

# Communities of practice as an analytical approach to understanding decision making on multifunctional aspects on Danish dairy farms

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## **Abstract:**

*In Danish dairy farming the use of summer grazing for dairy cows has been decreasing in recent years. Most dairy farmers acknowledge that there is a public demand for the multifunctional aspects of grazing but nevertheless an increasing number of farmers keep the cows stabled all year round. Economic and logistic arguments are often used to justify this decision but these arguments are not necessarily in accordance with realities. An earlier study based on the theory of communities of practice has shown that the work-related micro-level social interaction on the individual farm is pivotal for change of agricultural practices in accordance with public demand for compliance with e.g. environmental targets. Micro-level social interaction might also be pivotal for the decision on use of grazing on dairy farms. On the empirical basis of interviews on Danish dairy farms and drawing on the theory of communities of practices as an analytical framework, this paper analyses the social and technological preconditions for collaboration and decision making around the farmer and the work on the farm in relation to multifunctionality.*

## **Introduction:**

Farming in general is undergoing a process of specialization from farms producing a broad range of commodities into farms producing specific categories of agricultural commodities as a response to the competition caused by globalization of the markets. 50 years ago the Danish farms were traditional farms, each embracing a broad range of animals and crops but today the specialization has caused that three main categories of farms emerged, farms specializing in dairy production, pig production or crop production. From the perspective of the concept of multifunctionality, costs of specialization are reflected in negative effects and consequences for nature and environment as well as social effects reflected especially in the decrease in use of manual labour force due to mechanization and efficiency improvements. In the Danish dairy sector the specialization and intensification leads to a decrease in number of farms but an increase in number of cows per farm. Through the ages livestock farming and grazing has had a huge impact on the creation of nature and landscape in Denmark, but due to the specialization the use of grazing has been decreasing steadily and by 2008 only 34% of dairy farms with more than 100 dairy cows used grazing for cows (Kristensen *et al.* 2010). Due to summer stabling the traditional nature of the Danish agricultural landscape is losing some of its functionalities and thereby its character gets under pressure. Different traditional functionalities of dairy farming are under pressure such as animal welfare in relation to grazing, nature preservation in e.g. meadows and commons and in relation to this the use of grazing for heifers. Increasing herd size is often considered to cause logistic barriers to grazing, but nevertheless some farms are actually able to tackle the challenges of integrating multifunctional aspects in relation to e.g. grazing, in the production system along with production targets and new technologies needed for efficiency improvements.

According to a questionnaire among Danish dairy farmers with more than 100 cows 79% of the conventional farmers that do not use grazing answer that they totally or partly agree that grazing is positive for the image of dairy farming (Kristensen *et al.* 2010). So even if there was not a public demand for grazing the farmers think that grazing is necessary as a part of the image for farming. The question is why do the very same farmers stop using grazing despite their awareness about the societal

considerations? These circumstances points to a need to explore alternative factors influencing the decrease in use of grazing. In a recent study based on the theory of communities of practice it has been shown that in a project intending to adjust and change agricultural practices, it is fruitful to see to the work related social community on each farm and less to the farmer as an individual decision maker in order to get knowledge on environmental effects of agricultural practices transferred into concrete changes of practices and actions on farms(Madsen & Noe 2012). Furthermore the character of objects and boundary objects(Star & Griesemer 1989) in the center of a concrete collaboration is pivotal for the possibilities for a farm to develop an adaptive inclination to new ideas, demands and alternative possibilities(Madsen & Noe 2012). Thus the decisions on farms are dependent on not only the farmer but also on the social setting and physical objects on the farm. From this perspective this paper suggests that the theory of communities of practice is an analytical perspective worthwhile for analyzing the prerequisites for decisions on multifunctionality and especially grazing in dairy production because grazing requires specific carefulness in the collaboration between the people working on the farm and because grazing is an element where the physical setting and the technology interferes in the actual cooperation and social relations on a farm. In our reading of the theory of communities of practice possibilities for decision making on a farm is dependent on a discursive field shaped in the meaning negotiations that consist of verbal, social and physical elements. Thus based on an analysis of the community of practice on farms, this paper studies decision making in the field of multifunctionality in order to identify social and technological prerequisites and barriers to multifunctionality exemplified by the use of grazing in Danish dairy farming.

