contrast to the individual forms of framing, research on discourses and mass media highlight broader, societal forms of framing. Here, framing relates to how issues are presented: what is highlighted, what is ignored and what is the relation with other issues. An example is the study of Feindt and Kleinschmit (2011) about the reframing of responsibility during the Bovine Spongiform Encephalopathy (BSE), also called mad cow disease, crisis in German newspapers. This strand of research, thus, concerns the storylines present in society that frame events and meanings in particular ways. Frames in society, are voiced and reproduced in the media. These frames 'out there' have also been described as 'images' (Beers *et al.*, 2010), as 'structuring elements of discourse' (Hajer and Versteeg, 2005) or 'master frames' (Benford and Snow, 2000). Discourse analysis is about the social reality produced and made real through particular ways of talking about the world (Van den Brink, 2010). We will call this level of framing, *the global discourse,* stressing its encompassing and general nature.

While most studies tend to focus on face-to-face interaction and individual forms of framing which guides perception, sense making and, or alternatively, on broad forms of framing of societal issues, a third level of framing processes is important for our purpose. In multi-actor innovation processes, projects are central in which new ideas are developed and employed. Here, we claim, another form of framing is taking place and seems to be a crucial ingredient. Typically, in projects different actors are trying collectively to position their project and define what they want to reach with the project. Participants need to develop a joint idea, a shared approach and a temporal form of coordination. We propose to call this *localised collective* framing. It is distinct from, but influenced by personal schemata of the participants. Likewise, they are enabled and constrained by global discourse, which resonates in society. Localised collective frames can be very volatile during intense debate, but can also show some stability in the form of the 'shared understanding' that develops over time between the people involved in a common project. A similar level of framing is addressed in the studies on social movements (Benford and Snow, 2000). In this study we focused on framing at the localised collective level.

Cognitive, interactional and material framing

The ambition of this paper is to study framing in agri-food innovations. The idea is that innovation projects require – at least to some level – a common understanding of the problems and the preferred solutions. A first conceptual step was to delineate different levels of framing and to limit ourselves to localised collective framing. A next step is to be

more precise about how framing takes place. A useful starting point here is the distinction between cognitive frames and interactional framing as described by Tannen and Wallat (1987) and later extended by Dewulf *et al.* (2009). Tannen and Wallat (1987) make a distinction between 'interactive frames' and 'knowledge schemas'. Interactive frames refer to what is going on in interaction, and knowledge schemas refer to participants' expectations about people, objects, events and settings in the world (Dewulf *et al.*, 2009). Cognitive frames are relatively static structures or categories in one's mind. The interactional framing theory investigates the co-construction of issues, identities and processes as they are negotiated in interaction. Cognitive frames and interactional framing are not mutually exclusive categories (Dewulf *et al.*, 2009). As Aarts and Van Woerkum (2006) state, 'interactional framing and cognitive frames both emphasize different aspects of the framing process'. Also Tannen and Wallat (1987) point to a relationship between interactive frames and knowledge schemas. For instance, in case of a mismatch in knowledge schemas (cognitive frames) between people, a shift of interactive frames is triggered, and the other way around.

In the case of technological innovation processes, however, the fate of projects does not only depend on the perspectives of people (cognitive frames) and on patterns of interaction (interactional framing), but also on material constraints. Sustainable innovation processes in the agri-food chain, indeed, are socio-technical reconfigurations. The tradition of Science and Technology Studies has emphatically shown how artefacts and systems are not only shaped by interactions, but also shape interaction, in return. The so-called 'script' of technical objects, for example, refers to the action program inscribed in the material dimension of technological artefacts, which constrains the behaviour of actors. An example is the round conference table: it renders the actors around the table equal in the discussion because nobody is sitting at the head of the table. Another example is the speed ramp, which forces drivers to lower their speed. In this way the material aspects define the roles of the actors involved. As Akrich (1992: 208) puts it: 'technical objects define a framework of action, together with the actors and the space in which they are supposed to act'. Likewise, in design studies the term 'affordances' is used to point to the 'perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used' (Norman, 1988: 9). This is an argument that framing may include material dimensions as well. The *material frame*, as we call it, refers to the artefact(s) that enable and constrain the developments in the innovation process. We define the material frame as the *characteristics of artefacts that enable and constrain understanding, action and interaction*.

