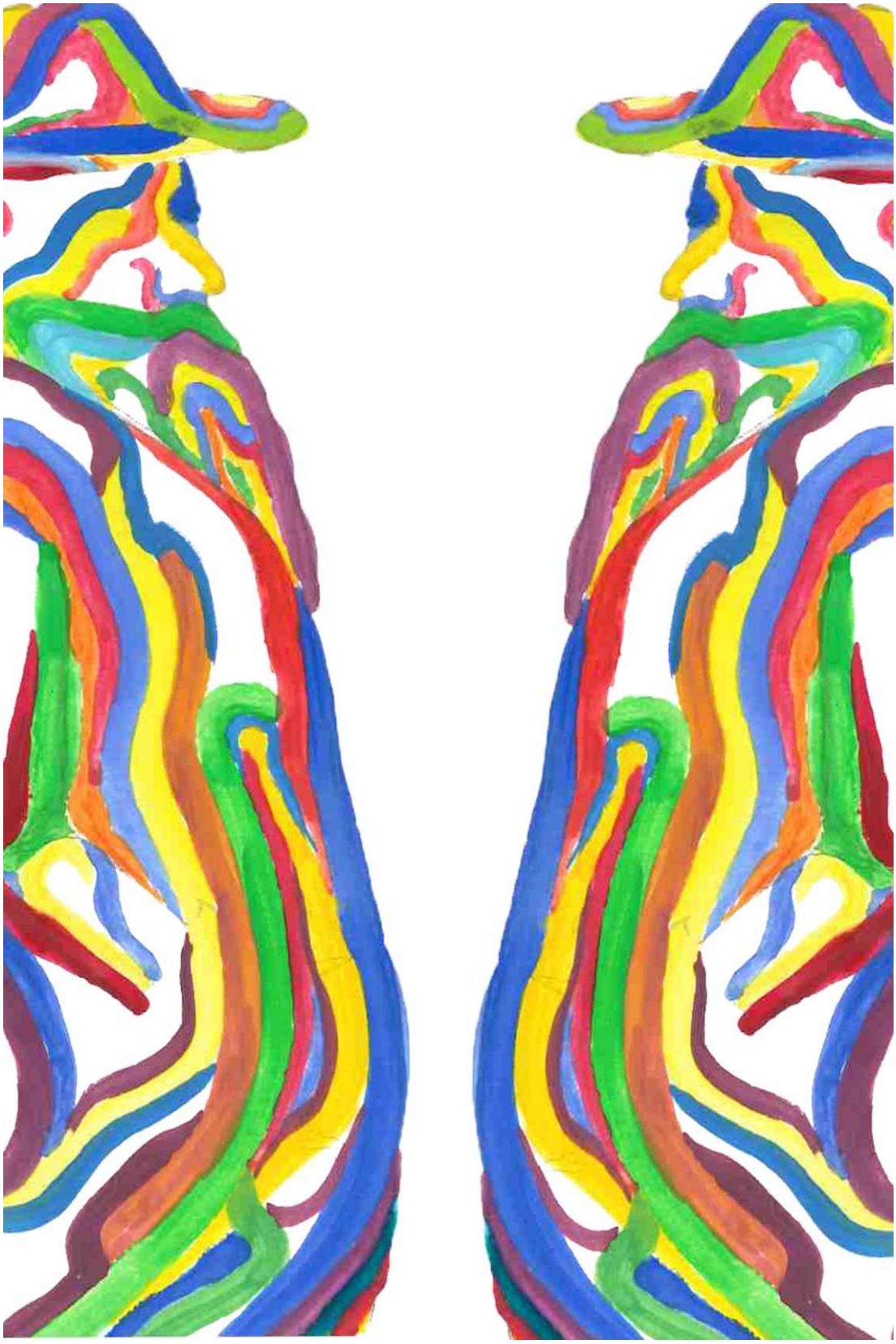
Herd health advisory services in organic dairy cattle farms



PhD thesis - Julie DUVAL

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Julie DUVAL

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Herd health advisory services in organic dairy cattle farms

JURY

Rapporteurs :	**Theo LAM,** Professor, Utrecht University, The Netherlands **Egon NOE**, Associate professor, Aarhus Universtity, Denmark
Examinateurs :	**Christian DUCROT**, Senior researcher (Directeur de recherche), INRA, France
Directeur de Thèse :	**Nathalie BAREILLE,** Professor, Oniris, France
Co-directeur de Thèse :	**Christine FOURICHON**, Associate professor, Oniris, France **Aurélien MADOUASSE,** Associate professor, Oniris, France

Oniris Nantes-Atlantic National College of Veterinary Medicine, Food Science and Engineering
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Preamble

This thesis has been conducted in the research group 'Biologie, Epidémiologie et Analyse de Risque en santé animale' (BioEpAR), Oniris-INRA, in Nantes, France. The supervison of this thesis was ensured by Nathalie Bareille (main supervisor), Christine Fourichon and Aurélien Madouasse (co-supervisors).

A research internship of 3 months was conducted in the research group Epidemiology and management, department of Animal Science of the University of Aarhus, in Foulum. This internship was supervised by Mette Vaarst.

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Acknowledgements

In their book 'Inter Views' Steinar Kvale and Svend Brinkmann use two metaphors for interviewers, namely miners and travellers. To quote Kvale and Brinkmann on travellers: 'the interview-traveller is on a journey to a distant country that leads to a tale to be told upon returning home. The interview-traveller wanders through the landscape and enters into conversations with the people he or she encounters. The traveller explores the many domains of the country, as unknown terrain or with maps, roaming freely around the territory. The interview-traveller, in line with the original Latin meaning of *conversation* as 'wandering together with', walks along with the local inhabitants, asking questions and encouraging them to tell their own stories of their lived world. The potentialities of meanings in the original stories are differentiated and unfolded through the traveller's interpretations of the narratives he or she brings back to home audiences. The journey may not only lead to new knowledge; the traveller might change as well. The journey might instigate a process of reflection that leads the traveller to new ways of self-understanding, as well as uncovering previously taken for granted values and customs in the traveller's home country'.

As far as I am concerned this whole thesis, and not only the interviews, were a journey to unknown countries, during which I had the privileged to enter new worlds, meet people, collect and share stories. I have definitely not remained untouched by these experiences. Moreover, this journey would not have been possible without the help and support of many.

The first turn has been my stay in the pathobiology department in Utrecht, thank you again Fons for encouraging me to go on in the direction of research. I am sorry to disappoint you; I did not stick to microbiology, even though I do agree it is a great world of wonders.

Than Nathalie and Christine, thank you for 'taken me in' 4 years ago, after a relatively short Skype-interview; me, sitting in my student apartment in Utrecht, trying to answer in my best possible French the questions of two persons who I could not even see. And I guess, you wondering why this girl had done all these weird internships during her study instead of having followed clinical internships like most people. You gave me and many other people the opportunity to start somewhere and some time to figure out what we like to do, that is important.

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Eric, Aurélie and Nadine, I really enjoyed sharing the office with you. Thanks for all the needed coffee breaks, pep talks and friendship. Nadine, thank you for watching over us and making everybody feel at home. I hope we all stay in touch. The same accounts for all the other PhD-students, post-docs or other 'young' colleagues: Racem (keep calm and it will all work out), Juan, Thomas, Erwann, Axelle, Guillaume, Simon, Maud, Pierre, Hélène, Mohamed, Sandie, Alix, Arnault, Luyuan...

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Chapter 1: General introduction

1.1 Context and stakes

Development of organic production in Europe and in France

Organic production has been growing steadily during the last decade in Europe, driven by an increasing consumer demand and the legal framework for organic production and labelling. Between 2005 and 2013 the organic agricultural land area in Europe grew from 6.76 million hectares to 11.46 million hectares (Willer and Lernoud, 2015). The total share of organic farmland represented 5.9% of the total farmland in the EU in 2014 (EUROSTAT). An important variability exists between countries. Leading countries in 2013 are Liechtenstein, Austria and Sweden, with a share of organic farmland of respectively 31%, 19.5% and 16.3%. Spain, Italy and France have the biggest areas of organic farmland in Europe. The European organic food production provides a wide range of products that meet the market demands. Denmark, Switzerland and Austria have the highest market shares of organic products to the total food market, with a share of 8%, 6.9% and 6.5% respectively (Willer and Lernoud, 2015).

The steady growth of the organic sector, including animal production, is promoted by the European Union (EU) agriculture policy. The EU Common Agricultural Policy (CAP) 2014 to 2020 aims to transform European agriculture towards more sustainable farming systems and to promote innovation towards more agro-ecological systems (Willer and Lernoud, 2015). This policy acknowledges organic agriculture eligibility to direct payments and to rural development programs, supporting for example conversions and the preservation of organic practices (European Commission, 2014).

In line with the EU policies and the national agricultural policy, advocating for agroecology, the French government promotes the development of the organic sector. The action plan 'Ambition bio 2017' aims at; (i) promoting production, by multiplying the organic agricultural area by two by the end of 2017, (ii) structuring the organic supply chain from 'farm to fork', (iii) developing the market, (iv) strengthening research and development, (v) granting more importance to organic agriculture in education and (vi) improving regulation (Anonymous, 2013). In France the consumers' demand for organic products, reflected in the growing market value of the organic sector, has been augmenting since 1999. The market share of organic products varies per product; organic eggs represent a market share of 20%, milk products nearly 12% followed by fruits and vegetables with a share of 7% (Agence Bio, 2016). The volume of organic milk production has been growing since 2006 and more conversions of dairy farms to organic are expected in the years to come (CNIEL, 2015).

In this thesis the choice was made to focus on the dairy production sector. In sectors with short production cycles like the poultry, pork and veal sectors, farms are, compared to the cattle sector, often more vertically integrated in the food chain and/ or under contract. Depending on the organisation chosen, these farmers have to follow certain objectives and farm management guidelines imposed by the agreements made (Anonymous, 2011). We can thus expect to find, in the dairy sector, farmers with the highest amount of liberty in deciding upon the animal health management on their farm.

Organic principles and European production regulation

The International Federation of Organic Movements (IFOAM), the official organisation representing at a global level the movements of organic agriculture, states that the principles of organic agriculture 'express the contribution of organic agriculture to the world and a vision to improve all agriculture in a global context'. Organic agriculture is based on four principles that are to be used as a whole, namely the principles of health, ecology, fairness and care (Table 1). The principle of health includes thus also the aim of sustaining and improving animal health (IFOAM, 2005).

Table 1.1: Organic principles as defined by the International Federation of Organic Movements (IFOAM)

Principle of health	Organic agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.
Principle of ecology	Organic agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.
Principle of fairness	Organic agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities.
Principle of care	Organic agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.

The principles are considered as ethical guidelines to inspire action (IFOAM, 2005) and form the inspiration for national and international regulations, including the European regulation on organic agriculture (Luttikholt, 2007; Padel et al., 2009).

Animal health and welfare is also underlined in the organic regulation. The European Commission regulation (EC) No 834/2007 on organic production and labelling of organic products states: 'organic livestock farming should respect high animal welfare standards and meet animals' species-specific behavioural needs while animal health management should be based on disease prevention. With regard to disease prevention and in terms of animal health promotion, the regulation promotes for example the use of appropriate housing conditions and stocking densities, the use of organic feed and the choice of adapted breeds (*Council regulation (EC) No 834/2007*). Commission regulation (EC) No 889/2008 describes in detail the rules for application of Council Regulation (EC) No 834/2007. The use of phytotherapeutic, homeopathic and other products listed is preferred over the use of chemically synthesized allopathic veterinary medicinal products or antimicrobials. It is stated that phytotherapeutic, homeopathic and other products are to be used as first choice, 'provided that their therapeutic effect is effective for the species of animal, and the condition for which the treatment is intended'. Furthermore the withdrawal time for antimicrobials is doubled compared to its use in a conventional farms (*Commission regulation (EC) No 889/2008*).

The organic principles and regulation thus provide organic producers with objectives in terms of the desired animal health and welfare situation. However, the regulation does not impose a minimum level to attain to be eligible for organic certification. The regulation only imposes on organic farmers the processes that are allowed to attain the organic production objectives. The certification of farms as organic is thus not based on the evaluation of animal health and welfare levels on the farm, but only on the means used to produce organic. In France, the minimum requirements for organic certification follow the EU regulation for organic production and labelling of organic products.

The multiple expectations and stakes relative to good animal health on organic dairy farms

Understanding consumers' trust in organic products is complex. Consumers' reasons to choose organic food vary between countries and can be influenced by the sociocultural context. Recurrent elements identified in literature are consumers' concerns about health, food safety and quality, e.g. reflected in a demand for products produced with no or little use of artificial fertilizers or pesticides. Furthermore, consumers relate organic food to health and various levels of well-being. Ethical considerations are also identified as reasons to choose organic products on a wide range of issues, such as animal welfare or the well-being of people involved in food production (Torjusen et al., 2004). Animal health is a key component of animal welfare. Animal welfare is considered not to be ensured, in the case of injury or disease (Brambell, 1965). Across Europe, in a study focusing on the possible innovations to further develop the sustainability of low-input and organic dairy farming systems, consumers and stakeholders strongly approved of innovations that lead to improved animal welfare in these two systems. Also, innovations specifically related to animal health were ranked high in individual countries, such as 'developing organic dairy production systems free of antibiotics' or 'developing the use of herbs in pastures for their phytotherapeutic properties to reduce animal health problems' (Nicholas et al., 2014).

In the context of organic farming, the continuous development of the sector could also be at stake if sufficient levels of animal health and welfare are not reached. Maintaining consumers' trust in organic products and at the same time ensuring the steady growth of the sector, based on a growing demand and supply, is identified as a major challenge for the European organic sector today (European Commission, 2014).

For numerous other reasons cow health and welfare must be ensured. From an ethical point of view, as cows are kept for food production, it is our responsibility as a society to ensure animal health and welfare. Animal health problems cannot be completely prevented, but it is the responsibility of the herd owner, supported by advisors in animal health if wished, to install management conditions to minimize the occurrence of disease (Green et al., 2012). Moreover, impaired health leads to production losses, such as reduced milk production and reproductive performances (Fourichon et al., 1999; Hortet et al., 1999), which in turn thus lead to suboptimal economic performances at farm level. Public health reasons are also at stake if adequate levels of animal health are not ensured. Related to the development of antimicrobial resistance, selective and reduced use of antimicrobials in livestock farming systems is recommended. Therefore, animal health situations in which the use of antimicrobials is not needed are to be strived for (Aarestrup et al., 2008). The prudent use of antimicrobials is further supported by the concerns regarding the effect of antimicrobial residues in the environment, originating, amongst others, from animal' effluents (Kemper, 2008). Furthermore, zoonoses are an important source of infectious diseases for humans. It is estimated that between 30 and 50% of infectious diseases in humans are zoonotic and animals or animal products are at the origin of about 75% of the emerging diseases during the past decade in humans (www.efsa.europa.eu/en/topics/topic/zoonoticdiseases, accessed on the 14.06.2016)

Animal health on organic dairy farms

The intensification of dairy production systems during the last decades has led to the occurrence of production diseases also called 'management related diseases', such as mastitis, reduced productive performances or claw disorders (Noordhuizen et al., 2008). Production diseases are still a major

threat to dairy cow health and welfare (EFSA, 2009). This is in contrast to the major infectious diseases in livestock, which have been eliminated or are effectively controlled (Brand et al., 2001), at least in developed countries.

The production diseases found in organic dairy herds are similar to those found in conventional herds (Thamsborg et al., 2004). Despite the aim of the organic principles and regulation for high health and welfare levels in organic farms, the health level on organic dairy farms is not consistently better, compared to conventional farms. Comparing the level of production diseases in the two farm systems also shows contradictory results, for example regarding udder health and lameness (Barkema et al., 2015; Hovi et al., 2003). Moreover, the prevalence of production diseases on organic dairy farms varies within and between European countries (Krieger et al., 2016). It can therefore be considered that the health status of certain organic dairy herds can be further improved.

Managing production diseases

As referred to by Mulligan and Doherty (2008) production diseases are 'man-made problems', the result of management practices and the selection of animals for 'efficient' production. At the origin of production diseases is an imbalance between the dietary input and the needed output for animal production (Radostits et al., 2007). The metabolic status will influence on the animals immune status which will, in turn, determine the animals susceptibility to disease and thus the health outcome. The metabolic status is influenced by the animals' genotype, nutrition, state/time (e.g. stage of lactation) and management factors (Ingvartsen et al., 2003). The causes of production diseases are multifactorial and the result of the balance between host, pathogen and the environment. To control and prevent diseases, all these factors have to be taken into account and acted upon, if necessary (Brand et al., 2001). It is well known that farmers' attitude and behaviour towards health management have an influence on the herd health outcome, in relation to production diseases, as shown for example for udder health (Green et al., 2008; Jansen et al., 2009).

The conversion of farms to organic farming potentially has a positive as well as a negative influence on animal health, depending on the association with other factors influencing farming conditions. The effect on health might be due to possible changes in: housing conditions and outdoor production, rules and regulation on medicine use, feeding management and availability of feed, cost-benefit relations, farmers' own attitudes and point of views (Thamsborg et al., 2004). In EFSA's scientific opinion on the assessment of dairy cow welfare in small-scale farming systems, the recommendation was made to perform research on organic farms to gain understanding in disease management and the impact of organic production system' characteristics on animal health and welfare (EFSA, 2015). Similar questions were raised already by Vaarst et al. (2001), regarding responsible veterinary medical treatments in organic dairy farms and the role of the veterinarian herein. It was observed, for example, that the duration of antibiotic treatment of acute mastitis was shorter on organic dairy farms compared to conventional farms, possibly due to the impact of organic regulation (doubling the withdrawal time for milk).