### **Theoretical background:**

Communities of practice is originally a theory of situated and social learning in professional contexts between employees sharing the same professions in an organization(Lave & Wenger 1991). Later the theory became a part of organizational learning and management literature, both in scientific context but also in e.g. management consulting context. In "Cultivating Communities of Practice" the theory of communities of practice focuses on knowledge management in learning communities in bigger companies. Communities of practice are defined as " groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Wenger *et al.* 2002). One of the key concepts is practice, which is commonly understood as a notion for practical action, but in Wenger's understanding "...practice is, first and foremost, a process by which we can experience the world and our engagement with it as meaningful" (Wenger 1998). Thus the theory embraces the social and physical elements of an individual's surroundings in the notion of meaning. Meaning is established and elaborated in the "meaning negotiation" that is driven by the human disposition to participation and reification. Participation means that we all co-exist in some social setting and that the negotiations with other people are contingent transformative processes of meaning creation (Wenger 1998). While participating, humans make reifications such as statements, documents, instruments and tools developed while participating in meaning negotiations. Participation and reification develop in a duality where the dynamic comes from the contingency of the humans in the negotiation, and the reifications function as anchors in the negotiations and as objects for creation of meaning and identity in the community(Wenger 1998, p. 51 - 71). Identity is "a layering of events of participation and reification by which our experience and its social interpretation inform each other"(Wenger 1998) and identity is situated in the "negotiated experience of self" and it is not equivalent to a self image"(Wenger 1998). Reifications will interfere in the meaning negotiation on equal terms as e.g. the verbal statements. In the context of dairy farming the machinery and technology are reifications introduced to the practical work on the farm and it thereby interferes in the negotiations on possible meanings related to actions and utterances taking place on a farm. Thus it can be expected, that the technology of a farm might have influence on the possible identities created in relation to the work on a farm. As such the identity is the result of a social meaning negotiation that presupposes three elements of

the communities of practice. In the ongoing process of negotiating meanings we create new and alternative identities, especially if the reifications are flowing freely in the community and are not introduced from outside as a result of what Wenger calls power of participation and reification that are linked to influence of power and institutional interests in the field of the community of practice in question. The way analytically to operationalise the potential learning in relation to introduction of knowledge and potential change of practices in a community of practice can be done by focusing on the “three fundamental elements; a *domain* of knowledge, ... a *community* of people, ... and a shared *practice* (Wenger *et al.* 2002). “A well defined domain legitimizes the community by affirming its purpose to its members and other stakeholders...”and” inspires members to contribute and participate, ..., and gives meaning to their actions”. “The *community* creates the social fabric of learning” and reflects the social aspects of belonging. “The practice is a set of frameworks, ideas, tools, information, styles, language, stories and documents that the community members share”. If these three fundamental elements are met in a community of practice, creation of new identities is possible.

In relation to work conducted by researchers partly in relation to previous IFSA Symposiums the theory of communities of practice has been introduced in the field of environmental planning (Blackmore 2007), in rural development context (Cristóvão *et al.* 2009), in agricultural extension and learning (Morgan 2010), and in the field of implementation of environmental knowledge in agricultural practice, communities of practice is introduced as analytical tool (Madsen & Noe 2012; Madsen & Noe 2010). The advantage of the theory as an analytical tool is constituted by the integrative capacity of the theory that encompass the individual in his social context, the significance of the physical objects and the co-creation of meaning, knowledge in a social and physical practice. This paper builds on this work and studies specific objects or reifications in agriculture namely technological equipment and its impact on the meaning negotiations and thereby impact on the possibilities for multifunctional initiatives.