3. Methodology of analyzing frames

In order to find out how and when framing is taking place we need to determine how frames and framing change over time. Cognitive, interactional and material frames, however, cannot be observed directly, as they are not present in an isolated form. Frames can only be inferred by considering what gets framed, as we discussed above. So, one way to study this phenomenon is to follow how *topics* are discussed in innovation projects over time. We define a topic as a problem or a goal, relevant to one or more participants in the interactions. Topics are explicitly or implicitly introduced into the interactions by the actors themselves, and can be traced afterwards by analyzing documents and interviews.

During innovation projects topics may emerge, become salient and dominant, or may leave the scene silently. It is possible to reconstruct the vicissitudes of a topic, or, how we propose to call it, the *biography of the topic*, on the basis of quotes of interviewees, traces of interaction processes and project materials. We emphasize that the topics are not invented by the analyst but brought into existence by the actors themselves: they discussed them, expressed their perspective on them and stressed their importance. When following topics we automatically encounter discussions about the roles of actors in the discussion and the processes around it. When some actors, for example, are talking about building permits, they implicitly seek to convince the local authorities to give a permit and thereby talk about the process and what they see as the role of the civil servants. The biography of a topic allows a further analysis of the framing around that topic. We consequentially follow four questions to get a complete description of a topic:

1. When, how and why was the topic introduced?
2. How did actors cope with the topic?
3. What was the effect of interactions on the fate of the topic?
4. How did cognitive, interactional or material frames change in due course?

The answers to these questions will produce a complete biography, describing the moments a topic became important, faded away or became an important topic again after a while.

Data collection

How did we trace the various framing processes related to the topics? First of all we interviewed the actors involved in the project. The semi-structured, in-depth interviews were transcribed verbatim with the help of the program

F4[1]. Besides the interviews also project material and other documents were studied. Project material included notes of meetings, project plans, evaluations and reports. In addition, interaction moments such as workshops have been recorded. These were transcribed verbatim as well. All the material has been coded and organized with the qualitative data analysis program Atlas.ti[2]. The transcripts were coded with words as close as possible to the words the actors use. Once the quotations were categorized, the quotes could be organized per topic. The biographies of topics revealed how the frames changed and why they changed. By studying the biographies and focussing at the changes in frames, one can find cognitive, interactional and material frames. With the help of the definitions as presented in Table 1, we define the different types of frames in the biography.

In the next section we provide some case material of a specific agri-food innovation project, the Roundel project, in order to corroborate our ideas. We start with a general case description.

4. General case description

The project we studied is about the realisation of a novel laying hen husbandry system in the Netherlands, called Roundel (Bos, 2008; Bos and Groot Koerkamp, 2009; Groot Koerkamp and Bos, 2008), which aimed to surpass current sustainability standards. In the Netherlands different ways of keeping laying hens co-exist, namely in cages, in barns, free range and organic.

Table 1. Definitions of types of frames

	Definition
Cognitive frame	The way actors conceptualize the substantive topics in a dispute as cognitive representations.
Interactional framing	The way parties negotiate the meanings of issues, identities/ relationships and ongoing interactions in social interaction (by cueing and reacting to each other).
Material frame	The way an artefact enables or constrains understanding, action and interaction.

In 2003 and 2004 the Dutch government initiated and financed a project called 'Caring for hens' (in Dutch: 'Houden van hennen'). In this project a visioning experiment was done in which two animal husbandry systems for hens were envisioned with the involvement of multiple heterogeneous actors, such as people from knowledge institutes, poultry farmers, egg and system building businesses, an animal welfare organization, government officials, communication people, journalists, sector organizations, consultancy organizations and advisory organizations. The actors discussed what the system according to them should look like. They came up with a lot of demands that should be met. These ideas were laid down in a Brief of Requirements (Project Team Houden van Hennen, 2005) and drawn up resulting in the first visionary ideas (Figure 2).