Leblanc et al. (2006) discussed that efforts to prevent health problems in dairy farms should be focusing on the implementation of management practices at farm level. During the last decades, a vast amount of knowledge has been developed on the prevention of diseases, arising from the better understanding of epidemiology and pathophysiology. However, in the best scenario, the disease incidence in dairy herds has remained stable. The challenge seems to be the transformation of the

large amount of knowledge on disease prevention of into on-farm use. The transformation requires understanding of the functioning of the farm as a whole, and motivating and educating the involved persons to implement appropriate management practices (LeBlanc et al., 2006). The understanding that the production diseases, to a certain extent, can be controlled by farm management practices has led to the development and use of advisory services in veterinary herd health and production management (Brand et al., 2001).

The role of farmers' advisors in general is to support farmers in reaching their objectives. We cannot expect dairy farmers to be experts in all the different farm domains. Advisors can support farmers by providing them with knowledge and reference values in certain farm areas, based on their experiences (Herling, 2000), provide farmers with an external opinion in a certain situation and/or give farmers the possibility to look with a 'fresh eye' at their farm. However, it is also important to include farmers' views on the potential efficacy of disease management practices on their farm. Tremetsberger and Winckler (2015) already discussed that the effectiveness of measures depend on farm specific situations. The identification of the most suited measure can be based on farming expertise or validated scientific findings.

The interaction between farmers and advisors will thus be necessary to transform scientific knowledge into on-farm use.

The animal health situation regarding production diseases on organic dairy farms is not consistently meeting the objectives of the organic principles, the organic regulation or consumers' expectations. Therefore, it seems relevant to study ways to improve dairy cow health on organic dairy farms in order to (i) ensure the animal health and welfare of organic dairy cows, (ii) maintain the development of the organic dairy sector by ensuring consumers' trust in the quality of organic dairy products that are produced under the organic principles and regulation aiming for enhanced health, (iii) reduce economic losses of farmers due to production diseases, (iv) provide an example of a sustainable farming system, e.g. by reducing the need to use antimicrobials. Due to their multifactorial nature, the control and prevention of production diseases require a holistic approach, involving farmers and farm advisors. Farmers' knowledge of their farm and day to day animal health management influences health outcome. Collaboration with animal health advisors can provide farmers with expertise and support in the management of health.

The main hypothesis of this thesis is that the biggest gain in terms of dairy health improvements is expected to be found in improving the on-farm implementation of existing knowledge on the management of production diseases. Bridging the gap between scientific knowledge and its on-farm application requires close interactions and exchange of knowledge in both directions between farmers and farm advisors. In addition, interactions with the research community could further reduce the gap. Therefore, the general objective of this thesis is to produce knowledge to gain better understanding of how the pertinence of advisory services in animal health for organic dairy cattle farms can be improved. This knowledge is expected to contribute, ultimately, to the improvement of animal health on organic dairy farms.

1.2 Existing knowledge on herd health advisory services

The role of farm advisors and in particular veterinarians on organic dairy farms

Veterinarians could be the expected partners of farmers in animal health, due to the nature of their formal education and their daily work activities.

However, veterinarians are not the only group of professionals advising dairy farmers on animal health (LeBlanc et al., 2006). Veterinarians can perceive non-veterinary advisors as a threat to their profession (Ruston et al., 2016). Dairy farmers find for example advice from their feed advisors (Derks et al., 2013a) or non-veterinary advisors replace veterinarians in their fertility management (Mee, 2007). In France, besides veterinarians, different groups of persons provide both organic and conventional dairy farmers with advice on animal health, such as; feed advisors, general dairy production advisors (from private and public funded organizations) and sales persons (unpublished data from the IMPRO-project).

Organic dairy farmers do not always consider veterinarians as pertinent advisors for their animal health strategy (Vaarst et al., 2007). Across Europe, stakeholders of the organic sector identified a lack of awareness of veterinarians regarding the fact that organic livestock production does not face the same challenges as conventional production and demands different practices to resolve problems. One of the identified weaknesses of veterinarians appears to be the veterinarians' lack of training in the organic principles and alternative medicines (Vaarst et al., 2006b). The role of veterinarians was investigated during a qualitative interview study aiming at describing Danish organic farmers' motivations and work conditions when employing an antimicrobial non-use strategy. According to the organic dairy farmers, they are at the initiative of the goal to phase out the use of antimicrobials and the veterinarians are usually not involved in the farmers' treatment strategies. Veterinarians are used by farmers as technicians to perform bacteriology or for questions regarding biomedical treatments (Vaarst et al., 2006a). The role of veterinarians on organic dairy farms was also addressed in a Danish study discussing the pertinence of the 'Stable School'-concept' for the goal of phasing-out antimicrobial treatments, as well as that of other advisory services to support individual farmers and organic production. Again as perceived by organic dairy farmers, reasons identified to dismiss veterinarians and their knowledge are: veterinarians disrespecting farmers' goals, veterinarians strong focus on animal disease instead of having a whole farm approach and a feeling inequality in their relationship (Vaarst et al., 2007).

In France, the role of veterinarians on organic meat sheep farms is limited to performing the diagnosis of health problems and providing farmers with prescriptions of veterinary drugs. Results from interviews with meat sheep farmers showed that veterinarians are less frequently called upon by organic farmers, compared to conventional farmers. A reason stated by the organic farmers for not always accepting veterinarians' guidance is veterinarians' insufficient knowledge on alternative medicine (Cabaret et al., 2011).

EFSA's scientific opinion on the assessment of dairy cow welfare in small-scale farming systems, recommended to perform research on the collaboration between organic farmers and veterinarians (EFSA, 2015). As described earlier, it has been suggested that the organic regulation might have a negative impact on employing good practices in the use of veterinary treatments on organic farms (Vaarst et al., 2001). However, it was also shown that treatment patterns of a herd can change after

close collaboration of a farmer and his/her veterinarian and cattle advisor providing herd health advisory services (Vaarst and Bennedsgaard, 2001).

In the studies conducted so far, key information is missing to understand why veterinarians are not always considered to be pertinent advisors by farmers and to identify solutions to overcome this. First, studies on veterinarians' perception on the role they have in organic dairy farmers' animal health strategies is rare, as far as we are aware. Second, the role of the veterinarian on organic farms has not been the main focus of earlier studies, but is one of the elements raised by farmers when discussing their animal health strategies or is one of the factors studied by researchers to explain this strategy. To our knowledge, no study exists with the main objective to study and to explain the role that veterinarians have in organic dairy farms from the farmers' point of view.

Therefore, the first objective of the research that will be presented in this thesis was to gain a better understanding of the role of veterinarians in organic dairy farmers animal health management strategies.

This research will add to the existing body of knowledge: i) veterinarians' perception on their role in organic dairy farms and opportunities to improve their advisory services for organic dairy farmers, ii) a more detailed understanding, from organic dairy farmers' point of view, for the role they give to veterinarians in their herds, iii) a comparison of both points of views, identifying and discussing shared and/or contrasting perceptions.

Herd health management programs

Tools can be used to facilitate animal health management. Different methods have been created to support farmers and herd health advisors in developing strategies to control and prevent disease and improve animal health. Probably the most developed and commonly used in dairy cattle production are herd health and production management (HHPM) activities.

The general aim of HHPM activities is the optimization of animal health, welfare and the production level of a production unit. Optimization is ensured through an iterative cycle of activities; (1) goal setting, (2) monitoring, analysis and interpretation of herd health and production data, observation of the animals and their environment. (3) Either, targets are met and can be redefined if necessary. Or, if targets are not met the problem will need to be diagnosed and corrective herd health management practices identified to prevent disease. In addition, the person(s) responsible for their implementation will be defined and (4) evaluation of the results will be undertaken (Brand et al., 2001; Green et al., 2012). The aim of HHPM activities is to provide farmers with the combined support from veterinary science and animal husbandry to achieve their goals. Farmers should thus be placed at the centre of HHPM activities and these should be adapted to individual farmers' objectives. Advisors are part of the HHPM concept and have the role to support farmers in reaching their goals. As to reach these goals, HHPM activities require that advisors take into consideration all the aspects of a dairy farm, such as production performance, udder health, lameness, young stock management, disease treatment, nutrition and welfare as these are often interconnected (Noordhuizen and Wentink, 2001).

Other methods that have been developed to contribute to herd health are disease control and quality assurance programs (Table 1.2).

Disease control programs aim to eradicate or reduce the impact of the targeted disease (Anonymous, 2014). Many different disease control programs have been developed to target a specific disease or health problem; examples are programs to control paratuberculosis or udder health problems respectively. These control programs can be on a voluntary basis, but can also be required by national laws or imposed by the industry.

Quality assurance (QA) programs have been developed since the 1990s in the livestock production sector, due to an increasing consumer demand for safe food, concerns in relation to animal welfare and the environment. QA programs aim at ensuring product, production method and production unit surroundings' quality. The focus lies on prevention, through the identification and monitoring of health hazards and the implementation of control measures in the case occurrence of a risk situation. Examples of QA programs are Hazard Analysis and Critical Control Points (HACCP) and Total Quality Management (TQM). In contrast to the voluntary character of HHPM programs, the targets to be reached in QA programs can be imposed to farmers and be linked to a 'license to produce and to sell' their product after inspection by certified inspectors. However, like HHPM programs, QA programs can also be developed between farmer and farm advisors, such as veterinarians and nutritionists (Noordhuizen and Wentink, 2001).

Table 1.2: Certain characteristics of the different types of animal health programs

Characteristics	**Disease control program**	**Herd health and Production Management program**	**Quality assurance program**
Aim	Eradicate or reduce the impact of a specific disease	Meeting farmers' objectives in terms of herd health, welfare and production	Ensuring quality of the product, production method and production unit surrounding
Target	One specific disease	Overall health and welfare	In practice often one disease is targeted
Monitoring	Health status of the animals	Health and production indicators	Presence of health hazards
Process	Until situation is resolved	Continuous	Continuous
Farm specific program	Standardized program	Adapted to farmers' objectives	Standardized program
Imposed or not	Can be imposed	Voluntary basis	Can be imposed

HHPM programs, in particular, have the potential to be a support well adapted to the context of organic farming too since they aim for the promotion of animal health, use as a starting point farmers' goals and rely on a global farm approach rather than focusing on a particular disease. Furthermore, HHMP programs seem to be more in line with the European organic regulation, as they do not impose minimum levels to attain in terms of animal health and welfare like in QA programs.

Principles for herd health management programs in organic dairy herds

The network for Animal Health and Welfare in Organic Agriculture (NAHWOA) and the network project Sustaining Animal health and Food safety in Organic farming (SAFO) identified the need to improve the use of farm-specific health plans, as a way to enhance animal health and welfare situations (Vaarst et al., 2011). Therefore, principles for animal health and welfare planning in

organic dairy herds were formulated by the project 'minimising medicine use in organic dairy herds through animal health and welfare planning' (ANIPLAN) (Vaarst, 2011). The principles can be seen as a variant of herd health management programs (Table 1.3). Health plans aim to promote animal health and welfare, using a farm-specific scheme. The plan takes into account farm-specific goals, pinpoints domains, actions for improvement and includes a plan for continuous monitoring and evaluation of the impact of these actions (Hovi et al., 2004). The planning processes first principle aims at changing the static health plan, which can sometimes be considered as another form of archived paper work, into a dynamic tool beneficial to farm management. The planning process needs to show a certain amount of flexibility and adaptability towards evolving conditions, opinions and understanding (Vaarst et al., 2011). As it can become a dynamic and interactive process and part of the farm management, I consider this set of principles therefore as a form of herd health management and as a basis for the design of a herd health management program.

Moreover, as formulated, the principles should allow implementing planning activities in different farming conditions (Vaarst, 2011). Indeed, animal health needs to be evaluated taking into account the regional and local farm conditions. Firstly, local conditions such as climate, animal disease pressures or farm structure are at the origin of the diversity in organic production systems (Roderick et al., 2004) and these differences can potentially influence health outcomes. Secondly, it is suggested that local and national farm management practices could influence the health outcome on individual organic dairy farms (Barkema et al., 2015; Bennedsgaard et al., 2003; Sundrum, 2001). Thirdly, it is known that individual farmers' management style can influence health outcome of a dairy herd (Barkema et al., 1999).

Table 1.3: Principles for animal health and welfare planning as identified by the ANIPLAN research consortium

1	A health planning process should aim at continuous development and improvement. It should incorporate health promotion and disease handling, based on a strategy, including the circular process of current status and risks (animal based and resource based parameters), evaluation, action and review
2	It should be farm-specific
3	It must ensure farmer ownership of the planning process: it should be based on farmer' goals (including being organic) and on how the farmer perceives the current herd problems, the data used for the planning process is accessible and understood by the farmer, the farmer decides and formulates the action points
4	External person(s) should be involved
5	External knowledge should be mobilised
6	The plan must fit within the framework of the organic principles
7	The plan should be written
8	The plan should acknowledge good aspects
9	All relevant persons should be included in the planning process

The impact of animal health and welfare planning, according to the proposed principles in ANIPLAN, was evaluated based on the use of antimicrobials and other chemically synthesized veterinary treatments and herd health and production parameters. Across European countries different types of planning activities were undertaken, e.g. face-to-face advisory services with an advisor and Stable School-systems were used. A significant reduction of treatments was found, as well as the mean milk somatic cell count per herd. However, these improvements could not be linked to the target areas chosen by farmers to improve through planning activities (Ivemeyer et al., 2012).

Precise content of HHPM programs and effectiveness in terms of animal health improvements

The concept of HHPM has been published in text books, scientific journals and professional journals for veterinarians and is taught in certain veterinary faculties across Europe.

In general, these information sources provide veterinarians with the overall concept of HHPM activities, list the indicators needed to evaluate herd performances, the data needed to monitor these indicators and the theoretical background on how to interpret and link them to relevant risk factors that could be at the origin of the health or production problem. Valuable practical examples can be given on how to organize farm data and calculate indicators. Often, case studies are presented as well, describing the whole process from defining goals to the identification of corrective measures (e.g. Brand et al., 2001; Green et al., 2012).

However, the ways in which this concept is transformed into advisory practices in the field are not well documented and there is relatively little research evaluating the effectiveness of HHPM programs. First, despite the fact that it is acknowledged that a global farm approach would be beneficial to reduce production diseases, it is rare to find intervention studies with HHPM activities that target overall herd health and not one specific health domain. Second, most intervention studies found in literature are not HHPM activities, but are interventions with disease control or quality control programs. Examples are intervention studies with HACCP-based programs targeting mastitis (Beekhuis-Gibbon et al., 2011) or lameness control programs (Green et al., 2007). Third, often these studies do not mimic real-life situations since the advisory activities are performed by the involved researchers and/or veterinarians that are not the farms' private veterinary practitioner, such as identifying risk factors present on the farm and providing farmers with advice.

It seems difficult to improve existing advisory services, since we have relatively little feedback on how these different advisory programs were actually carried out in the field. The study of Ivemeyer et al. (2012) evaluated the impact of overall herd health planning activities on herd health but participating herds received advisory services in different formats. Moreover, they were not able to show the link between focus areas chosen by the farmer for these planning activities and health outcome. A detailed understanding of how advisory services impact health seems thus to be lacking. Derks et al. (2014) evaluated the impact of HHPM activities provided by veterinarians to dairy farmers in the Netherlands on herd health and performances. They showed a positive effect on milk production and udder health, but negative effects on fertility, culling rate and age at culling. Again, they were not able to show a clear link between the topics discussed during these advisory activities and herd health outcome. These results point towards the importance of not only the quantity but also the quality of advice given, but which could not be evaluated.

The successful implementation of HHPM activities is indeed complex and requires not only technical skills from advisors, but also a certain level of expertise and skills in stimulating farmers to take action and adopt change (Green et al., 2012). Formalized HHPM activities are not common practice on all dairy farms (Derks et al., 2014; Hall and Wapenaar, 2012) and the adoption of HHPM advisory services requires promotion by veterinarians (Mee, 2007). In a commercial setting farmers' perception of advisors' qualifications regarding having an advisory role in herd health management will influence their decision whether or not to buy in these services (Kristensen and Enevoldsen, 2008). Indeed, an advisory role in herd health management requires from an advisor different knowledge, skills and trust level between farmer and advisor compared to solely a curative role

(Kleen et al., 2011). Therefore, it is considered necessary that advisors in herd health management, including veterinarians, have to invest in, amongst other things: knowledge, time, empathy and different analytical and communicative skills (Cannas da Silva et al., 2006).

Although references on HHPM present it as a rather standardized method, except for the goal setting part, (e.g. Brand et al., 2001; Green et al., 2012), a diversity of practical implementations have been found in field conditions, but are little documented. Certain crucial steps of the HHPM concept are known to be sometimes skipped, such as goal setting with the farmer. Derks et al. (2013b) showed that veterinarians were not always aware of dairy farmers' priorities and thus do not identify the same priorities as the farmers they work with. The veterinarians stated as reasons for non-goal setting on farms; that they are already aware of farmers' wishes, they considered it a too formal approach, or they considered not to have a good reason to do so (Derks et al., 2013b). Furthermore, the farm areas discussed during farm visits of the veterinarians in the context of HHPM activities vary (Derks et al., 2014a, 2014b). In addition, veterinarians and dairy farmers do not always share the same understanding of what the veterinarians' role is in herd health management (Hall and Wapenaar, 2012). HHPM activities in organic dairy farms can be expected to face the same difficulties as on conventional farms. Additional difficulties might be encountered due to the limited role veterinarians seem to have in organic dairy farmers' animal health strategies and their incomplete understanding of the organic dairy sector, as perceived by organic dairy farmers (Vaarst et al., 2006a; Vaarst et al., 2006b).