#### **Empirical data:**

This paper is based on farm interviews and visits on 6 Danish dairy farms. The farmers have been chosen among dairy farmers in the Danish National Livestock Register. Herd sizes were in the average area of both herds using grazing and herds not using grazing, between 150 and 200 dairy cows, because they can practically find solutions for using grazing despite the herd size and at the same time they have a size that is a result of a development in herd size within the last approximately 10 years. Only conventional production systems were selected because in organic production systems grazing is prescribed. The farm selection represents farms using grazing and not using grazing as well as automatic milking system (AMS) and conventional milking systems. The farmers have been interviewed individually using a semi-structured interview guide where the questions are composed on background of theoretical questions and concepts of the theory of communities of practice that underpin the analysis of this paper. In relation to the interviews the farmers have been giving the interviewer a tour on the farm where the articulations on the conditions on the farm in question constitute the background for field notes on the discourse in relation to concrete social and physical circumstances on the farm. Together the field notes and the transcribed interviews have been systematized and analysed on background of the conceptual framework of the theory of communities of practice.

#### **Analysis, fundamental issues concerning social learning on farms.**

Concerning the *domain* of the farms involved in this analysis, they are constituted in different strategic developmental pathways. Some farms have a business plan that formulates strategic goals for the coming years but all the farms are characterized by explicit dreams and intentions and the farms are managed in concordance with that. The spectrum of domains of the different farms seems to some degree to be spanned out between farms with plans of expansion and farms with plans of status quo production level. Some farmers focus on building up a business for the children of the family and others focus on their own working life as the outer limit of planning. This spectrum to some degree constitutes

the willingness to do investments in modern stable systems and new technologies and on the other hand the focus on e.g. minimizing input costs in the daily management. The position of the farm on the spectrum is to some extent dictated by environmental regulations in the local area and by future possibilities of buying more land which is most often needed for an expansive business plan. Furthermore the prospect of a young generation that will take over the farm has influence of the business plans and dreams and intentions of the farmer. Farmers are aware of their own position on the spectrum and express the domain of the farm and the strategic decisions as well as daily management in opposition to other farmers different from themselves. The domain is not only expressed verbally but also in the appearance of the farm and production system as a whole. E.g. a cost-effective low technological stable system might be flanked by a strategy of following a low fodder input cost level which is constituting the way of planning the working procedures around e.g. fodder efficiency from an economic output point of view. The employees can easily adopt the markers of the domain and negotiate meanings to their actions in accordance with the system in question.

The character of the analytical category of *community* is reflected in the communicative and social orientation of the farmer and the collaborators, e.g. employees, family members, consultants and vets, on the farm. The social orientation of the farmer can be characterized by an internal or an external orientation. The farmers that orientate their cooperative focus on activities outside the farm on networking groups and different other benchmarking initiatives based on productivity and economic efficiency as well as technological networking groups and collaboration around machinery and technology. These farmers are sharing ideas and information and collaborate as equal business owners in these different groups and the matters concerning the farm and the work on the farm is to a higher degree discussed outside the group of employees, veterinarians, family members and so on that actually constitute the team around the concrete work on taking care of the animals. Often these farmers are progressive strategic thinking and more business orientated and therefore the openness to new technology as a competitive improvement is more present in this group of farmers.