Based on the Brief of Requirements, a programme developed in 2004, in which the needs of hens, farmers and citizens were defined, a consortium was formed in 2005 with a large egg packer and a husbandry systems developing firm, with the goal to redesign one of the two designs into a system to be used in practice. This system was called the 'Roundel' after its typical round form. The aim of the project was to realize 'a system innovation' by developing and introducing a new 'socially responsible table egg' to the market, with a sustainable production system and chain (internal communication, 2009). In the first part of the project (2007-2008) the focus was mainly on the technical development of the new laying hen husbandry system (see Klerkx *et al.*, 2010 for details). In the second part (2008-2010) the focus was on realisation, development and marketing of an egg, produced in a system that leads to 'happy poultry, proud farmers and satisfied citizens'(Wageningen UR project team Houden van hennen, 2004).

Various actors started working on the implementation of the design, and thinking of how to sell the eggs. Core participants in the project team were: the husbandry system builder, a research institute (ASG Animal Science Group, part of Wageningen University and Research Centre), TransForum[3] as intermediary organization and project funder (since 2007),

[1] http://www.audiotranskription.de/english/transcription/.

[2] Atlas.ti version 6. source: www.atlasti.com.

[3] TransForum is a Dutch program which hosts many innovation projects in the agri-food sector, with the aim to improve upon ecological, economic and social sustainability, and in which heterogeneous actors, such as the government, societal organizations, businesses and knowledge institutes are involved (Veldkamp *et al.*, 2008).

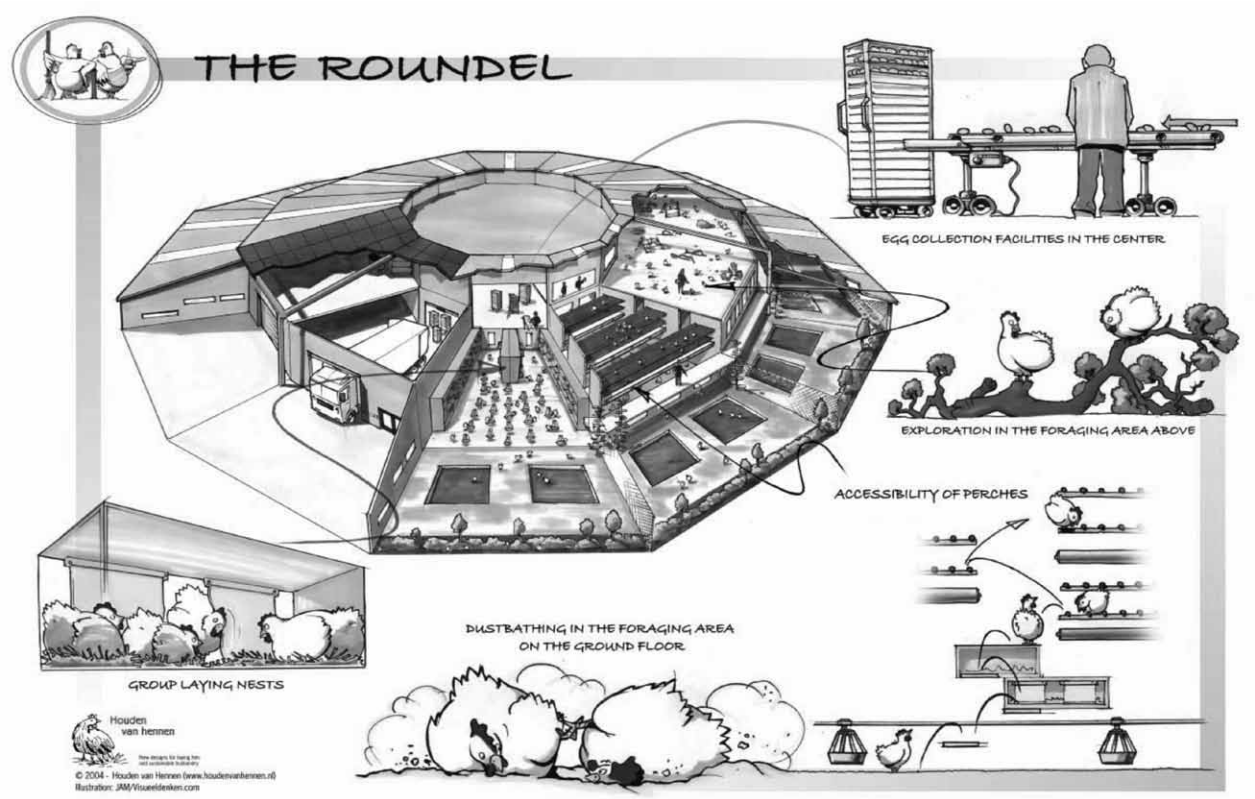

Figure 2. Design of the Roundel system and typical aspects. Source: brochure laying hen husbandry (Wageningen UR project team Houden van hennen, 2004).