The collaboration between the organic dairy farmer and its external advisors (e.g. feed advisors, veterinarians, peers) is recognized as important to ensure the continuity in the planning process, related to the goal setting and identification of focus areas (Vaarst et al., 2011). Yet, arriving at a state of mutual trust and understanding demands time and a continuous dialogue (Vaarst et al., 2007). Dairy farmers in general, who considered to have a good relationship with their veterinarian have a higher probability of discussing a greater number of different topics during herd health management than persons who did not consider to have a that good relationship (Derks et al., 2013a).

How to stimulate the adoption of and compliance to herd health management activities by farmers?

Farmers compliance to proposed corrective measures can impact health outcomes (Green et al., 2007). However, as already described in the Health Belief Model the perceived threat of a certain disease, the perceived benefits and barriers of adopting recommendations to prevent disease are important factors influencing the decision to take action to prevent disease (Janz and Becker, 1984). A farmer's decision to adopt or not recommendations can thus depend on a great number of factors determining its perceived pertinence of a preventive action; previous experiences, social pressure, farmer habits, being familiar with practices, perceived effectiveness, adaptability to farmers' routine and farm infrastructure etc. (Beekhuis-Gibbon et al., 2011; Garforth, 2011; Jansen et al., 2010).

The importance of advisor awareness of farmers' objectives and farm system is underlined in the principles for animal health planning on organic dairy farms (Vaarst et al., 2011) and herd health management in general (Noordhuizen and Wentink, 2001). Some of these factors the advisor will not be able to influence. Even though advisors might not be able to change these factors, it can be hypothesized that they have to be aware of them as it will influence the pertinence of their recommendations. As hypothesized and represented in Figure 1.1 advisors' awareness of these

factors will be determinant to the acceptability, feasibility and perceived effectiveness of the recommendations as perceived by the farmer. Some factors in farmers' decision-making process will be identifiable to the advisor, simply by looking around on the farm, such as constraints due to the choice of housing system. However, for others the farmer is the only person holding the information and thus a **dialogue** between farmer and advisor will be necessary.

We hypothesize that herd health monitoring activities could contribute to the acceptability of advice on herd health, promoting the shared perception of the herd health status between farmer and advisor (Figure 1.1, box A). Does the farmer agree with the advisor on the problem identified? As described earlier, herd health monitoring is a key element of herd health management programs. The hypothesis can be made that systematic and pertinent herd health monitoring activities could be beneficial to both farmer's and advisor's perception of the herd health situation. This could contribute to their shared understanding of the herd health situation and evolution and, in turn, contribute to the farmer's acceptance of a diagnosis and thus to the perceived pertinence of the monitoring activities and the recommendations given.

Moreover, it is important to evaluate the impact of control measures on health outcome and monitoring can be a way to motivate farmers to keep on going with the corresponding effective activity (Beekhuis-Gibbon et al., 2011).

The dialogue between farmer and advisor(s) seems thus to play an important role in herd health management activities. A shared understanding of the goal of the herd health management activities and the advisors' role herein is supposed to be the first step in the cycle of herd health management activities and seems primordial to its success. A dialogue of sufficient quality, in terms of the information shared, between farmers and their advisors is needed to ensure the implementation of herd health management activities, including recommended practices.

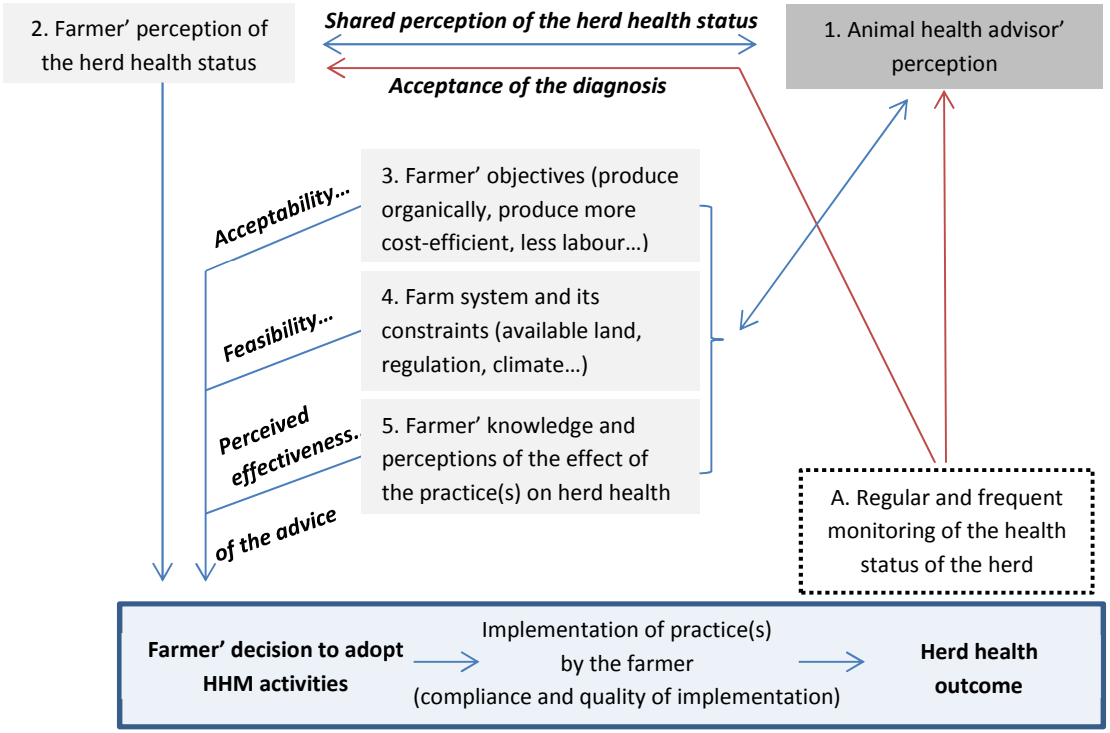

Figure 1.1: Model for farmers' decision-making process, regarding adopting or not herd health and production management (HHPM) activities, including recommended practices given by an advisor in animal health.

Adoption of herd health management practices by a farmer will depend on whether the farmer agrees with the perception of the advisor (box 1) on the health situation requiring or not an improvement by implementing practices to correct this (box 2). Furthermore, the advice needs to fit farmers' objectives (box 3), the farm system (box 4) and whether the farmer perceives a positive effect of the practice(s) proposed on herd health (box 5). The farmer's decision to implement advice will more likely result in a positive herd health outcome if the practices are correctly implemented by the farmer. Regular and frequent monitoring activities (box A) can influence both the farmer's and advisors' perception of the health status of the herd. In addition, sharing monitoring outcomes is expected to promote a shared perception by the two actors on the health status. In turn, this could influence the level of agreement by the farmer regarding herd health problem(s) and priorities for improvement identified by the advisor.

Based on their nature, HHPM programs can be regarded as a promising tool to improve herd health in organic dairy farms. The adoption of these tools and herd health management recommendation requires a good understanding between farmers and their advisors. We can conclude that animal health advisors, including veterinarians, are not always proposing HHMP activities, including recommended animal health management practices, which are considered to be pertinent by farmers for their farm-specific situation. This leads to the non-adoption of HHPM activities and is thus a missed opportunity to improve herd health. To be considered as pertinent by farmers, the different components of HHPM activities will have to be deemed pertinent by farmers. Recommendations need to be in agreement with the farmer's perception of the problem; their adoption must be accompanied by expected positive effects on herd health, and consistent with the farmer's objectives and farm system and its constraints. Ensuring a dialogue between farmer and advisor(s) seems to be crucial for advisors if they want to be able to learn about these elements influencing farmers' perception of the pertinence of HHPM activities and adapt their advice to it. However, information on how to exactly initiate these activities is scarce.

This brings us to the second objective of this thesis, namely to design a herd health management tool that will promote the dialogue between farmers and advisors in animal health and to evaluate its use and effectiveness on animal health advisory services and herd health.

1.3 Objectives, research strategy and outline of the thesis

1.3.1 Objectives

It has been discussed that solutions to improve dairy herd health are expected to be found by facilitating the transformation of the existing body of scientific knowledge disease prevention into practices implemented at the farm level. The general research question of this thesis is thus **'how to improve the pertinence of herd health advisory services in order to reduce the level of production diseases in organic dairy cattle farms?'**

Two pathways have been identified that seem promising to provide new insights into that question. Due to the gap of knowledge identified regarding the collaboration between organic dairy farmers and veterinarians, the first pathway is to improve the understanding of why veterinarians seem to have a limited role in organic dairy farmers' animal health strategies and to identify perspectives to develop veterinarians' role as a herd health advisor on these farms. The second pathway is to provide herd health advisors with herd health management tools that stimulate the dialogue between farmers and advisors. We hypothesise that it will lead to more pertinent advice adapted to farm-specific situations.

The **general objective** of this thesis is to gain a better understanding of how the pertinence of advisory services in animal health for organic dairy farmers can be improved. This knowledge will contribute to improve organic dairy cow health. Three sub-objectives have been formulated, namely;

Objective 1: Improve our understanding of veterinarians' role in organic dairy farmers' animal health management strategies.

Objective 2: Design a HHPM tool that will promote dialogue between dairy farmers and advisors in animal health and evaluate the use and effectiveness of the tool on animal health advisory services and herd health.

1.3.2 Research strategy

Qualitative research interviews to understand the roles of veterinarians on organic dairy farms

Qualitative research interviews were chosen as a method to gain a better understanding of the roles veterinarians have in organic dairy farmers' animal health management strategies. Veterinarians' perspective on that matter is nearly absent in scientific studies and the studies on organic dairy farmers' point of view do not allow us to fully understand the origin of the fact that they do not always consider veterinarians as pertinent advisors.

The aim of qualitative research interviews is to try to understand why the interviewees perceive the world the way they do, by interviewing them about their experiences. Qualitative research interviews aim to show a range of experiences and attitudes on a certain question, rather than presenting a representative sample or quantifying opinions of a certain group of interest (Brinkmann and Kvale, 2015). When trying to understand a certain phenomenon, an average 'case' might not always be the most informative. A variation in cases and cases at the extreme ends of the spectrum can contain more information than average cases or a random sample. Moreover, if the aim is to understand the problem, it can be more relevant to explain the underlying causes of a problem instead of describing its occurrence and the way the problem presents itself. The same accounts for when we look at it from the perspective to try to solve the problem (Flyvbjerg, 2006). The consequence of showing variation rather is that the results should be used in their context and cannot be generalized (Brinkmann and Kvale, 2015).

The use of qualitative research interviews seemed better adapted than using standardised questionnaires to answer our research objectives. Understanding the role veterinarians are given and/or able to take, is most likely the result of a situation that is of a complex nature. Furthermore, since there is relatively little information available on this subject it would have been difficult to design a standardized questionnaire that would allow capturing this complex nature. Therefore, two qualitative interview studies were conducted: one with organic dairy farmers and one with private veterinary practitioners.

Participatory research for the design of a herd health management tool

The choice was made to employ a participatory research approach for the design of the herd health management tool. Due to the objectives of participatory research approaches it was considered a promising research strategy in the context of this PhD thesis. Participatory methods integrate end-users' views (in this case farmers, veterinarians, other advisors in animal health) and perceptions in the research process, through interactions with scientists during this process. This serves different purposes, such as ensuring that research targets issues considered of importance to the end-users, facilitating the transformation of results into beneficial practices to end-users and promoting end-users' trust in research. However, no specific definition of a participatory research approach can be given nor a set of rules on when to use it. In addition, it can

present itself in different formats and the level of involvement of the stakeholders in the research process varies between studies (Lilja and Bellon, 2008).

Lilja and Bellon (2008) presented a practical definition of participatory research that is useful in the context of this thesis. Their definition for participatory approaches in practice is: 'participatory approaches engage people in a community in some or all aspects of the research process - determining research questions, developing technical solutions and approaches to obtain information, and deciding what the research means and how it should be used to benefit the community'. In the context of this thesis, a participatory method is used from a functional perspective, namely with the aim to improve the design of the tool so as it will be accepted, used by the targeted end-users and they will be informed of its existence (Lilja and Bellon, 2008).

Participatory approaches to co-construct and implement HHPM programs at farm level

Stimulating the dialogue between farmers and animal health advisors seems to be of particular importance, to ensure the HHMP programs' adaptability to farm-specific situations and farmer's ownership of the process. As described earlier in the principles for herd health management programs, farmer's ownership of the planning process is considered as one of the element to its success. Ownership can be promoted when based on farmer' goals and farmer' perception of herd problems and the farmer is involved in the decision-making and formulation of measures to implement (Vaarst et al., 2011). These are elements, as discussed in the introduction, which are important for advisors to understand in order to ensure the pertinence of animal health management activities. In addition, the data used in the context of animal health planning must be accessible and understood by the farmer (Vaarst et al., 2011). This seems to be in particular of importance in organic dairy farms due to the earlier described difficulties regarding the collaboration between organic dairy farmers and veterinarians.

A participatory approach was used for the co-construction and implementation of the HHPM program at farm level. In theory, the use of participatory approaches permits to design tools that allow the involved persons to share, demonstrate, examine and improve their knowledge of a certain problem. Principles of participatory approaches are to (i) involve all the persons whose lives will be influenced by changes made using the approach influencing uptake, (ii) acknowledge that local people (in this context farmers) have much more knowledge of their own situation (here their farm) than external people will ever have and (iii) create a space to reflect on and analyse the information (Whay and Main, 2010). We expect that the use of a participatory approach in the design of an advisory tool will ensure that it is adapted to be used in the context of organic dairy farming. Moreover, we expect that an advisory tool in herd health management containing a participatory approach, will stimulate the dialogue between the farmer and his advisor and thus ensure the farmer's ownership of the planning process and adaptiveness to farm-specific situation. The ultimate aim is to ensure that the HHPM program is considered as pertinent by the farmer to improve herd health.

Controlled trial to evaluate the HHPM program in different contexts of advisory relationships

To evaluate the effectiveness of the HHPM program, a controlled trial was designed. In both Sweden and France the designed HHPM program was tested on certified organic dairy farms. The two countries were chosen for their differences in farm systems and existing advisory contexts (as will be

described in more detail in Chapter 4). In both countries the HHPM program was implemented during a period of 12 months on the farms. Besides the effect of the intervention on the participating farms, the results of the farms receiving the intervention were compared to control farms and comparison was made between French and Swedish farms.

One of the ultimate aims of HHPM is to improve herd health. However, evaluating the effectiveness is difficult due to the complex nature of the intervention: multiple health areas are involved, production diseases have a multifactorial nature and the context such as farmers' practices, the health situation and the collaboration between farmer and advisor all influence the outcome (Krogh and Enevoldsen, 2014). Furthermore, quality of the advisory services are expected to play an important role in the outcome (Derks et al., 2014a). Measuring the quality of advice, such as the verification of the pertinence of recommendations in relation to the diagnosed health problem and their correct implementation, is extremely difficult. Several studies discussed the limits of study periods to measure the impact of advisory activities on herd health, a one year period was discussed as too short (Bell et al., 2009; Ivemeyer et al., 2012). Some studies focused on the effect of HHPM activities on a specific health domain, such as reproductive performances (Krogh and Enevoldsen, 2014; McDougall et al., 2014). This reduced the complexity to one health domain, but by doing so the global approach of health, that is characterizing HHPM programs, is lost. Other studies evaluated the impact of herd health planning activities on overall herd health, but were not able to link this to the themes that were focused on during these activities. Furthermore, the exact extent of the advisory services were not described and differed across countries (Ivemeyer et al., 2012).

In order to improve future HHPM programs, we need to have a detailed understanding of how these HHPM activities are implemented in the field. Especially when there appears to be no effect on herd health, one can wonder why that is, and whether specific parts of the process are responsible. It seems therefore relevant to measure elements of the tool implementation and intermediary effects, as we might not always be in the disposition to measure the long term effects on herd health situations. Therefore, the objective is to evaluate the use of the HHPM program by farmers and advisors in animal health and its effectiveness on herd health advisory services and herd health.

1.3.3 Outline of the thesis

After this general introduction (**Chapter 1**), the second chapter will present the results of two qualitative research interview studies on the role of veterinarians in organic dairy farmers' animal health management strategies. **Chapter 2.1** will present the results of the interviews with private veterinary practitioners providing advisory services in herd health management to dairy farmers in general and who have organic dairy farmers in their practices. In **chapter 2.2** the experiences and point of views of organic dairy farmers, from the same geographic area in which the veterinarians were interviewed, are presented. Thus, allowing comparison of the two groups of interviewees in the discussion of chapter 2.2.

Chapter 3 describes the process and the results of the design of the HHPM program, using a participatory research approach involving local stakeholders of the organic dairy industry.

In **chapter 4** the process and results of the co-construction process of herd health indicators at farm level is described. The co-construction of herd health indicators is the first step in the implementation of the HHPM program designed in chapter 3.

Chapter 5 will present the evaluation of the use and effectiveness of the designed HHPM program on advisory services and herd health. The process of its use and implementation is described as detailed as possible, allowing a better understanding of how HHPM programs were implemented and what worked and failed.