As a result the farmer and his employees orientate their work around the technology e.g. an AMS. They act on the background of very different observation procedures. The traditional way is to observe the animals e.g. during milking or feeding and the technological way to observe is to read the numbers on the computer reflecting the latest record of the milking of each individual cow. A farmer says, that "before we worked in present tense and now we work on background of what happened in the past" (Farmer interview, February 2012). The data from an AMS system is already data from the past when you read it and therefore the work and planning of the work is reactions on anomalies in the herd or in the machinery of the stable whereas the prophylactic nursing of the animals in the traditional milking system is characterized by a more constructive negotiation around the work, free of technological points of reference or reifications defining the negotiation. A constructive working process is steady and provides a structure for appreciation when something is going well in the herd. A reactive working process has a more acute character of symptom treatment and does not appreciate the value of the work but on the contrary points to some underlying cause that you most often not can act constructively or prophylactic on. The social communication of low-tech stable systems is more likely to strengthen the community and continuity in the relations between the people working together on the farm. One farmer that is able to use summer grazing for his cows states that "I always insist on doing the milking myself" (Farmer interview, May 2012). This does not reflect bad cooperation skills but actually the opposite because the farmer wants to be in the middle of the collaborative ongoing working process. "I am the best to observe the cow, if it e.g. has mastitis and if I do not milk myself, my employee might not get to know about the mastitis until it was too late"(Farmer interview, May 2012). The farmer places himself in the middle of the negotiations on the work on the farm and is thus a flexible cow-observer and planner negotiating with his employees. If an AMS had been installed on this farm the farmer as cow-observer, work planner and meaning negotiator would have been under pressure by the static observing AMS producing data and being an inflexible reification in the meaning negotiations on the farm. The community on the farm is thus

from this analysis suggested to be quite different on the farms partly dependent on the technology level and the use of technology as a way to observe and organize the work on the farm.

The *practice* is closely related to the domain and the community. On background of the technology use on a farm the observation of cows and organization of work on a farm is different and thus the communities are of different character regarding the role of technology as an interfering static reification in the meaning negotiation. In relation to practice, AMS is meant to be a tool for implementing the domain in practice, but the AMS as a reification is due to its data producing features so strong that it takes over the practice as an ongoing social and verbal negotiating practice on the farm. The social practice is potentially in a position where the technology takes over the position of producing and transferring observations into the language and organization of work on the farm. It is thus not only the physical constraints caused by the technology that leads to summer stabling, but also the technological control over the social practice between humans cause difficulties integrating dynamic elements as e.g. grazing which is dependent on season and fluctuating weather conditions.

Thereby three structural criteria are met in different ways on the farms in this study. It is possible to account for the differences and their contexts on background of the theories described. The meaning negotiations consist of the basic human dispositions to participation and reification. Participation seen as social negotiation among persons involved in the work on the farm is important in order to create new identities in negotiations with the other persons involved on the work on the farm. New identities created on background of negotiations on e.g. a new way to carry out routine tasks on the farm are important in order to sustain the changed routines over time because a new identity is a product of a social accepted negotiation of meanings and because the involved persons become obliged to appreciate new routines as a token of common negotiation of meanings. Reifications function as the statements on and concrete changes in practices that find place and in a farm context this could also become manifest in investment in new technology. Once a technology is installed it functions as a fixed reification that has to be justified in meaning negotiations in the future which might imply an inertia in the dynamic of the meaning negotiation and thereby inertia in the adaption to new ideas and creation of new identities. Furthermore in our case the AMS technology on dairy farms is special because it continually produces data that is in every instance reifications that will be included in the meaning negotiation in relation to the daily management and taking care of the animals. Regarding reifications an AMS technology has dual impact on the inertia of the dynamic in the ongoing meaning negotiation. Furthermore the technology makes demands on the employees' ability to integrate e.g. computer technology and observations in shape of data and employees might be appreciated for the unassisted ability to create their own working day on this background. A farmer tells that one of his employees is not interested in AMS and integrating computer data in the work in the stable. The farmer says that the employee "does what I tell him to do - and that is it! If you invite a person to get more knowledge about something on the farm and you don't get any response, you just stop inviting" (Farmer interview, February 2012). In this case the farmer actually evaluate the capacity of the employee on background of the AMS and the evaluation affects his integration of the employee in other fields than just the AMS. Thus the AMS technology not only produce data inputs to meaning negotiation but it also it influences the possibilities for cooperation between persons involved in the work on the farm. Both the farmer's and the employee's possibilities for creating new identities understood as negotiated experiences of self in the context of the community of practice around the work on the farm is reduced by the focus on the technology. As such AMS understood as a reification can act as a barrier to cooperation on the farm.