and a consultant in the field of animal welfare and social corporate responsibility. Besides these core participants, other actors involved were the Society for Protection of Animals, farmers interested in building and exploiting a Roundel system, municipalities in which the Roundel would be built, architects, building contractors, and other consultants and process facilitators. The project team met every six weeks to discuss the progress of the activities. In addition, workshops were organized by the project team. In these workshops experts in the field were invited and topics such as how to position the egg in the market and how to organize the product chain were discussed together with the project team. In spring 2008 Roundel Ltd was formed as a daughter company of the husbandry system-building firm. Figure 3 shows some important events in the Roundel project.

5. Results and analysis: framing the fit in the landscape

In order to analyse the case, we selected the topic 'fitting in the landscape of the Roundel system'. This topic was mentioned by the actors involved as a key characteristic of the system. The general idea was to design a totally different way of dealing with egg production, yet it should not conflict with established ideas about the rural environment. Fitting in the landscape is about the way the Roundel system is situated in the landscape, which not only concerns visibility and technical design, but also the image of the system. It is a socio-technical topic, containing different elements of the system. Topic intensive discussions took place between researchers, designers, businesses and civil servants, who had different ideas about when something fits in the landscape and is at the same time manageable, good for animal welfare and does not lead to very high expenses.

One of the needs in the Brief of Requirements (2004) for the farmer was an open and transparent laying hen system, with outside space for chickens. At the same time chickens should be protected against risks from the environment, such as migrating birds, which could 'distribute' avian influenza via their excrements. The system should be accessible for visitors (people have to be able to see the chickens), but at the same time the public health should be guaranteed. In order to be able to build the system, it is important that it 'fits in the landscape', in an esthetical, economic, technical, regulatory and societal sense.

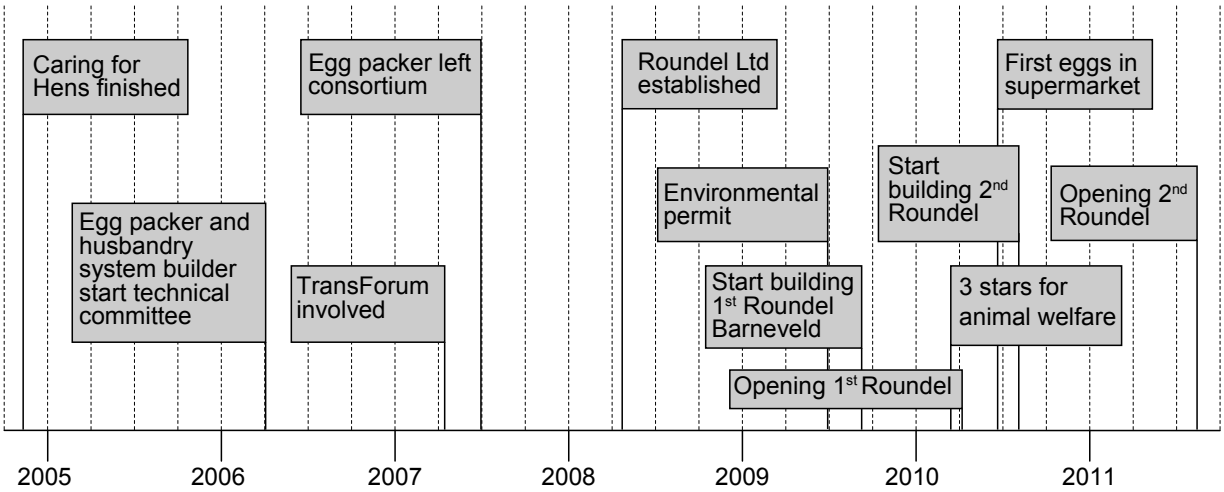

Figure 3. Timeline of the Roundel case (adapted from Klerkx *et al.*, 2010).