Finally, **chapter 6** will provide a general discussion on herd health advisory services in organic dairy cattle farms; presenting the main results, discussing the research strategy chosen and provide research perspectives as well as perspectives for the application of the results in the field.

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Chapter 2: Understanding veterinarians' role in the animal health management strategies of organic dairy farmers

Chapter 2: Understanding veterinarians' role in the animal health management strategies of organic dairy farmers

Preamble

It was considered essential to understand both organic dairy farmers and veterinarians' perception of the role veterinarians play in their animal health management strategies. This would allow identifying where their perceptions meet and to discuss differences or points of misunderstanding between the two groups. Therefore, two research studies were conducted to gain better understanding of veterinarians' role in organic dairy farmers their animal health management strategies.

In this chapter, first the interview study with the veterinarians will be presented followed by the study with the farmers. This choice was based on the fact that the discussion of organic dairy farmers' perception on the role of the veterinarians in their animal health management was found to be more interesting when having the perceptions of the veterinarians in mind. It is not a reflection of a difference in importance of the results.

Chapter 2.1: Perceptions of French private veterinary practitioners' of their role in organic dairy farms and opportunities to improve their advisory services for organic dairy farmers

J.E. Duval[1], N. Bareille[1], C. Fourichon[1], A. Madouasse[1], M. Vaarst[2]

[1] BIOEPAR, INRA, Oniris, La Chantrerie, 44307, Nantes, France
[2] Aarhus University, Department of Animal Science, DK-8830 Tjele, Denmark

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Abstract

Veterinarians could be the expected sparring partners of organic dairy farmers in promoting animal health which is one of the main organic principles. However, in the past organic dairy farmers did not always consider veterinarians to be pertinent advisors for them. The objectives of this study are - from private veterinary practitioners' point of views- i) to describe the roles of veterinarians today in organic dairy farmers' animal health promotion strategies, ii) to identify factors related to organic farming which determine veterinarians role on organic dairy farms, and, iii) to identify opportunities for improvement of veterinarians' advisory services for organic dairy herds. Fourteen veterinarians were interviewed using qualitative semi-structured research interviews. A modified approach to Grounded Theory was used for data collection and analysis. Most often veterinarians had only contact with the organic dairy farmers in cases of individual ill animals or acute herd health problems. Even though certain veterinarians experienced situations and approaches of animal health and welfare on organic dairy farms not meeting their standards, they were not always able to establish themselves an advisory role supporting farmers in improving this. Indeed, organic production principles, regulations and farmers' health approaches challenged veterinarians' values on animal health and welfare and their perceptions of 'good veterinary practices'. Also, some veterinarians considered that there was no direct economic interest for them in the organic dairy sector and that could diminish their willingness to invest in this sector. Possible opportunities for improvement were identified; for example proposing more proactively advice via existing organisations, by making adaptations to advisory services for the organic sector and/or by dissociating veterinarians' curative role from their advisory role in disease prevention.

Keywords: dairy cattle, organic production, animal health promotion, veterinarian, communication

2.1.1 Introduction

Health plays an important role in organic agriculture. As stated in the principle of health of the International Federation of Organic Agriculture Movements' (IFOAM); organic agriculture 'should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible'. Furthermore, health is defined as 'more than the absence of disease and includes the preservation of physical, mental, social and ecological well-being' (IFOAM, 2005). Health promotion strategies in organic farming aim to support organisms to be in a state of homeostasis (Vaarst and Alrøe, 2012) or in other words be resilient to disturbances (Döring et al., 2015). These strategies go further than targeting specific disease conditions (Vaarst and Alrøe, 2012). The principles of organic agriculture as stated by the IFOAM are ethical guidelines to action. IFOAM's standard setting inspired the formulation of the European Regulation on organic agriculture (Luttikholt, 2007). Organic farmers have to operate within the framework of rules set by the European Regulation on organic agriculture (Council Regulation (EC) No 834/2007) to produce quality products and fulfil their responsibility of providing appropriate care to their animals. Organic farmers have to comply with rules on the origin of animals, husbandry practices and housing conditions, breed, feed, disinfection, disease prevention and veterinary medicine. Despite the specific objective to promote disease prevention and the rules on the use of veterinary treatments described in the European Regulation, the role of the veterinarian is not formally laid down in the regulation (*Council regulation (EC) No 834/2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91*, 2007).

In France, the organic dairy sector has been growing steadily since 2006 and more conversions of conventional dairy cattle farms to organic production are expected in the years to come (CNIEL, 2015). Thus, we can assume that more and more professionals, such as private veterinary practitioners will be faced with organic farming. Private veterinary practitioners could be potential sparring partners of organic dairy farmers in reaching the organic principles such as the promotion of animal health and welfare. Even though the production conditions on organic farms aim to promote animal health, the results have not always been shown to be better in comparison to conventional farms (Sundrum, 2001). Furthermore, the role of veterinarians has changed over the last twenty five years, from responding to emergencies and treating individual animals towards disease prevention and even further to an advisory role on health management to maintain health (LeBlanc et al., 2006). This shift of veterinarians' role emphasises the relevance of considering veterinarians as potential partners in developing the organic dairy herds towards a high level of animal health and welfare.

However, private veterinary practitioners in different places across Europe have not always been found to be adequately trained to work on organic farms by stakeholders (Vaarst et al., 2011, 2006b). Organic dairy farmers expressed a variety of experiences and opinions on their collaboration with their private veterinary practitioners when they were interviewed on their animal health management strategies. In general veterinarians are involved in treatment decisions but it is rare that they are involved in the process of reflexion of farmers' animal health management strategies (Vaarst et al., 2006a, 2003). Reasons for this are, as explained by organic dairy farmers, the limited interest of private veterinary practitioners in farmers' goals, in the organic production system or in advisory services (Vaarst et al., 2006a). Furthermore, according to organic dairy farmers, veterinarians' strong focus on animal disease is not always in accordance with their wish for a whole

farm approach (Vaarst et al., 2007). The risk is that these factors lead to situations in which private veterinary practitioners are not considered by organic dairy farmers as pertinent advisors and are excluded from farmers' reflexion on herd health improvements (Vaarst et al., 2007). In light of these concerns expressed by farmers, it is interesting and relevant to study the situation seen from the veterinarians' point of view. To our knowledge, the veterinarians' point of view remained non-exposed, so far. We hypothesized that, in addition to general obstacles encountered in their work, private veterinary practitioners also experience difficulties specifically related to organic farming, and that these difficulties might influence the role they play in the animal health management strategies of organic dairy farmers.

The objectives of this paper are - from private veterinary practitioners points of view- i) to describe the roles of private veterinary practitioners today in organic dairy farmers' animal health promotion strategies, ii) to identify factors related to organic farming which determine their role on organic dairy farms, and, iii) identify opportunities for improvement of private veterinary practitioners' advisory services for organic dairy herds.

2.1.2 Material and methods

The context: French organic dairy production and veterinary practitioners' legal role in animal health care and surveillance

In 2013, 3.4% of the French dairy cattle farms were certified as organic. More than half of the French organic dairy cattle population is localised in the West of France, in the regions Pays de la Loire, Bretagne and Basse-Normandie (Agence BIO, 2015).

The EU regulation on organic animal production does not formally give guidance on the role of private veterinary practitioners on organic farms. The French national regulation does not either. However, the national regulation describes the tasks of private veterinary practitioner in animal health care and surveillance in holdings with animals producing products destined to human consumption in general. To ensure animal health surveillance, regardless of whether the herd is organic or not, regular monitoring visits performed by the farm's veterinarian are prescribed. In practice, the veterinarian has to perform at least once a year an on-farm herd health assessment. It is based on the morbidity and mortality figures of the herd, treatment records of the farmer, additional diagnostic tests if necessary and the animal husbandry situation. Based on the results of the assessment, the veterinarian will recommend an animal care protocol for the farm. It can include the identification of recurrent health problems for which the veterinarian can prescribe drugs without clinical examination of the animals and the control actions the farmer has to take to be allowed to treat these conditions (Anonymous, 2007).

Selection of interviewees

Due to the relative importance of the organic dairy production in Western France, it was considered pertinent to choose to interview private veterinary practitioners in that region on their working relationship with organic dairy cattle farmers.

From these three regions 14 veterinarians were interviewed (referred to as IV1 to IV 14). Veterinarians were selected using two criteria:

- Firstly, veterinarians had to work in a private veterinary practice that offers advisory services to dairy cattle farmers, besides their curative actions to control animal health problems. Different degrees of importance of advisory services in the daily work of veterinarians were allowed, as this is the reality in the field. All veterinarians were practicing in private veterinary practices. In addition, IV10 is contracted by an organic farmers' organization to provide advisory services on organic dairy farms and was interviewed on that service.
- Secondly, the veterinary practices, in which the veterinarians worked, had to have organic dairy cattle farmers in their clientele. The study aimed at including veterinarians with different levels of experience working with certified organic farmers, reflected in the number or percentage of organic dairy farmers among their clients.

First, a short-list of potential veterinarians was made from a list of veterinary practices available to students of the veterinary school of Nantes to perform their internships. This list contains information on the activities that the veterinary practices offer related to herd health management. Thirty-five practices were identified that met the criteria of providing advisory activities on dairy herd health. Second, the interviewees were approached by telephone until enough interviewees were found. Fourteen interviews were considered enough, but 12 were performed, as after the 12th interview no new themes emerged. In total 26 veterinarians were contacted. Five veterinarians never returned our messages. Reasons for veterinarians to refuse to participate were: no organic farmers in the clientele (3), no interest to participate in the study (1), lack of time (2) and a veterinarian refused because interviewees were not paid for participating in the study (1).

Data collection and analysis

Qualitative semi-structured research interviews were used to interview the veterinarians. They took place between August and October 2015 (duration of 30-81 minutes) and were performed by one person (the first author; JD). The interviews took place in the offices of the veterinarians at a time most convenient to them. The interviews were conducted in French. All interviews were recorded and fully transcribed anonymously, except for one case when the veterinarian asked not to be recorded (IV9), because he felt uncomfortable being recorded. In this case, only written notes were taken during the interview by the interviewer and subsequently used for the analysis.

A qualitative research interview is a method to try to understand the world as seen from the interviewees' point of view and to unravel the meaning of central themes in their world. Showing variation rather than quantification is the goal of qualitative interviews. Interviewees are encouraged to describe their experiences in their own words and express their reasons for acting. They can be seen as subjects and actors, and they are not approached as objects mechanically controlled by causal rules. Besides, they are also subject to their environment, for example to the weight of power relationships and discourses. And although the interviewees might not have participated in creating these power relationships and discourses, they can still affect and maybe compose what the interviewees talk about (Brinkmann and Kvale, 2015). Thus, as formulated by Brinkmann and Kvale (2015); 'We can think of people as authored-authors'.

The interviewer's role was to focus the interview on themes of interest, as described in the interview guide (Table 2.1.1), using open questions. The interviewee determined which elements he or she found important to address within the theme. Thus, the interviewee directed the course of the interview and depending on the interviewee's experiences not all the themes were discussed with the same depth across the different interviews. It was the interviewer' task to clarify, as far as possible, ambiguous or contradictory answers to earlier statements made.

Table 2.1.1: List of themes discussed during the interview with the private veterinary practitioners

1	Organization of work between veterinarian and organic dairy farmers: discussion of the veterinarians' experience of the reasons that are typically given by organic dairy farmers for inviting the veterinarian to the farm, the topics discussed with these farmers and the type of role veterinarian has (treatment/advisory role) on organic dairy farms. This included discussing possible differences compared to the organization of work with conventional dairy farmers.
2	Veterinarian' experiences on the collaboration with organic dairy farmers: discussion of positive and negative aspects of working with organic dairy farmers. And differences found with the work on conventional dairy farms, if any.
3	Veterinarian' opinion on the principles of organic agriculture.
4	Veterinarian' opinion on alternative medicines. Veterinarians' use of alternative medicine in their work and its possible influence on their relationship with organic dairy farmers.
5	Veterinarian' thoughts on organic dairy farmers' expectations towards their veterinarian: discussion on how they are made aware of this. And discussion on the possible differences compared to conventional farmers.
6	Veterinarian' needs from organic dairy farmers to be able to ensure a good collaboration.
7	Situations in which the veterinarian could not meet the demands of organic dairy farmers: the topics identified and possible reasons why.
8	Involvement of the veterinarian in the conversion of dairy farms to organic: topics discussed and (expected) added value of veterinarians accompanying organic dairy farmers in the conversion.
9	Effect on conversion of dairy farms to organic on the working relationship between veterinarian and farmer: comparing the types of services asked by organic dairy farmers of the veterinarian before and after conversion of the farms to organic, if any.
10	Understanding of what the veterinarian considers as the most satisfying working relationship he/she can have when working with farmers in general (advisory role versus a treating role) and if that corresponds to the veterinarian' daily work situation.
11	Understanding of what the organic farmers' disease prevention strategies are according to the veterinarian.
12	(Desired) role of veterinarian in organic farmers' disease prevention strategies.

A modified approach of Grounded Theory was used for data collection and comparative and theoretical analysis (Charmaz, 2014). The iterative process used in Grounded Theory allowed for continuous improvement of the interview guide during the data collection in order to reformulate questions, follow-up on emerging themes and formulate new hypotheses to be used in the next interviews. To analyse the transcribed interviews, relevant short statements were coded with headings. Across interviews, the codes were combined to form themes describing equivalent topics and these themes were further organised in sets of themes to form categories. Codes that were considered central, displaying a certain logic and direction were considered in the emerging analysis. Using Grounded Theory allowed to rise and try to answer 'why' question by formulating a model of understanding (Figure 2.1.2) arising from the results of the analysis and not solely answer 'what' and 'how' questions (Charmaz, 2014).

2.1.3 Results

2.1.3.1 Private veterinary practitioners' roles in organic dairy farmers' animal health promotion strategies

Most of the interviewed veterinarians intervened on organic dairy farms on cases of individual ill animals or isolated situations of severe herd health problems. Examples for such veterinary intervention were respectively, difficult calving or a rise in bulk milk tank somatic cell count that would lead to a reduced milk price. However, three veterinarians visited organic farms on a regular basis for the monitoring of reproduction performance. For one veterinarian, this was the main reason for visiting organic farms. An alternative to these collaborations is provided by a local organic farmer group' initiative to contract two veterinarians (IV10) to provide their members advice on herd health management.

Even if providing advisory services can represent a very important part of the daily professional activity of certain veterinarians, it does not guarantee a transposition of that activity to their organic dairy clients. This is illustrated by the following example; 'We *don't work with them! We never see them!'* was a reaction from one of the interviewed veterinarians, illustrating his experience collaborating with organic dairy farmers. This veterinarian (IV5) explained further: *'The question of what influences the way we work together doesn't even arise. We have nothing under control on their farms. Much less than on conventional farms where I go every 15 days, those who are in an overall monitoring system, we go there every 15 days. I know exactly what is going on there, as well as with those where we monitor the reproduction [performances Ed.] and whom I see once a month.'*

Most veterinarians had a relatively low percentage of organic dairy cattle farmers in their clientele (Table 2.1.2). The median number of organic dairy cattle farmers in the veterinary practices of the interviewed veterinarians was 6, with a minimum of 2 and a maximum of 20. Moreover, the interviewed veterinarians worked in practices in which multiple veterinarians shared the rural activity. Therefore, they were not always the designated person to visit the organic farms when a veterinarian was needed. Consequently, in some cases the veterinarians' opinion on the working relationship with organic dairy farmers and organic farming in general was based on relatively small number of experiences.

The veterinarians expressed a diversity of opinions on the organic production system and principles. It ranged from an opinion that the organic production system is not the future for agriculture since - according to one of the interviewed veterinarians - it is not possible to feed the whole world when producing organic. Another interviewee expressed that some of the production principles are proof of great wisdom but that unfortunately, in practice, not all the principles are applied. Yet another person was of the opinion that veterinarians should support organic dairy farmers because they have '*a beautiful profession*'. In between these extremes, a range of different opinions were present among the interviewed veterinarians.

2.1.3.2 Factors specific to organic farming influencing veterinarians' role on organic dairy farms

The following paragraphs describe different themes that were identified from the interviews explaining veterinarians' perception about their working relationship with organic dairy farmers.

2.1.3.2.1 Veterinarians have specific expectations of organic dairy farmers' approach to animal health and welfare

Veterinarians were asked if there were aspects of their work with organic dairy farmers that they did not appreciate as much and what these were. Several veterinarians have started illustrating this with situations in which they were disappointed by the manner that organic dairy farmers handle animal health and welfare. The veterinarians expressed that they would expect of organic dairy farmers to work on disease prevention rather than looking for (alternative) treatment solutions and ask veterinarians as advisors in this instead of seeing veterinarians as 'fire fighters' to treat ill animals.

Other veterinarians had different experiences, such as one who expressed that a positive aspect of working with organic dairy farmers was the very good animal health situation. Another positive aspect of working on organic farms was, for example, that a veterinarian still felt to have the opportunity to treat individual cows. In intensive production systems, this was not always an option anymore, because cows were culled immediately and veterinarians were only involved in herd health management decisions. One veterinarian described as a positive facet of working in organic farms, being involved from the start in the diagnosis of diseases and the initiation of treatments. This was compared to the non-organic farms where animals often had been treated by the farmers before he arrived.