## **Discussion**

Technology is reflected in at least two waves of influencing practices in farming. First the mechanization of agriculture has resulted in a number of different kinds of machinery making former manual working procedures more efficient and the second wave is when devices take elements in the production under surveillance by producing data on e.g. production level or functionality of e.g. each individual dairy cow.

They both are reifications in the sense that they are physical objects that affect the meaning negotiations on the farm but they are different from the point of view of communities of practice theory because machinery is just one reification where an electronic device producing data actually produce reifications continuously on each cow or aggregated units of animals or on farm level. The AMS is making observations but not just summative numbers reflecting input and output as several other devices. AMS provides a flow of observations substituting the daily manual nursing of the animals related to milking. The observations and data in a dairy herd can be fitted in on a time line. The summative data spans from the yearly making up of the accounts of the farm to the ongoing accounts from the dairy company. Until recently the observation of the cow was a matter of the farmer's craftsmanship. This kind of observations are live observations that the farmer acts on immediately, he observes and acts in presence. The new technological achievement is the observations on each individual cow that substitutes the farmer's own observations. These observations are not live observations but are numbers on the screen and as such they appear as reifications in the meaning negotiations on the farm. The question is what happens when data from the nearest past is integrated in the present work of taking care of the cows? On the one hand a farmer says that "Now the AMS can spot a cow with mastitis much earlier than I could myself before I got AMS" whereas another farmer reflects that the challenge in AMS is to react on background of observations from the past. The first farmer use grazing and AMS and is interested in animal welfare partly as a result of the positive reactions of the villagers living very close to his farm. This farmer is able to integrate the data in his animal welfare and health profile which can actually be improved by the AMS. The AMS is able to support the community and practice around the domain of the farm and improve the meaning negotiations and creation of new identities. The use of grazing is planned to be increased even more in future as a result of a strong appreciative social structure. The second farmer has an up to date farm in terms of technological solutions including AMS and he intend to expand his farm in preparation for a generational handover. He finds his inspiration outside the farm among colleges and cooperates with other farms on technology and machinery. On the farm the business perspective entail a minor focus on taking care of the cows. The domain is not focused on the work around the animal and the AMS data is infused in a community of practice partly detached from the actual core activity on the farm, to take care of the animals. In this milieu the data from the past is hard to integrate in the present work on the farm. In this milieu the reifications from the AMS appear as disturbances that dictates the activities of the working day. On a farm like this there is a limited structure of appreciation which affects the possibilities for creation of new identities in relation to the work on the farm.

Most farmers in this study explain the decrease in use of grazing as a result of increasing herd size because of logistical and economic challenges but nevertheless some farmers are able to cope with these challenges. This study suggests that the herd size might not be the only explanation but an increase in herd size is often flanked by an increased mechanization and automation by means of e.g. AMS. In many instances this entails changes in the social relations around the work on the farm where the technology gets to occupy a pivotal position on the farm as a reification which leads to consequences for the dynamic meaning negotiations needed for creation of new identities. In this manner the deselection of grazing is dependent on consequences on the social dynamic caused by new technologies and not only dependent on logistical challenges in relation to herd size.

### **Conclusion:**

In cases of decision making on multifunctional aspects in agriculture, the work-related micro-level social interaction on each farm is pivotal because of its inherent possibility of appreciation of possible multifunctional initiatives. In this paper the theory of communities of practice suggests that decision making on multifunctional aspects in dairy farming to some degree depend on the meaning negotiations on the farms and these meaning negotiations in some instances are less dynamic when a farm has a high level of technology. The quality of integration of observations based on data from technological devices in the community of practice around the work on a farm is a marker of a farms ability to implement new

multifunctional aspects. Thus we find that if the society intend to implement more multifunctionality in farming the focus point should not only be on developing new practical solutions for farmers to cope with the challenge of combining efficiency and nature, animal welfare or environment. One of the challenges to implementation of multifunctional initiatives on farms is to find a way to uphold a community of practice that is able to sustain an appreciative structure in the cooperation on farms despite the pressure of mechanization and automation.

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