In the summer of 2006 the first talks with the municipality of Barneveld (the 'egg capital of the Netherlands') were conducted. The civil servants were enthusiastic about the first ideas. Already in the first meetings of the project team there was an idea to build the first Roundel system at a 'sight location' near the highway. The drawings were elaborated and discussions took place on animal welfare, outdoor run, and what type of egg should be sold. In the meantime (between autumn 2006 and spring 2007) some other possible places to build the system came to the fore, as there were some financial and regulatory issues, which made it uncertain whether the system could be built in Barneveld.

In spring 2007 the actors developed most of the technological aspects of the Roundel system and recognised it was important to start with other aspects as well, such as the marketing of the egg. Since then the focus was again on Barneveld. The project team regularly discussed with the municipality and an advisory company specialised in permits. In these discussions, the differences in what is meant by fitting in the landscape and the role the system needs to fulfil in the landscape came to the fore. The first request for a permit to build the system was done in August 2007; around the summer of 2008 the permission was given. But before the permission was given some hurdles had to be taken, with regard to the design and the regulations. After all, this was a new type of system that needed another way of thinking about permits and design.

At the end of 2009, when all the permits were arranged and also the financial issues were solved, they started with building the first Roundel system in Barneveld, which was finished in spring 2010. A second Roundel was built in a different municipality in 2011, and a third one is planned to be finished in 2012.

In studying the topic 'fitting in the landscape of the Roundel system' we find numerous instances of framing, which are grouped below under the different subheadings.

'Fitting in the landscape'

The general requirement that the envisioned system should 'fit in the landscape' was not a straightforward condition. According to one of the researchers, for instance, chickens being outside contribute to fitting in the landscape and the perception of the concept.

> '…and now we say that it contributes to fitting in the landscape and the perception of the concept, and the chickens are outside.' (Researcher)

In this quote 'chickens outside the stable' is framed as contributing to fitting in the landscape, meaning that a stable surrounded by space for chickens will better fit in the landscape than a closed system. So, fitting in the landscape is framed as chickens outside. An advisory company, on the other hand, translated the requirement to esthetical concerns. They argued that the typical round shape of the system did make the design look like a big circus tent, which they found problematic. A system with a round shape and a big size has a big impact on the rural environment.

> 'The Roundel actually has an impact on the environment; it is a gigantic construction that is built. It is a circus tent, that was our first thought: what a huge circus tent in the landscape. It is a completely

different design than we are used to. But it is good to change that' (Advisory company).

The radical new ideas of the Roundel, thus, resulted in 'a gigantic construction' that does, according to the actors, not fit the surroundings. It is as strange and exotic as a circus tent. In this example fitting in the landscape is framed as: not a circus tent.

Eventually, the design had to be changed in 2007. A civil servant recalls:

'In principle the Roundel does fit the building blocks, so there are no real changes in that. But the model did change, especially the fit in the landscape of the Roundel. Then you are talking about roofs with grass and plants and trees accompanying the shape of the system in order to not make it rise as a circus tent in the landscape. Some concessions were made to make it fit in the landscape.' (Municipality)

According to the project team, a natural appearance was needed as well, although it would be nice if the system was visible for the public from a distance. To counter the framing of a circus tent (in 2006) they changed the design: by planting trees around the system it became more integrated in the landscape. Now, it was seen as a 'hill in the landscape' (in 2008). Fitting in the landscape now is framed as 'planting trees around it', as the quote below demonstrates:

'At the commission of the municipality employed to enforce the regulations regarding the external appearance of buildings it first was a circus tent, and in the end it became a 'Teletubbie hill' in the landscape. It fits within the rolling of the hills, and that created a basis at the municipality.' (Architect)

The quotes above show that 'fitting in the landscape' is not only one aspect, but many aspects together. They also indicate that the design changed as a result of changing frames.

While the discussion was about how to fit such a system in the landscape, it also became clear that it is difficult to decide whether something fits in the landscape, and that it is not possible to develop one design that fits everywhere. According to the final report of the project in 2009 it 'is a personal opinion and it depends on the landscape and the environment of the system' when the system fits the environment. So it was agreed that the way one Roundel fits the environment could differ from another one. As the architect said:

'Every Roundel will be built on another spot. So at this spot it will be built like this, with the plan for the plants and trees surrounding it. And at another spot, for example besides a creek, it has to be fit to that landscape.'