Table 2.1.2: Description of the working environment and their daily work as described by the interviewed private veterinary practitioners

ID veterinarian	Number of veterinarians working in the practice	Proportion of the practice' activity related to farm animals	Domains in which the veterinary practice offers advisory services for dairy farms	Description daily work of the interviewed veterinarian	Percentage of dairy farmers organic	Reasons stated by the veterinarians for intervening on organic dairy farms
IV1	6	67% (nearly 100% dairy)	Reproduction, evaluation functioning milk machine and milking technique and nutrition	Mainly individual medicine (about 10% of their clients have advisory services)	3%	Health problem on an individual animal
IV2	4	75% (nearly 100% dairy)	Reproduction, udder health , evaluation functioning milk machine and milking technique, podal disorders including hoof trimming, work with nutritionist on nutrition problem	Mainly individual medicine (about 12.5% of their clients have advisory services)	1%	Health problem on an individual animal
IV3	13	33% (95% dairy)	Reproduction, lameness, milk quality and nutrition	Both	10%	Mainly for a problem on an individual animal, some advisory services when occurrence of isolated herd health problems (e.g. high somatic cell count problems, advice on nutrition) and one farmer has regular advisory service regarding reproduction
IV4	2	90% (67% dairy)	Reproduction, lameness, milk quality and parasitology	Mainly individual medicine (about 20% of their clients have advisory services)	10%	Most common reason is for regular advisory services reproduction. Other reasons are problem on an individual animal, on two farms for dehorning calves under anaesthesia
IV5	4	50% (100% dairy)	Reproduction, nutrition, udder health, lameness, parasitology, animal husbandry	Works fulltime as advisor (about 40% of their clients have advisory services)	2-3%	Health problem on an individual animal
IV6	9	85% (75% dairy)	Reproduction, including global farm inspections, nutrition and heifer management. Udder health. Lameness; global farm inspection, housing, hygiene, nutrition, hoof trimming. Parasitism. Calf rearing and growth.	Well-developed advisory services but also individual medicine	3%	Mainly for advisory services on reproduction and some intervention for problems on individual animals
IV7	7	50%, (40% dairy)	Reproduction, udder health	Individual medicine (about 5% of their clients have advisory services)	2-3%	Health problem on an individual animal
IV8	8	62% (50% dairy)	Reproduction (incl. fertility, milk production and quality milk quality), milk quality, hoof trimming, calf health	80% of his time he spent on advisory services	10-12%	Health problem on an individual animal
IV9	6	75% (50% dairy)	Reproduction, nutrition and milk quality.	Mainly individual medicine	7%	Health problem on an individual animal
IV10	2	100%	Specialized advisory services for organic dairy farmers by the organic farmers' organization; farmers pay for these services	100% advisory services for organic dairy farmers	100%	Advisory service on herd health
IV11	7	55% (95% dairy)	Reproduction, udder health, nutrition (with external expert)	Mainly indivdual medicine	2%	Problem on an individual animal and two farms follow-up on their programs in the management infectious disease (Bovine Viral Diarrhoea and Paratuberculosis)
IV12	4	80% (70% dairy)	They work with subscriptions to packages; either only for reproduction or for all their visits. Farmers pay a fix fee and then they do not pay for each time the vets come to the farm.	Both (about 15% of their clients have advisory services)	5%	Health problem on an individual animal
IV13	7	80% (85% dairy)	Claw trimming, milk quality, fertility, calf growth, nutrition, disease prevention (vaccination and anthelmintic respiratory diseases)	More advisory services than individual medicine	2%	Health problem on an individual animal
IV14	20	30% (75-85% dairy)	Reproduction, claw trimming, production performances with an agricultural engineer, nutrition and housing, laboratory services milk quality	50% individual medicine, 50% advisory services	2%	Health problem on an individual animal

2.1.3.2.2 Disappointing animal health situations harm veterinarians' positive view of organic farming

IV6: *'So yes, on the organic farms, what is in general pretty pleasant is the fact that the farmers are rather, in general they are rather relaxed, they have a rather global overview on the society, they are not selfish right. Ehm… they…they place themselves as farmers in the middle of a web, a rural web. Often they participate in…they are people that participate quite a lot in associations and things like that. Yes. So there is a…there is a human relationship that is a bit different. And then, that…that makes us also think of our own place, our way to do our job, etcetera …well this very productivist agriculture, very mechanised, etcetera, in which we also participate. Even though, it is not necessarily our choice.'*

The example above illustrates how, at a community level, this veterinarian experienced that organic farmers live up to the organic principle of care. Although veterinarians could acknowledge such positive aspects of the organic principles, their opinion of organic farming was often strongly determined by the animal health and welfare situations at farm level, as illustrated by the example below.

IV5: *'Well, me, it goes into the right direction [organic production principles. Ed.]; it is a good approach! The problem is that we should not confuse organic agriculture and product quality! Organic agriculture only guarantees a working method, but it does not guarantee the quality of the product. I think that people mix up the two! At least for livestock rearing! I do not know for the part, for the crop part, it is just a bit different, because there are a lot less pesticides and everything, since they have become harmful, I think it is a bit different for the crop part. But for the animal part, I may eat more willingly conventional products than organic, (...) I think that the animals are better [in conventional systems], in my opinion, they are less maltreated! Due to undernutrition, due to the non-use of anthelminthic treatments! Well, there is still, only in organic [farms], were we see, heifers on pasture that are dying of parasitism like in the 50's, well! It no longer exists! So I think that, although actually, it's on the rise, this technical side, I have serious problems with that.'*

In the example above, the veterinarian states that the organic production principles are a positive development. However, the minimum standards set did not guarantee satisfying animal care and health situations. Organic dairy farmers did not ensure sufficient and appropriate care of the animals seen from this veterinarian's point of view, e.g. related to feed for the animals and treatments when needed. Furthermore, farmers seemed to accept what the veterinarian regarded as 'unnecessary mortality'. Thus, despite the positive overall approach of organic farming the veterinarian approves more of conventional than organic farming.

The quote below illustrates a related issue. Because of the fact that non-organic farmers reach organic standards, the veterinarian' opinion on the organic dairy farming system is downgraded. This is further amplified by experiences of poor animal health situations on organic dairy farms. Other benefits of the organic production principles, e.g. the reduced use of pesticides on the land were acknowledged but seem not to be of the same importance to the veterinarian when forming his opinion on organic dairy cattle production.

> ***IV1: '****Ehm, well…well the…the agriculture, the labour of the land in organic, I think it is good. The organic rearing of animals, I think it is rubbish, I think that is ehm…already, the norms that are fixed now make no more sense because…three treatments, three diseases per cow per year, ehm…all our farmers are organic, regarding the animal health part.*
> *In my opinion, organic doesn't bring…does not give an added value to animal health. For …what is agri…the labour of the soil, I am not an agronomist, I don't know anything about it, so it is true that…on paper, it seems more interesting, because…the consumption of pesticides compared to other countries, we see that there is something to be changed. But on animal health, I don't think that there is something pertinent and …I, personally, we see farmers that are organic, ehm…that have the tendency to vaccinate less, deworm less and thus have animals that have more chronic diseases, moreover…they have poorer body condition, so the animals, from my point of view, I, that are in lesser health condition than those in the traditional, well conventional [farms].'*

Some veterinarians did express appreciation of the overall organic production principles. Even though some veterinarians sympathized with the overall organic production principles, disappointing animal health and welfare situations were reason to discard completely organic production as a positive approach.

> *2.1.3.2.3 Organic production system, principles and regulation interfere with veterinarians' view of 'good animal health management practice'*

The veterinarians used different examples to show how in some cases certain characteristics of the organic farming system, the organic regulation and/or organic principles interfere with what they consider the most appropriate animal health management practices (Figure 2.1.1). Some veterinarians brought up the more comfortable financial position of organic dairy farmers compared to conventional farmers as one of the reasons that organic dairy farmers accept more health problems on their farm rather than re-evaluating their practices.

> ***IV5****: 'Well, I think that they [organic dairy farmers Ed.] have as much problems as the others [conventional farmers Ed.]. (…) I think, unfortunately, the milk price is too high for them. So, they don't question their work methods! If the milk were paid less, maybe they would be a bit careful.'*

However, some veterinarians had other opinions based on the argument that they had experienced that farmers in a better financial situation ask the veterinarian to come more easily on the farm.

Examples were also given by veterinarians of how in their opinion some of the organic principles can have a negative effect on dairy cattle health, for example veterinarians could also question the principle of avoiding drug use on animal health. In the example below, the effects of the promotion of naturalness are discussed by the veterinarian.

> ***IV6: '****And there is also the idea that animals have to combat [a disease] by themselves. That natural selection does things well. Except that an organic farm, even what we call today an*

> *organic farm has nothing that is natural. (…) Yes, a good example, yes: the horns. So the organic farmers say 'Ah, but no! We should not cut the horns! We should not cut the horns it hurts the animals and…and well, the horns link them to the cosmos', well…I don't enter this sort of discussion, yes! But that is, well, well very good, so we leave the horns. But in fact, three years later all organic farmers, they call you to cut the horns, right! Because horns in nature, of course it doesn't cause any problems. Cows, if they are in a 10-hectare field, it is not a problem, they can escape. Moreover, they do not approach each other. But cows in a place big like this [referring to his office], three cows with horns. Even if they have been staying together for the last 10 years in a 10-hectare field, it is…it is fatal. It is fatal! So ehm…well, either we have an open air farm and we pick up with falls and that is it. Or, if we want to have indoor production it is necessarily without horns.'*

Certain veterinarians indicated that in their experience the organic regulation can have a negative impact on the animal health and welfare situation on organic dairy farms. This can be related to the constraints of the organic production systems, such as not always being able to buy feed when the health status of the herd would indicate the necessity. Another example that was given is the promotion of the use of alternative therapies over chemical products. According the some veterinarians, treatment with alternative therapies can lead to health situations that are worse than when they would have been treated with allopathic therapies applied in a good way (choice of the right product, for the right animal and applied at the right time). Veterinarians identified also the problem with farmers' decision-making in choices of antibiotics. Farmers might ask to choose the antibiotic with the shortest withdrawal time, due to the doubled withdrawal period under the organic regulation, but this might not be the most appropriate one to use in that specific situation.

> ***IV8:** 'Negative aspects? Ehm…their difficulty in using allopathy, so ehm…they are sensitive to the withdrawal period, etcetera, so we have to make particular choices in molecules, which are not always well indicated for what we have.'*

A different example was a veterinarian with doubts on whether organic dairy farmers sometimes not 'hide' behind the interpretation of the organic regulation when they do not adopt disease prevention practices. For example, concerning the use of vaccination or when stating that they cannot find teat dipping products that are allowed under the EU organic production regulation.

2.1.3.2.4 Divergent approaches to animal health management between organic farmers and veterinarians

Veterinarians discussed that the way certain farmers handle animal health is not always the same as for the veterinarian (Figure 2.1.1). This can start with the fact that the two have different philosophical approaches of health. Veterinarians described for example their philosophy as 'scientific' or 'logic' versus a 'mystical or occult' approach of health of organic dairy farmers, in the most extreme case. In the end, these different approaches can lead to different practices to handle health, which can be inconceivable for the one or the other person. Farmers' practices can become an obstacle for veterinarians. Disease control methods, such as the use of antibiotics or vaccination, proposed by veterinarians might not be in line with those of farmers and thus not accepted.

Several veterinarians also expressed the difficulty of working with certain organic farmers that have a negative attitude towards them or their animal health management practices. This can be related to what a veterinarian called the 'antiness' of certain organic dairy farmers towards 'the system' in general. That is not necessarily only against veterinarians but it could also be the rejection of formalized advisory services from other organisations. Some organic farmers reject the diagnostic approach of the veterinarian, such as performing additional diagnostic tests. But most often examples were given of 'antiness' that was directed towards the use of allopathic treatments and vaccines.

> ***IV3:*** *'I am thinking of a farmer that I know very, very well, and who is almost a friend and he has had for a long time problems with a high somatic cell count level of the herd. Thus eh, the milk quality has been catastrophically since I know him, which is for 1O years. And he has never wanted to make a control plan with us. He is against antibiotics, he is against eh…disinfection, 'anti' all these things. So, he treats all his cows with essential oils and everything. But obviously it doesn't work since his herd is still at a somatic cell count level of 800.000 and he culls every year a third of his animals.'*

Alternative medicine was the only topic identified on which veterinarians considered that they could not always meet the demands or answer questions of organic dairy farmers. Organic farmers have asked veterinarians for alternatives to the conventional medicine. Veterinarians' attitudes towards and experience in alternative medicines varied. For example, among the interviewed veterinarians there was a trained homeopath, veterinarians who did not believe much in the effects but sold alternative medicine and firm non-believers in the effects of alternative medicine that therefore did not offer any products or advice on the matter. The lack of knowledge on alternative medicine was not always considered as a problem by the interviewed veterinarians since, in their view, there should be no need for the use of alternative medicine but farmers should aim for disease prevention. And it is thus on disease prevention that farmers should ask veterinarians advice according to them.

> ***JD:*** *'You are not trained in homeopathy or in other alternative medicines?'*
> ***IV6:*** *'Well eh, in the end not that much. It is something that we have discussed in the past but in the end we don't feel that much the need for it. Because in fact, if we have a good disease prevention and apply well husbandry measures, in particular on organic dairy farms that are not intensive, where we don't push the animal, well, normally we don't need therapies, very little. So in that case we don't need to go and find an alternative therapy. The objective is the less therapies possible, whatever the kind.'*

The severity and frequency of herd health problems can change after conversion of farms to organic, according to the interviewed veterinarians. However, veterinarians articulated that it can be difficult for them to evaluate herd health in organic farms when farmers change their health management practices, e.g. when farmers start using alternative treatments that are not bought from the veterinary practitioners.

> ***JD: '****Of those that you have followed during the conversion, in fact, regarding the health status of the herds, did you see an effect of the conversion to organic?*
> ***IV8:*** *… I would not say that there are fewer diseases. They don't come anymore to get the medicines, that, it is certain, they do other things, but do they have less mastitis, less things, I am not sure. I am not sure. They consume less, that is clear, but I am not sure that they have fewer diseases, for those that I know well.'*

The evaluation of herd health without treatment data to reflect the health status of the herd can be an additional obstacle for veterinarians. Or as was said by IV10: 'the number of treatments is not a reliable reflection of the animal health situation on organic farms. Therefore, we need to find other points of entry to propose advisory services.'

Examples of areas where veterinarians experienced that their perceptions were challenged and they questioned organic farming	**Referring to which level in relation to organic farming**
Why do organic farmers prioritize naturalness over animal welfare?	Principles
Why are certain disease prevention actions not authorized, e.g. teat disinfection? Why does organic regulation promote the use of alternative medicine over chemical drugs?	Regulations
How to overcome situations of different health approach between organic farmer and the veterinarian?	Individual farmers' goals, health approach, and constraints…

Figure 2.1.1: Perceived difficulties by private veterinary practitioners of organic dairy farming system interfering with their approach of animal health management. At different levels difficulties are perceived to be due to the framework of working in the organic dairy system; at the level of the organic principles, the organic production regulation and at the level of the organic dairy farmer.

2.1.3.2.5 The low number of organic dairy farms prevents investments in the organic sector

Veterinarians questioned themselves whether or not they should aim for closer working relationships with organic dairy farmers. They gave different examples of why they did not invest in organic dairy farming systems. One recurrent explanation was the low percentage of organic dairy farmers in the veterinarians' clientele.

> ***IV14:*** *'It is certain that if we would have 50 organic farms, I think that we would be…maybe we would be more attentive to or be more involved in, in the organic sector. But since they are so few, and we rarely see them, they are part of the farms that are set apart a little bit'*

As a consequence of the low percentage of organic farmers in their clientele, veterinarians expressed a lack of sense of feeling invested in the organic farming system (Figure 2.1.2, box §3.2.5). As stated by veterinarian IV7 'we don't feel invested in a mission, since there are so few farmers'. This could influence their inclination to invest time in understanding the organic production system. Although other reasons influence that decision too, the low percentage of organic dairy farmers in the clienteles could also influence their willingness to train veterinarians in alternative medicine.

> ***IV1:*** *'I think it asks for a lot of investment, time investment, to be trained because…if we use homeopathy, it is to do it the real way, it is not…at least that is my point of view*
> *…it is really a different kind of medicine that…is really different from allopathy, so we would have to review the diagnostic approach...and then learn the pharmacopoeia in homeopathy, I think it takes also some time to master it, so ehm...I think takes a lot of time ...to devote in order to train and then...for a market that is a relatively small market, so...apart from the prospect of possibly...recruiting new organic farmers in other sectors, but...it's not necessarily...'*

Furthermore, as expressed below some of the veterinary advisory services developed today can be, according to veterinarians, more adapted to farming systems other than organic. For example, advisory services that have been developed by veterinarians aiming at optimisation of the dairy production were expected not to be in line with organic farmers' objectives.

> ***IV14:*** *'even though we can bring them, I think, things to optimize their farm a bit, it is true that everything that is, ehm, follow up of herds like we do it today, is more interesting for big farms that look for…performances, optimisation of production, improving areas like that, and ehm…organic farmers give more the impression to function, not on a slow pace but search for quality rather than really the big quantity.'*

2.1.3.3 Opportunities for veterinarians to improve advisory services for organic dairy farmers

The low frequency of visits of veterinarians on organic dairy farms and resulting low amount of communication between farmers and veterinarians can lead to an impasse (Figure 2.1.2).

> ***JD:*** *'And do they discuss with you why they contact you so little?*
> ***IV7:*** *Well, no, because to be able to discuss it, we would need to see each other.'*

Different opportunities that have been identified by the interviewed veterinarians to break this impasse will be discussed in the paragraphs below.