So the framing of what had to be designed changed. In the design phase the Roundel system was developed as an isolated object. Now it changed into an object that is part of the landscape and differs per region and has to be defined in interaction with the municipality involved.

Environmental permits

A particular important episode in the Roundel innovation project was the negotiation about permits. In order to get a permit, interaction with the municipality was important. In 2007 the project team was working on obtaining environmental permits of the municipality of Barneveld and had to prove that it met the environmental requirements. Because the Roundel system had a typical round form, it did not fit the existing rules for building in the rural area, as someone from the advisory company said:

'It is not easy to get a permit for a round system, with such an impact on the surroundings. We had to work hard in order to make it fit in the landscape'.

The people in the project realised that completely new systems had to go through the whole procedure of for example testing and measuring the emissions. Instead of getting a permit for a new system, therefore, the project team decided to make use of existing systems for laying hens. Available techniques were combined in every compartment of the system. For example, the interior of the system was an already existing system of the system builder, although it had to be adapted to the new design. So, instead of framing the system as one new, round system, the system was framed as five separate systems, placed in a circle. This shortened the permit procedures, as these existing systems were already proven to meet the rules. In the middle of the circle there was space for the egg packing machines and between and surrounding the systems an outdoor run was created.

'I think in the first instance the concept was a Roundel with a tree in the outdoor run and a really open system. In the final design there are five systems. Systems with a common design, built in a circle. That is different from the first concept.' (Researcher)

In this example the way the system is framed has changed in order to meet the criteria regarding permissions. This is an example of how a new framing may support the project.

Public debate

Besides meeting the demands of the building inspector of the municipality, the idea of the project team was that when a system fits in the landscape, the public is willing to accept it better than when it does not. So fitting in the landscape also means creating public acceptance. During the Roundel project, there was an intense public debate in the Netherlands about the desirability of so-called mega farms: systems in which huge amounts of animals were kept at one spot (Van Lieshout *et al.*, 2011). As they had a strong and negative connotation, it was important for the project team not to be associated with that type of farms. Especially when a system is very prominent in the landscape, people might find it big, or mega. They tried to counter that danger by seeking forms to open the Roundel system.

> 'The perspective that the public has on livestock farming depends partly on the current big and closed systems in the landscape.' (Final report, 2009)

Here we see that the global discourse, in this case about mega farms, is influential. The project team tries to position itself in the global discourse: the Roundel is different, because it is open to the public. We might call this anti-framing. The idea is that by opening up the system, visitors can see how the animals are kept. A system in which visitors can see the chickens was already part of the design in 2004, and with the menace of the mega farms image it gained new urgency. Here the role of the citizen was put central.

The role of the citizen

When in 2007 the openness of the system became urgent, new plans were made, for instance for a visitor's corridor through the housing of the chicken. The corridor was lowered to allow visitors to see the system from the same height as the chicken and to connect to how chicken experience it. According to the project team the 'design of the corridor equals the visitor to the animal'. The openness of the system, and the technological feature of the lowered corridors, also changed the role of the public. The fact that the system is literally open for the public makes the public not only a consumer, but also a spectator. The project team hoped this will change the idea people have on closed systems and the way animals are kept. According to one of the designers the building is '… a place to which excursions are planned'. In this way it also informs citizens about the way of keeping hens. So, by welcoming visitors, the system not only becomes a production site, but an information centre as well. Here we see framing of the role of the public. It is a particular example of material framing: the lowered corridor frames the citizen as a spectator, experiencing the system as a chicken. In Table 2, an overview is given of framing in the Roundel case.

6. Conclusion and discussion

The aim of this paper was to study how framing occurs between various actors within the agri-food value chain. The basic idea was that framing either facilitates or hinders innovation towards sustainability in complex multi-actor settings. We first investigated the concept of 'framing' and the various strands of literature. Clearly, 'framing' is an encompassing concept, which is present in social interactions in many different ways. We organized the insights from the literature into a typology of three levels

Table 2. Framing in the Roundel case.

What aspect is framed?	Initial frame	Later frame
Fitting in the landscape	The Roundel is a new system that enables a new form of egg production. Contested as a circus tent.	The Roundel is a natural element (hill) making the system less visible, by changing the colours and by planting trees around the system, adapted to specific rural environment
Environmental permit	The Roundel system is one new large round system	The Roundel system consists of five rectangular systems positioned in a circle
Public debate	Roundel system as a production facility	Roundel system as visitor centre
Role of citizen	The public consists of consumers eating eggs	Citizens are spectators who can appreciate the living/production circumstances of the chickens

of framing: global discourse, face-to-face interaction and localised collective framing. Since systemic innovations in agri-food typically occur in localised innovation projects we focused on this latter type of framing.

Our case is the Roundel project (2004-2010) in Barneveld, the 'egg-capital of The Netherlands', which aims at developing and exploiting a sustainable and animal-friendly way of keeping hens. It is a typical example of a systemic innovation process in which different stakeholders cooperate. The project faced various difficulties, but in the end resulted in a more or less viable system. We traced the role of framing by following a particular topic in an agri-food innovation project. The so-called biography of a topic allowed us to reconstruct the different forms of framing and their efficacy. In our case study, we selected the topic 'fitting in the landscape of the Roundel system'.

During the project the general requirement that the eventual system had to 'fit in the landscape' appeared in very different and sometimes conflicting ways. The initial framing inspired plans for a visible construction that clearly differed from traditional forms of egg production. This led to contestations from the municipality about the construction being an unwanted 'circus tent'. Subsequent negotiations within the project team resulted in a framing of the construction as a 'natural hill', which succeeded in regaining the support of the municipality. This, thus, is an example of a deadlock due to conflicting frames *and* an example of solving the deadlock by changing frames. Sometimes, changing frames also helps to solve other, more mundane, problems. In the stage of obtaining environmental permits, the project was forced to pause when it turned out that the plans were not in line with the current regulation. Here, the framing of Roundel as five rectangular systems positioned in a circle, instead of one big circular building, saved the project. A third example of safeguarding the project, due to framing, occurred when the increasing public discontent with mega farms threatened the Roundel experiment. The framing of Roundel as another mega farm was countered by stressing the naturalness of the 'hill' and by opening the system to visitors. People were invited to walk around in lowered corridors and to experience the system differently. Here, the material conditions of the corridor framed the citizens (who might oppose mega farms) as spectators who could relate to the living conditions of hens.

In this paper, we designed and used a typology of three levels of framing. Between the framing in face-to-face interaction studied by symbolic interactionists and discursive psychologists, and the framing at a global discourse level, studied by political scientists and mass media scholars, we position framing processes at a project level, coined as the *localised collective*. Besides distinguishing between levels of framing we also reviewed different ways in which framing occurs. Whereas the literature mainly studies cognitive frames and interactional framing, we concluded that a third category is helpful, material framing, based on the notion of 'script' from Science and Technology Studies. After all, in case of technological innovations, the fate of projects does not only depend on the perspectives of people (cognitive frames) and by patterns in interaction (interactional framing), but also on material constraints. The lowered corridors, for example, enforce visitors to adopt a 'chicken perspective', as a developer once phrased it.

A general lesson, then, for the study of systemic innovations is that material framing may occur, next to what happens in people's minds and in interactions. In further studies we may want to understand better if cognitive/interactional and material frames can be understood as really distinct concepts or should be seen as related aspects of a specific frame. Whichever the outcome, material framing as a concept can add to our understanding of technological innovation processes. A second lesson is that framing refers to different levels, ranging from individual perceptions to societal debates *and* that these are interdependent. Theoretically, this is maybe not surprising, since both interactionism and political science stress that in daily interpretations people 'enact' general frames, and, by doing so, slightly modify them (Goffman, 1974; Hajer and Versteeg, 2005). Our study, however, shows that this may have pertinent practical implications as well. Remember how the project team recognized the danger of the global discourse on mega farms, and averted the danger by anti-framing, by positioning themselves as something totally different than a closed mega farm.

We conclude, therefore, that framing matters, both conceptually, in terms of understanding complex multi-actor innovation processes, and practically, as it may help projects to avoid imminent deadlocks. In the case of the Roundel project, the developers eventually encountered the force of framing and acted accordingly, often without fully acknowledging the role of framing. In the search for sustainability, other agri-food experiments will encounter many pitfalls and challenges as well. We think that a better understanding of framing helps to make the efforts of developers, stakeholders and society at large less vulnerable to these pitfalls and challenges.

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