> *2.1.3.3.1 Pro-actively seizing opportunities within existing work organisations to change their role on organic dairy farms*

Most of the veterinarians have identified opportunities within their current organization of work with organic dairy farmers to further develop their working relationship, changing their role of solely a 'fire fighter' towards the role of an advisor in animal health management (Figure 2.1.2, box §3.3.1).

A potential opportunity could be to have a more proactive approach regarding providing advice on disease prevention when being asked to intervene on organic dairy farms. As IV14 stated: *'it is not a forbidden territory [talking about disease prevention practices], I think, but it is true that we are always there for a fast intervention, maybe we don't take the time to be interested in what they can do'*. A more pro-active approach to animal health problems of veterinarians rather than a reactive

stand is dependent on their general motivation to have a role in farmers' animal health promotion strategies. This motivation varied from veterinarian to veterinarian interviewed, even though all provided advisory services in animal health to farmers.

The annual mandatory sanitary visit has been given by veterinarians, as another example of an opportunity to change their current role towards that of an advisor in organic dairy farmers' animal health promotion strategies.

> ***IV10:*** *'The annual mandatory visit is an excellent opportunity to show a broader interest in the farm and to ask questions that go beyond what we usually discuss. It is an opportunity to start a dialogue on other treatment practices they have and to show to be open-minded'.*

However, the quote below expresses that not all veterinarians agree with the veterinarian above on the value of the annual mandatory visit as an opportunity for veterinarians to discuss more in depth the health situation of herds.

> ***IV11:*** *'We do the annual mandatory visit because it is a legal obligation, but it has no value hmm…it has no professional value for the farmer.'*

But examples were given of situations where the discussion on herd health during mandatory visits on organic dairy farms did lead to a change in the organization of work between farmer and veterinarian by the establishment of advisory services. Indeed, the quote below shows the example of a veterinarian explaining that he had one organic dairy farmer that used advisory services offered by the vet in order to improve the reproduction performances of the herd.

> ***IV8:*** *'It is often during the annual mandatory visit that we propose our services. So, during the annual visit we discuss the results of the farm and often at that moment that triggers a follow-up service. Or farmers ask us to have a follow-up, but it is nevertheless often during the annual visit.'*

Some veterinarians were aware of situations were organic dairy farmers in their clientele turn to other persons and organizations to find information on the management of animal health. The farmers' information sources and the organization of education (farmer exchange groups, one-day courses, etc.) were sometimes known by veterinarians.

> ***JD:*** *'Have you been invited to organic farmers' meetings or meetings organised by the Chamber of Agriculture?'*
> ***IV8: '****No never. Never, never. I have been to an open house but that is all. An open day of an organic dairy farm, that is all.'*
> ***JD****: 'Would you be interested?'*
> ***IV8****: 'I have not had the invitation. I would have gone there, because it does interest me, but ehm…I think that we are not the main interlocutor of these farms, typically.'*

In general, the private veterinary practitioners were not taking part in these moments of information exchange on animal health management, outside the context of their work on the farms.

Veterinarians expressed their interest and willingness to participate in such meetings in several cases. Yet, they have not undertaken many steps to be able to. Only one of the interviewed veterinarians, other than the veterinarian contracted by the farmer group, had participated in an organic farmer group by giving a presentation on the management of young stock.

2.1.3.3.2 Opting for an alternative organization of work between organic dairy farmers and veterinarians

An alternative model for a working relationship between organic dairy farmers and veterinarians has been developed by a local organic farmer association. Based on a need identified amongst their members for advisory service services on dairy health management, the association took the initiative to contract two veterinarians to design and provide this support. The two veterinarians are trained homeopaths, which could contribute to their understanding of particular health approaches of certain organic farmers. However, in their opinion, farmers should aim to attain animal health situations where there is no need for treatments whatsoever. And that the necessity of any form of treatment is the result of a failing disease prevention strategy.

> ***IV10**: 'The farmers themselves came to find us. For a long time, the demand has been there, farmers were frustrated regarding the lack of the alternative side in herd health advisory services. Of course there are the alternative treatments, but also regarding alternative approaches such as Obsalim [French method based on cow observation], taking into account the farm system as a whole, going further than what you would do during the annual mandatory visit. Or at least we didn't go far enough during the annual visit.'*
> ***JD:** 'In what way didn't it go far enough?'*
> ***IV10:** 'Well, we do [during the follow up proposed by the organic farmer group. Ed.] a complete tour of the farm, we go and see the animals on pasture, we look at all the different age groups. Inevitably, we are very interested in nutrition…The first visit may take about 6 hours.'*

The farmers had different motivations to ask for the service, e.g. in case of herd health problem, with the aim of optimization of their production system or for the design of criteria to identify health problems at an early stage. The services provided are adapted to the needs identified by the individual farmer, such as the goals set, the topics discussed and the number of visits per year.

In this example, the farmers pay the veterinarians a fixed day rate. If the farmer wishes, the private veterinary practitioners of the farmers are informed of the services provided, welcome to participate and remain the referent veterinarian of the farm. In general, the farmers do not wish to communicate to their referent veterinarian. The veterinarians contracted by the farmers' association do not sell drugs to the farmers and have only an advisory role. In this setting the dual role that veterinarians have in general has been uncoupled; the curative role is separated from the advisory role.

2.1.3.3.3 Model of understanding explaining and showing opportunities to break a situation of the veterinarian in the role of a firefighter on organic dairy farms

Figure 2.1.2 illustrates themes described above in a model of understanding. This model aims at explaining how these different elements can lead to situations of an impasse in which veterinarians can feel stuck in on organic dairy farms in the role of a 'firefighter' in case of individual ill animals or occasional herd health problems. And not being able to change this since they are often rarely called to visit the farms. Opportunities to break that vicious cycle and change the organization of work between private veterinary practitioners and organic dairy farmers, as discussed above, are integrated in the model.

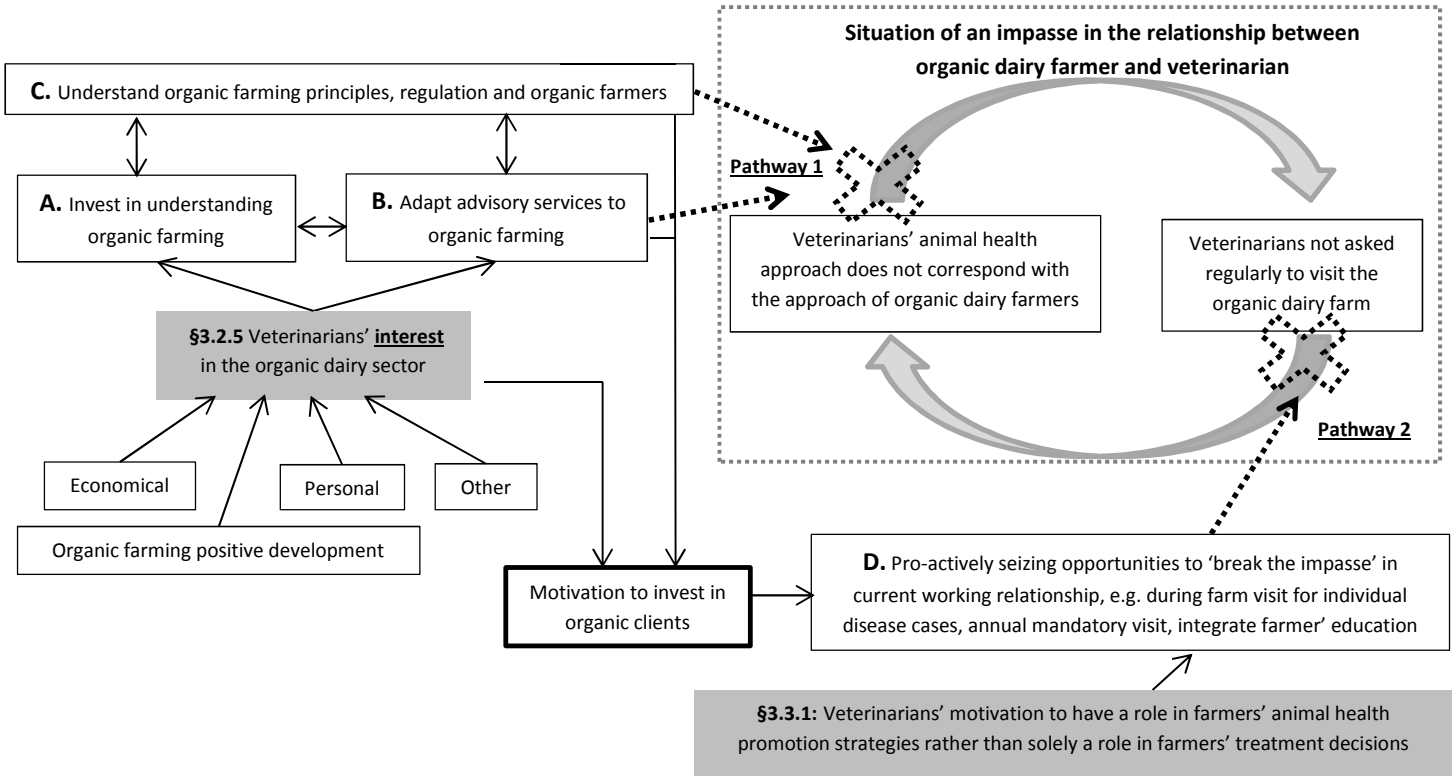

Figure 2.1.2: Model of understanding explaining and showing opportunities to break a situation of an impasse in which the veterinarian has solely a role of a 'firefighter' on organic dairy farms.
Pathway 1: Veterinarians' motivation to invest in organic dairy clients can be driven by an interest that they have in the organic dairy sector (box §3.2.5). This interest can drive them to develop their understanding of the organic dairy sector and/or specific advisory services for organic dairy farmers. In turn, functioning like a reinforcing mechanism, it will promote the understanding of the organic farming principles, regulation and organic farmers. This improved understanding might remove the blockage of an animal health approach that does not correspond to the approach of organic dairy farmers as was discussed in paragraph 3.2.3 and 3.2.4.
Pathway 2: *Indirectly* the investments made in the organic dairy sector could further motivate veterinarians to devote themselves to organic clients to make profit out of their investment seizing opportunities to break the 'impasse' via the second pathway (box D). This pathway can also be influenced *directly* by an interest in the organic dairy sector and/or by veterinarians' motivation to have a role in farmers' animal health promotion strategies (box §3.3.1). The model of understanding shows that veterinarians can break a situation of an impasse with or without investing in knowledge or skills specific to the organic dairy sector.

2.1.4 Discussion

Presenting veterinarians point of view on their role on organic dairy farms

This study presents French private veterinary practitioners' perception on their role in organic dairy farmers' animal health promotion strategies. In contrast to organic dairy farmers' point of view, the point of veterinarians was, to our knowledge, non-exposed so far.

Veterinarians did not always manage to establish themselves in an advisory role even when experiencing disappointing animal health situations

Private veterinary practitioners played a number of different roles on organic dairy farms. However, most often, the interviewed veterinarians had only contact with the organic dairy farmers of their clientele in case of individual ill animals or occasional herd health problems. Even though some of the veterinarians experienced situations and approaches of animal health on organic dairy farms which did not meet their standards, veterinarians were only a few times able to establish a role of advisor supporting farmers in their animal health promotion strategies to improve these situations. These results are in line with a previous study in Denmark, where veterinarians of organic dairy farms were mainly involved in treatment decisions for individual animals, and rarely included perspectives on herd health (Vaarst et al., 2003). Therefore, the results of this study can also be considered interesting in contexts other than the French context.

The risks of a situation of an impasse

The relationship between organic dairy farmers and veterinarians can be in an impasse; veterinarians identifying a need for improvement of certain health and welfare situations, but were rarely asked to intervene on farms, and in particular to participate in farmers' reflections on animal health management strategies. An explanation might be that veterinarians' approach to health in combination with the advisory service offered to dairy farmers in general does not meet the exact expectations of organic dairy farmers. Furthermore, this situation can be accentuated if veterinarians, as a consequence of this, are asked less and less to work on farms. When veterinarians are not regularly present on farms and confronted with the conditions and challenges which are specific to particular farms, the risk is that it negatively affects their development of knowledge, expertise and awareness of clients' needs (Bellet et al., 2015). Moreover, frequent contact between farmers and their veterinarians can be valuable in itself, as it favours a common understanding of the current herd health situation (Klaas et al., 2011). It is likely that a common understanding of the health situation is a pre-requisite for veterinarians if they want to propose advisory services in line with the needs perceived by farmers. As hypothesized by Garforth (2011), farmers' attitude to risk management practices and their intention to implement these are influenced by the farmers' attitude towards animal disease risk.

Veterinarians focused view on health and welfare influences their opinion on organic farming

Veterinarians did not always identify an interest in organic farming as a positive development in farming. This could partially be explained by the veterinarians' strong focus on animal health and welfare, which shaped their opinion on current practices and health situations in organic dairy herds. Consequently, some veterinarians did not see the added value of organic production, when the same

standard was also reached in non-organic farms in their clienteles. However, the restrictions of the EU Council Directives on organic livestock production should not be seen in an individualistic perspective on animal health and welfare. The directives are to be viewed as incentives for profound changes of the agricultural system as a whole aiming at adapting the system to provide conditions to prevent animal health and welfare problems. Furthermore, the organic principles to take into account the agricultural system as a whole, rather than at individual level, provides a broader range of pathways to improve animal health and welfare situations. This systemic approach includes reviewing e.g. breeding goals, housing systems and production strategy in the search of preventing and solving of problems (Alrøe et al., 2001; Verhoog et al., 2004). Furthermore, the organic principle of health considers health of soil, plants, animals, humans and the planet as one and indivisible (IFOAM, 2005). Veterinarians did acknowledge some positive aspects of organic farming e.g. on plant production and the environment. However, veterinarians in their opinion forming on organic agriculture did not always seem to value these aspects or consider them with the same importance as animal health.

Organic dairy farming lies outside the sociotechnical regime of veterinarians who have therefore different values and practices than organic dairy farmers

We can consider organic dairy farming as a niche in French agriculture, today. Most veterinarians are in a (mainly conventional) sociotechnical regime, which is different from that of organic dairy farmers. Sociotechnical regimes are the result of organisational and cognitive routines that are shared by and embedded, in amongst other, the practices, governance structures and knowledge sources of the different social groups involved (Geels, 2002). The interviews pointed to the fact that veterinarians did not always understand organic farmers' priorities and management regarding animal health and welfare. The veterinarians also explained that they could not comprehend the ideas behind the so-called organic values. This may explain why they did not understand farmers' priorities. Alrøe et al. (2001) and Lund (2006) already highlighted that veterinarians should be made aware that the values of animal health and welfare are different than in non-organic farming otherwise this can lead to criticism of organic farming due to misunderstanding.
Animal welfare, considered in the light of the organic production principles, is more than meeting animal's needs. It includes the notion of naturalness, assuring within the context of a farm system that animals can express as much as possible their natural behaviour and have feed and an environment that is considered adapted to the species and breed (Vaarst and Alrøe, 2012). In organic farming, naturalness can be regarded as a precondition for animal welfare and an aim in itself (Lund, 2006). Negative effects of naturalness on the individual may thus be accepted to a certain extent, but it is clearly stated that humans have the obligation to intervene when necessary to avoid poor animal welfare, and this is considered a part of the so-called 'ethical contract' of care between the animals and the humans in organic agriculture (Vaarst and Alrøe, 2012; Verhoog et al., 2004). Veterinarians may prioritize physical health over natural living conditions, which can explain many veterinarians' critical attitude towards organic farming for situations of poor welfare, when natural living conditions compromise the physical health of animals (Lund, 2006).
The definition of health, as understood in the organic principles, goes further than the absence of disease and high performances, aiming for a state of homeostasis where animals can cope with changing situations in their environment and stress. Döring et al. (2015) suggest an understanding of health as 'resilience', and this is very much in accordance with the organic principles' focus on health as an overarching principle on all levels of the farm. Disease prevention actions often target the

prevention of one specific disease condition, whereas homeostasis takes into account the animal as a whole, focusing on practices that improve immunity, for example through good quality feed, air and water (Vaarst and Alrøe, 2012).

The values of animal health and welfare specific to organic farming might explain why, like in this study, veterinarians can be disappointed in and a mismatch arises with organic dairy farmers' approach to manage herd health. Indeed, according the theory of Geels (2002) and as was evoked by Hellec and Blouet (2010), advisors create their professional identity based on their technical skills and they may try to make farmers evolve in their direction. As shown by Hellec and Blouet (2010), advisors with a background in animal production, were focused on improving the technical and economical performances of organic dairy farms by improving the technical skills of farmers. It was questioned whether that is in line with the expectation farmers have of the further development of themselves as organic farmers (Hellec and Blouet, 2010). The interviewed veterinarians in our study did not question whether their relationship with organic dairy farmers might be impacted by lack of knowledge or expertise from their side, with the exception that some the veterinarians thought that the fact not meeting farmers' expectations regarding alternative medicine might have an influence. They realized that the organic dairy farmers in their clientele sometimes sought specialized services from other types of advisors. In this study some of the organic farmers in the clientele of the interviewed veterinarians used alternative treatments such as homeopathy, but veterinarians did not seem to have been their partners in developing these practices. This is in line with results on the independent use of alternative treatments by French organic meat sheep farmers (Cabaret et al., 2011). The overall communication on animal health could potentially be harmed, if the topic of alternative therapy was completely avoided, including in situations where the veterinarian does not have training or is sceptical toward the use of alternative medicines.

The different approaches to health management that are being tried in organic farming, e.g. the use of alternative medicine or alternative organization of work can be regarded as innovations. Innovation in a sociotechnical regime aims at adding on to the existing trajectories. In contrast, radical innovation is created in niches. So-called 'windows of opportunity' are needed for radical innovations to become part of and influence the dominant regime. These opportunities are the result of developments in the sociotechnical landscape and stress on the sociotechnical regime, e.g. political pressure and market growth respectively (Geels, 2002). So far, the lack of a direct economic interest in the organic dairy sector diminished some veterinarians' willingness to invest in better understanding of the organic dairy sector and/or to adapt existing or create advisory services specific to the organic dairy sector. And this lack of interest could also lower their motivation to have a more pro-active approach in trying to establish an advisory service on organic dairy farms. Without a change of the environment leading to incentives for veterinarians to do so, that adaptation will not likely occur. The (lack of) incentive for change can be financial, intellectual stimulation (Mee, 2007) or, as seen in this study, a personal motivation. It is the reality of the private veterinary sector that they have to maintain an economically sound business. At the same time, they have to act within a legal framework imposed to them, deal with the fact that their clients search for the best value for veterinary services and they have to face competition on certain services (Petitclerc, 2013). As presented, alternatives to the standard organization of the work between organic dairy farmers and veterinarians do exist and it could be interesting for the sectors to study these alternatives further.

Veterinarians' motivations to have an advisory role in farmer's animal health promotion strategies vary

Not all interviewed veterinarians showed the same motivation to establish themselves as advisors on farms, irrespective of the type of farm. This is despite the fact that they all provide advisory services to their dairy clients. Often there was a lack of a proactive approach in discussing herd health even though veterinarians did identify possible 'contact moments' during which they could have. However, veterinarians have been mandated to safeguard animal health and welfare and food security all along the food chain. The role of veterinarians is therefore more than only performing medical procedures. At each level of the food chain the quality of the veterinary services must be guaranteed (Petitclerc, 2013). Veterinarians cannot allow themselves to wait until a farmer calls for a specialized service, their services need promotion (Mee, 2007). Farmers, as animal keepers, have to ensure good animal care to maintain good animal health and welfare levels. Vaarst et al. (2003) already discussed that when organic farmers asked veterinarians only for treatment decisions, there was little chance for dialogue between farmers and their advisors to develop common understanding on organic farming. A major argument in this debate was that if neither the farmers nor the veterinarians felt the need to work towards changes in animal health management that met the specific organic goals, then development would not be likely to occur (Vaarst et al., 2003). In the present study, veterinarians did express to have specific expectations regarding animal health management on organic dairy farms. It is in organic dairy farmers and their private veterinary practitioners' common interest to promote animal health and welfare in organically reared animals, and it can be viewed as their common responsibility to keep the dialogue on animal health management open. The use of advisory tools in animal health management promoting dialogue can help advisors to identify farmers' objectives, priorities and management practices and to adapt for example herd health and production management programs to each farm (Duval et al., 2016). The design and use of such tools could be further developed and promoted.

2.1.5 Conclusion

The interviewed private veterinary practitioners in France rarely played a role in organic dairy farmers' animal health promotion strategies. The veterinarians perceived difficulties specifically related to organic farming context that challenged their own values on animal health and welfare and their perceptions of 'good veterinary practices'. This can, at least partly, be explained by veterinarians' strong focus on animal health and disease and the fact that they seem not to be fully aware of the values of organic agriculture. However, examples have been provided that there is a place for veterinarians in an advisory role on organic dairy farms. This requires that veterinarians identify an interest in organic farming and/or have the motivation to have a proactive approach to maintain and develop relationships with (organic) dairy farmers and possibly adapt advisory services to the needs of organic dairy farmers. Nevertheless, a common effort is needed of both organic dairy farmers and private veterinary practitioners to maintain the dialogue on animal health promotion ongoing.

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Chapter 2.2: French organic dairy farmers' perceptions of private veterinary practitioners' role in their farms

J.E. Duval[1], N. Bareille[1], C. Fourichon[1], A. Madouasse[1], M. Vaarst[2]

[1] BIOEPAR, INRA, Oniris, La Chantrerie, 44307, Nantes, France
[2] Aarhus University, Department of Animal Science, DK-8830 Tjele, Denmark

Abstract

Organic dairy farmers have to live up to the organic goal of 'good health' and at the same time respect the organic principles and regulation. Veterinarians could be the organic dairy farmers' expected sparring partners in reaching this goal but have found difficulties to establish advisory relationships with them. The objectives of this study are -from organic dairy farmers' points of view- (i) to describe farmers' objectives and strategies regarding herd health, (ii) to describe private veterinarians' roles in farmers' animal health promotion strategies and (iii) to identify farmers' reasons for not adhering to the advice of veterinarians. Fourteen organic dairy farmers were interviewed using qualitative research interviews. Data collection and analysis was performed using a modified approach to Grounded Theory. Organic dairy farmers had animal health management strategies focusing on animal health promotion, in contrast to veterinarians whom they perceived to have a focus on disease. Veterinarians had most often solely the role of therapist in organic dairy farmers' animal health management strategies. Reasons explaining that veterinarians were not able to establish an advisory role were found in the differences between veterinarians and farmers regarding: long-term animal health promotion strategies and solutions to disease problems. Generally, farmers experienced lacking dialogue and experience sharing with veterinarians. Improving the dialogue between organic dairy farmers and veterinarians seems crucial to develop veterinarians understanding of farmers' (organic) objectives and adapt their advisory services to this. However, this requires investment of time by the veterinarians in organic dairy farmers and a pro-active attitude showing interest in their herd health situation and practices. Farmers on the other end should also aim to maintain the dialogue with veterinarians; learn about and acknowledge veterinarians' background and resulting reasons for action to enhance mutual understanding. Improving the dialogue between the two 'worlds' could be a good starting point, to move on in search for innovative solutions in animal health management. Due to the importance of continuing education and experience exchange groups seem to have for farmers, it would be interesting to study further their value in animal health management.

Keywords: dairy cattle, organic production, animal health promotion, veterinarian, advisory services, communication

2.2.1 Introduction

Health is one of the key principles of organic farming. The International Federation of Organic Agriculture Movements (IFOAM) declares that 'Health is the wholeness and integrity of living systems. It is not simply the absence of illness, but the maintenance of physical, mental, social and ecological well-being. Immunity, resilience and regeneration are key characteristics of health.' Organic agriculture should 'sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible'.

Farmers constantly need to develop the herd and its surroundings in ways which live up to this goal of 'good health', and respond to all challenges while respecting the organic principles and standards. In organic agriculture, health promotion strategies go beyond targeting specific disease conditions and aim at reaching a state of homeostasis (Vaarst and Alrøe, 2012). Döring et al. (2015) suggests that health could be perceived as 'resilience', which widens the concept and understanding of health to become the capacity of animals to adapt and handle challenges and different living situations.

Conform to the European Council regulation on organic production, animal health should be promoted mainly through the use of appropriate housing conditions, feeding practices and choice of breeds. The use of conventional veterinary products is restricted and the use of alternative medicines is promoted (Council regulation, 2007). Thus, animal health promotion strategies on organic farms are based on long-term and strategic farming decisions, in contrast to tactical disease prevention strategies targeting a specific disease based mainly on goal-focused efforts (Hovi et al., 2004). LeBlanc et al. (2006) supported this view, affirming that an advisory-oriented role in health management, in general, requires a global farm approach of advisors of farmers. However, despite the objective of enhanced health, applying the organic standards does not guarantee less production diseases in organic dairy herds, compared to conventional herds (Barkema et al., 2015).

Private veterinary practitioners clearly should be expected to be the most relevant partners of dairy farmers in developing their herd health promotion strategies. The roles of veterinarians have generally shifted towards being more management related, acting on the herd level, advising on disease prevention and even health promoting strategies, where it previously was more about treating individual ill animals (LeBlanc et al., 2006; Ruston et al., 2016). The veterinarians should therefore be in a good position to be sparring partners and able to give good guidance to the farmers. However, veterinarians are not the only persons anymore to have to an advisory role on dairy farms, they have to deal with the challenge of competition by non-veterinarians to maintain their role (LeBlanc et al., 2006; Ruston et al., 2016).

In certain cases veterinarians, providing herd health advisory services to dairy farmers in general, have found it difficult to develop these services on organic dairy farms, even when in their eyes the animal health situation could benefit from their advice (Chapter 2.1). In Europe, studies about organic dairy farmers' animal health strategies in general, without focusing on the role of the veterinarian, also showed that most often veterinarians were given a limited role in farmers strategies, being solely involved in disease treatments or diagnostic procedures, such as bacteriological culturing (Vaarst et al., 2003 & 2006). Also, French organic meat sheep farmers did not turn as often to their veterinarians, in case of animal health issues, compared to the conventional farmers (Cabaret et al., 2011). A Canadian study reported that veterinarians, besides their work in

emergencies, also were involved on organic dairy farms in planned and frequent advisory services in reproductive performances and possibly in herd health. However, few farmers stated to receive or count on veterinarians to provide them with advice on disease prevention (Pieper, 2014).

The studies on organic dairy farmers' animal health strategies provide some elements to understand the limited role of veterinarians on these farms. Organic dairy farmers can dismiss the knowledge and skills of veterinarians, because of veterinarians' focus on disease and lack of overall farm approach. In previous studies, organic farmers were found to perceive that veterinarians were not the best qualified health management advisors, because they perceive that veterinarians lack respect for farmers' goals, most importantly being 'organic production'. A perceived lack of dialogue and a feeling of inequality by farmers were also reasons not to appreciate fully the collaboration with veterinarians (Vaarst et al., 2007). The found focus of veterinarians on treatments rather than having an approach to solve the underlying problem could be another reason (Pieper, 2014).

The organic dairy sector in France is expected to continue to grow in the coming years, consolidating the sectors' steady growth since 2006 (CNIEL, 2015). This growth is expected to be even further stimulated by the current economic crisis in French agriculture, which also negatively affects conventional dairy farms' financial situations (Anonymous, 2016). We can thus assume that private veterinary practitioners (further referred to as veterinarians), will be working more frequently with organic dairy farmers in the near future. It is therefore important to understand why French veterinarians have a limited role in organic dairy farmers' animal health promotion strategies (Chapter 2.1), seen from the farmers' perspectives too. To our knowledge, organic dairy farmers' experiences and views on their working relationship with veterinarians have not yet been put in perspective with the actual role of the veterinarians on their farms. The objectives of this paper are - from organic dairy farmers' point of view- (i) to describe farmers' objectives and strategies regarding herd health, (ii) to describe private veterinarians' roles in farmers' animal health promotion strategies and (iii) to identify farmers' reasons for not adhering to the advice of veterinarians.

2.2.2 Material and methods

Selection of interviewees

Organic dairy cows represent 3.4% of the total French dairy cattle population. More than half of the French organic dairy cattle population is located in the West of France: in the regions Pays de la Loire, Bretagne and Basse-Normandie (Agence BIO, 2015). This was the reason for choosing to interview organic dairy farmers farming in these regions. In addition, farmers had to be in an area in which it was known that advisory services in herd health were offered by private veterinary practitioners.

Two other inclusion criteria were taken into account in the selection of interviewees, namely different herd sizes and the number of years that the farm had been certified as organic had to be represented. Assuming that herd size could be expected to influence the occurrence and types of disease problems, the care offered to animals (e.g. organization of work), and time spent with animals. The number of years certified as organic might influence the farmers' experience in the use

of alternative treatments. Moreover, it could influence the herd health status, as it might require time to return to a balanced state after conversion.

Interviewees were contacted by telephone until 14 interviewees were found. Contact details, location, farms' year of certification as organic and agricultural productions (only dairy or also other animal productions) were found in an online directory of organic farmers of the French agency for the development and promotion of organic farming (Agence BIO). Farmers were chosen without prior knowledge of their farm or relationship with their veterinarian. Some farmers referred to a lack of time or interest for not agreeing to participate. A total of fourteen farmers were interviewed. Fourteen interviews were considered sufficient since after twelve interviews saturation was reached, meaning that no new themes seemed to emerge from the interviewees.

Data collection and analysis

Qualitative semi-structured research interviews were conducted in French with all participating farmers on their own farm, using the interview guide presented in Table 2.2.1. All interviews were digitally recorded and farmers were promised anonymity. The first author conducted all interviews between July and October 2015. On average the duration of the interview was 57 minutes, and most interviews followed a farm walk led by the farmer.

A qualitative research interview approach aims at understanding the life world of the interviewees, and unfolding their experiences and perceptions in their own wordings. This method was regarded as ideal in this case because it considers the interviewees as subjects rather than objects of their environment. People contribute to their environment, but at the same time they are also influenced by its discourses, power relations and ideologies. The objective is to know how interviewees' describe their experiences or reasons for actions in the world as they experience it. Qualitative research interviews aim at showing variation rather than quantification (Brinkmann and Kvale, 2015).

The interviews were structured around thematic questions by the interviewer, using open questions. However, the interviewees were encouraged to speak and steer, to some extent, the course of the interview. Interviewees could direct the course of the interviews and depending on their personal experiences, particular themes were discussed more or less in depth during the different interviews. The interviewer was responsible for the clarification, as far as possible, of seemingly self-contradictory or unclear statements.

A modified approach of Grounded Theory was adopted for the data collection and analysis (Charmaz, 2014). The iterative process used in Grounded Theory permitted continuous improvement of the interview guide during the data collection process, through the reformulation of questions, ensuring more in depth discussion of emerging themes and the identification of new hypotheses to be tested in the next interviews. To analyse the interviews, statements relevant to the studied topic, portraying interviewees' views and (arguments for) actions were coded with headings. Across interviews, the headings describing similar topics were combined and these were further organised into categories. Several codes emerged from the analysis as central, displaying a certain logic and direction. Using Grounded Theory allows not only to describe the phenomenon under study, but also to attempt finding explanatory factors (Charmaz, 2014).

Table 2.2.1: List of themes discussed during the interviews with organic dairy farmers to understand their working relationship with their private veterinary practitioner

Farmers' motivation to convert the farm to organic production
Farmers' perception on animal health promotion strategies and the role of veterinarians in this; farmers' disease prevention strategy, its importance in the management of herd health
Organization of work with the veterinarian: reasons for inviting the veterinarian to the farm, topics discussed, number of different veterinarians that visit the farm
Farmers' experience of the collaboration with the veterinarian today; positive and negative aspects.
Farmers' expectations for the collaboration with the veterinarian; are the expectations being met and farmers' criteria used to judge this. Are the expectations related to being in organic dairy farming or not. Farmers' methods to make veterinarians aware of his/her expectations.
Farmers' perceptions on whether their expectations regarding the working relationship with their veterinarian are currently met.
Evolution of the role of veterinarians on the farm during the conversion process to organic; involvement of the veterinarian in the conversion, evolution of the herd health status during conversion, possible change in expectations for the veterinarian due to conversion process. Possible change in services provided by veterinarians in time.
Persons, other than the veterinarian, that have the role of advisor in animal health on the farm; and reasons why.
Sources of information that have been used to define the herd health strategy by the farmer. If wished, ways to involve the veterinarian in the strategy.

2.2.3 Results

2.2.3.1 Organic dairy farmers' objectives and herd health strategies

2.2.3.1.1 Reasons for farmers to convert to organic

The interviewed farmers evoked different reasons that stimulated their decision to convert to an organic mode of production. Some were motivated to stop the use of pesticides to reduce their negative impact on human health and the environment, or to reduce the number of allopathic treatments used on the animals, and/or the farmers' overall search for an 'improved quality of life'. A better valorisation of their farm products and ensuring the economic viability of their farm was either determinant in the decision making process or added on to their initial willingness to change their system to organic.

> ***IF7****: Well, I have always been sensitive to nature…And treatments, pesticides, I did not like it, I saw the damage it did to the soil (…) So there was a desire to convert to organic, but triggers were needed, so there were, ehm, personal reasons and everything, that made us want to convert to organic. (…) I remember a day I had been weeding, the day after (…) I was ill because of the pesticides. I said: 'It is over, we stop spraying'. There were different things that made… And I, I liked to plant trees, and to respect an ecosystem that favours meadows, the animals and everything. Today I see it, the guys here, when it is too hot, they keep their animals in the stables, because there are no trees anymore. (…) But I, when it is hot, I put my animals in the fields where there are trees. And financially, well...we are not on a family farm,*

> *so we managed to finance our farm (…) In the end, we have created our farm, we managed to live, to take holidays, and to have a profession that we like, and that is very important.*

In most cases, the conversion to organic had not been a dramatic or abrupt change. Often their farming system and practices had gradually changed towards or were already close to an organic production system at the time of formal conversion. Examples could be that they already had limited the use of pesticides or chemical medical treatments of animals, and/or they had a feeding system based on grazing on pastures, and adapted to organic farming, like expressed by IF8 below.

> ***IF8****: We used antibiotics and I was not satisfied. So, I said to myself, there are guys that succeed in organic. In that [group of organic farmers, Ed.], you have people that are 'cool', even too relaxed, and then you have people that are more 'technical'. So, we will go and see how the 'technical' manage. So, it opened us, at the start, not to a change of practice, but to a reflexion on our farm, to the 'why' we have problems (…) instead of being always in an emergency situation and treating, asking you the 'why' question. So we have evolved like that, trying to reduce our consumption of antibiotics. And we have evolved step by step, and in 2009 during the milk crisis we asked ourselves whether our system was profitable, and at that moment we said that we would go towards a bit more autonomy. So, we started to change our reasoning, introduce alfalfa, things like that (…) and then in 2012, we have done an economical study [of the conversion of the farm to organic]. Because there, I saw what could work on the farm…we did an economical study, and we said 'go'…*

2.2.3.1.2 General development of the herd's health and disease situation since conversion

Farmers experienced the consequences of the conversion on herd health differently. Some farmers noticed different forms of improvements whereas others experienced deterioration in the beginning of the conversion, or no effect at all. The most important factor seemed, according to the farmers, to be how much the farm system had to be changed to become certified organic: in cases where almost nothing needed to be changed, the conversion did not have any impact on the herd health situation. Various disease challenges had occurred over time, and presently, some farmers experienced disease problems at herd level, beyond the occasional diseased individual animal (Table 2.2.2). Others did not consider having had or presently having particular herd health or disease problems.

2.2.3.1.3 Farmers' general approach to herd health on organic dairy farms

Farmers generally focused on animal health promotion strategies to ensure the health of their herd. Most often feed quality played a central role in farmers' animal health promotion practices. All interviewed farmers had a feeding system in which grass in different forms was the main component of the cows' diet, and based on relatively long grazing seasons, up to year-round. The importance of animal health promotion in the management of the herd differed between farmers and could evolve over time. Farmers sometimes had developed this approach over time from almost non-existing.

> ***IF14****: we used to monitor the herd, but without asking ourselves too many questions when she [a cow, Ed.] was ill, either we treated or we called the vet. But we did not go as far as to say; 'Well, if she is ill, or if there are several cases like that, I must have a problem with the feed, maybe I should resolve it'.*

Other elements of their animal health promotion strategies were for example the use of adapted genetic material, housing conditions, hygiene measures, surveillance and timely human care-taking. These were all measures targeting 'health' rather than a specific disease.

2.2.3.2 The role of veterinarians on organic dairy farms

2.2.3.2.1 Veterinarians were not involved in the conversion to organic agriculture

The interviewed farmers either stated explicitly that the private veterinarians were not involved in the conversion of the farm to organic or they did not mention them while discussing the conversion period, which suggested they were not involved. This is with the marked exception of the case of IF7 where the veterinarian played an important role in supporting the farmer in the conversion of the farm, for example by advising the farmer on the adaptation of the feeding system of the cows.

2.2.3.2.2 Veterinarians mainly visit the farms to treat diseases

In the interviewees' herds, veterinarians generally intervened in relation to ill animals, calving problems or acute herd health problems when farmers felt that they could not manage to resolve the problem themselves (Table 2.2.2). In general, farmers were satisfied by this service provided by the veterinarians, and they appreciated veterinarians their availability to intervene quickly in emergencies and for their technical competences, such as surgical skills. Moreover, farmers expressed that the need for this type of intervention by the veterinarian on their farms would always remain. Less frequently, farmers asked their veterinarians to intervene to diagnose a disease problem, unknown to the farmer, and to choose treatments for certain specific conditions or to give their opinion on specific questions, or for tasks such as echography for pregnancy. Veterinarians were mainly given a role of therapist, rather than a role in disease prevention or animal health promotion on the farms.

2.2.3.2.3 Unfulfilled request for support to prevent disease and/or in alternative medicine

Farmers' expectations to their veterinarian varied widely from 'only intervening in emergencies' to more involvement in the development of agriculture in general.

Farmers felt that they had insufficient support from their veterinarian, mainly in two areas, namely disease prevention and alternative medical treatments. Some farmers focused mostly on one of these two domains, and others had a focus on both.

Regarding disease prevention, a number of farmers reproached their veterinarians for that they did not take the initiative to take a step back, reflect and discuss with farmers on the possible origin of disease problems encountered on their farms, either when being at the farm for a (recurrent) health problem of an individual animal, or during the annual mandatory visit.

> ***IF1:*** *For me, that is what I reproach. To explain us, tell us what the probable causes are. And to tell us, yes, on what we should work. For example, everything that is about hygiene, we are aware of that. But he does not pronounce the word. He arrives, he treats…(…) even if he comes just here in an emergency, well, I would like him to tell me, to ask me questions,…That is what I reproach him.*

> ***IF10**: The annual mandatory visit, it should be for that, to step back and…to re-examine the feeding system. To look for the flaws. That is what I miss.*

Some farmers felt that only they themselves or other actors intervening on the farm questioned the origin of (recurrent) health problems, but still found it a part of what they would expect the veterinarians to do more pro-actively, like the example of IF5 below.

> ***IF5**: The other day the hoof trimmer came. He told us why [we have diseases](…) He said: 'there is a problem. You have a problem with the bedding that heats up, or you might have a problem with the surface of the concrete, or things like that', and he explained all of that. He explained why the abscess was on the side of the hoof (…) I found that very good. I believe that veterinarians should do that too. When you have always the same case, that comes back regularly, at that moment, you have to ask yourself some questions.*

Regarding alternative medicines, farmers articulated different expectations for their veterinarians, ranging from having a veterinarian that only sells alternative medicines is sufficient, veterinarians that are open-minded towards and looking for alternative solutions to chemical drugs, and to veterinarians that are able to advise farmers in their use. As farmer IF5 expressed: '*They [the veterinarians, Ed.] are not looking for other solutions. That is a pity.'* As a result, farmers often educated themselves on the use of alternative medicine through courses organised by local (organic) farmer groups or agricultural institutions. Farmers bought alternative medicines, if not sold by their veterinarian, from local pharmacies or specialized companies. Alternative medicine was the first choice in treatment options for four farmers in the study (Table 2.2.2), although they all would allow the use of allopathic treatment if they considered it needed. Most farmers used both alternative and allopathic treatments.

2.2.3.3 Farmers' reasons for not adhering to advice of veterinarians

2.2.3.3.1 Sometimes veterinarians' considerations of good practices seem conventional

A number of times farmers expressed that they would like veterinarians (and other advisors) to take the time to reflect on their working methods and to try to understand alternative methods. What veterinarians and advisors in general consider as good practices are not always adapted to the objectives of organic farmers, as described below by IF10.

> ***IF10:** Not only the veterinarians, also the technicians that work on crops, well, they don't understand what we do. Some, some of them don't understand it. Even in the meadows without clover, after a couple of years, well, the meadows grown normally, they are green in spring like the others [conventional, Ed.], maybe a little bit later, because the others, had nitrogen in March (…) but no, we always [are advised, Ed.]…to add 30 units [of fertilizer]. They do not try to see what is happening; to understand what is happening (…) certain advisors cannot [question their own methods, Ed.]. It is stronger than them…because, they have had an education in which everything is explained with certain logic, so we must not break that all down.*

Veterinarians' reference values for a successful dairy farm might also be different from farmers' values. IF9 gave the example that his veterinarian considered organic dairy farms with high

production levels more successful than his farm. The farmer disagreed with the veterinarian because he related a milk production at that level to feeding imported soya, which he considered not coherent with an organic farming system.

Table 2.2.2: Characteristics of the organic dairy farms and organic dairy farmers' appreciation of the health status of their herd, their animal health management practices and collaboration with their private veterinary practitioner

Farmer ID	Years certified organic	Average number lactating cows	Average milk production (kg/cow/year)	Current herd health status and disease challenges	Usage alternative medicine	Main reason veterinary intervention
IF1	4	64	8000	Some cows show a strong loss of body condition after calving	yes, occasionally	Individual disease problems
IF2	2	100	5400	No particular disease problem	yes, limited use	Individual disease problems
IF3	1	85	4500	Insufficient mastitis cure rates during dry period	yes, occasionally	Individual disease problems
IF4	6	40	4500-5500	Some mastitis problems after the dry period	yes, important	Individual disease problems
IF5	6	60	Unknown	Mastitis problems during the dry period	yes, important	Individual disease problems
IF6	6	85	7000	No particular disease problem	yes, occasionally	Individual disease problems
IF7	17	55	6000	No particular disease problem	yes, first choice	Diagnose individual disease problems
IF8	0	60	6000	No particular disease problem	yes, occasionally	Individual disease problems
IF9	15	23	4000	No particular disease problem. In the recent past, rise in herd SCC	yes, limited use	Individual disease problems
IF10	6	30	5000	No particular disease problem. In the recent past, rise in herd SCC	yes, first choice	Individual disease problems
IF11	0	75	Unknown, used in cheese production	Milk quality for the transformation of milk to cheese	yes, first choice	Individual disease problems, diagnosis disease problem
IF12	16	42	5000	No particular disease problem	yes, occasionally	Individual disease problems, hoof trimming, dehorning calves and fertility checks
IF13	13	50	5800-6000	Lameness problems, calves with coccidiosis	yes, occasionally	Individual disease problems
IF14	7	50	5000	No particular disease problem	yes, first choice	Individual disease problems

2.2.3.3.2 Veterinarians solutions to animal disease problems are sometimes not in line with organic dairy farmers' objectives

Some farmers were unsatisfied with the solutions for animal disease problems proposed by their veterinarian and this could also influence their opinion on veterinarians as advisors. They explained that a major reason for being un-satisfied with their veterinarian was that veterinarians' solutions did not correspond to their objectives as individual organic dairy farmers. In several occasions this feeling was related to the veterinarians' first choice of allopathic treatments, and disagreement on the threshold for using treatments.

> ***IF8****: Like, apparently, we managed to reduce the [infection] pressure, last year, it was not too bad at the level of the somatic cell count, it was at an interesting level, so we went for phytotherapy to try to work on the immunity of the animals, always with a coprology monitoring, to now where we are. Because I am in favour of slowing down [on treatments, Ed.], but not blindly, because one day it will back-fire on me. So, we monitor afterwards to know where we are, and of course. Of course, as soon as we see three eggs [of parasites], we should bomb. We have intervention levels that are a little bit higher. Otherwise, we will never succeed. If we wipe everything clean, there is no immunity. We act based on alert levels that are a little bit higher. It is here, in terms of advices, sometimes they scare themselves…*

As illustrated below, certain farmers expressed that this difference in treatment threshold is, at least partly, motivated by the organic regulation.

> ***IF10:*** *So, hmm, I used to use antibiotics at drying-off from [an individual somatic cell count level of, Ed.] 300.000, and then the veterinarian said to me; 'no, it should be at 200.000', what does that mean? Well, if I do that I treat systematically (…) well, yes, I told him 'I cannot, it is like… anthelmintics, it cannot be systematically. It can…if the animals are ill (…) I do not normally have the right.*

Farmers could also be reluctant to ask veterinarians for further diagnostics tests or advice because they felt that in the end the outcome would be that veterinarians as a first choice would propose to treat with chemical drugs anyway.

The fact that the medicine proposed was not always in agreement with farmers' preferences had in a few cases severe consequences on the relationship between the farmer and the veterinarian. Examples were stated in which one or the other party decided to reduce the working relationship to what is strictly needed.

> ***IF5:*** *So he [the veterinarian, Ed.] came to suture [a cow, Ed.], and he said; 'we will give her a product to eliminate the toxins, so that she will not…' And we, we said to him; 'wait, we have what is needed, we will give her…' We had from company X what was needed to make her pee, in fact, it was very simple, to remove everything that could cause an oedema. After that, he did not talk to us anymore. Well, he did not talk to us anymore…He did his job, but…it did not go any further. He was not…He said; 'they perform their medicine at the side'. It is a bit ….voodoo-style.*

> ***IF14:*** *For me it [our working relationship with veterinarians, Ed.] is limited to diseases…parasites, coccidiosis, yes, things like that where he explains and it is interesting, it is interesting also because they have an experience…and it allows to detect symptoms. We can also work well with them on analyses for example, milk analysis, faecal analysis, but well it ends there.*
> ***JD:*** *It is not an analysis with a discussion afterwards on how to deal…*
> ***IF14:*** *No, because I know very well that…I will not necessarily listen so…*
> ***Wife IF14:*** *because they don't have any alternative to propose than…*
> ***IF14:*** *than antibiotics*
> ***Wife IF14:*** *only antibiotics or synthesized products*

All interviewed farmers who used alternative treatment, did this without consulting their local veterinarian. In general, farmers' use of alternative treatments seemingly did not impact the working relationship with the veterinarian. Some veterinarians sold alternative medicine to farmers, although they rarely provided farmers with advice on their use and sometimes told farmers that they did not even believe in its effectiveness even though selling the products. Other veterinarians asked farmers about the results that they obtained using alternative medicines or expressed an interest in alternative treatment but a lack of time to invest to educate themselves on the subject.

> ***IF7:*** *They [the veterinarians, Ed.] are eager to get information, on what we do, in the domain of homeopathy, aromatherapy, they are very eager. It really surprises us. We are well complementary to each other, there is a good partnership, ehm,… with regard to our differences, our approaches, and ehm. And indeed, with aroma- and homeopathy we cannot solve everything, sometimes, well…well we need the prescription.*

2.2.3.3.3 Farmers question veterinarians' credibility when they sell drugs

Several farmers questioned the credibility of advice given by veterinarians to promote health as veterinarians' live from the sale of drugs and the cure of ill animals. Some farmers were wondering whether veterinarians are impartial and act independently from the pharmaceutical industry.

> ***IF6:*** *We have the impression that medicine that…that the sale of medicine is important for them [the veterinarians] (…)*
> ***JD:*** *Would it be imaginable that veterinarians one day sell advice?*
> ***IF6:*** *Well, we are not looking for, we would not expect advice to come from them (…) we would be surprised if advice would come from them, because they will certainly be at loss. We look for it in farmer exchange groups in fact, amongst producers, and from external speakers. Vets like…Yes, and there are vets that, that do it [intervene as experts in farmer exchange groups] because they do not have the same approach. They are neutral in fact, in the end, because they do not sell anything.*

Some farmers explicitly stated how they appreciated when their veterinarian did not push them to buy or use medicine. The fact that veterinarians directly earn money from the sale of drugs made some interviewees question their interest in general animal health promotion and their credibility as

advisors herein. . Furthermore, it could also influence the image of related activities provided by veterinarians, as shown in the example below.

> ***JD:*** *And do they [the veterinarians, Ed.] provide sometimes education for farmers?*
> ***IF12:*** *Eh well, we have been invited sometimes…I never go because it is more for the companies that sell the…anthelmintics and everything like that…*

2.2.3.3.4 Farmers' expect their veterinarians to have an advisory posture

Numerous farmers felt that veterinarians often were in a hurry, although they acknowledged and understood that veterinarians had busy working days. For example IF5 stated: '*They work…it is impressive how much they work (…) veterinarian X, day and night we can call him*'. However, veterinarians often seemed to be taken up by emergencies leaving no time for other activities. According to some farmers, it was due to this lack of time that some veterinarians do not take the time to walk around the farm and understand how farmers work. Moreover, it was one of the explanations given by farmers for the situation, described earlier, where veterinarians did not take the time to reflect on the animal health situation of the herd. Or, take time to identify risk factors for disease problems on the farm, discuss these with the farmers and give advice on disease prevention.

> ***IF10:*** *they [the veterinarians, Ed.] will not necessarily look at the environment, you need to take time to do that. It is not easy. They are caught up in that thing [emergencies, Ed.].*

This time pressure was experienced during farm visits of veterinarians for individual disease problems of an individual animal, but it also influenced in some cases on the amount of exchanges the farmers and veterinarians had during the annual mandatory sanitary visit.

In addition, for farmers who used alternative approaches in health management, that require time to observe the animals to diagnose a disease problem, the fast intervention of veterinarians did not always match with their approach.

> ***IF14:*** *It always has to go fast. Everything is done in emergency mode. Even when they come to nurse a cow it is hmm... That is why it is not compatible with another system [alternative methods]*

In the example above the farmer refers to his use of a French animal observation method that links clinical signs to the identification of nutritional misbalances. To use this method, time for close observation is needed both of individual animals and the herd as a whole. Some veterinarians also explained to the farmers that they could not invest more time in training themselves for example in alternative methods. Some farmers questioned whether this was due to a lack of time or lack of possible return on investment due to the fact that the organic dairy sector represents a small proportion of their clients.

Farmers sometimes regretted the fact that their veterinarian did not use their experience, built up by visiting different farms and encountering different situations every day, to exchange with them on possible effective practices seen in other farms.

> ***JD:*** *Would you be willing to pay the veterinarian for advisory services?*
> ***IF1:*** *I do not know. I would have to be sure that he has the competences. Because I am not*

> *sure that when doing operations all the time, having a curative role, he…he stands back, if he doesn't interrogate. Because it is by confronting all the farm strategies that, that allow to give good advice, on what is being done better elsewhere.*

In other words, in order to be able to give advice, certain farmers expect veterinarians to show that they have a reflective and pro-active posture in trying to analyse and understand the origin of the herd health situations. Another way to accomplish this, as suggested by the farmer below, is to review regularly herd health data, such as medicine consumption. The French law makes it compulsory to have a yearly visit from the veterinarian delivering medicines to the farm in order to evaluate herd health with the farmer.

> ***IF8:*** *But we see that veterinarians do not review. We should have it [an annual review report of the herd' health. Ed] every year and for everybody, but it is not done (…) The number of boxes of antibiotics used, it allows to know, more or less, how many mastitis cases there have been and to ask questions related to that. But there are not many veterinary clinics that do it. And if we want to enter, in terms of advice, on a farm, for me it is a must.*

Several farmers expected of veterinarians to have a pro-active approach to give advice when they visit the farms for individual health problems. This requires that veterinarians take the time to discuss with farmers and observe and analyse the situation.

> ***IF12:*** *I talked to him about buying calf huts. (…) He advised me on that. Yes, I quite agree with him on the preventive advice anyway, even if homeopathy, herbal medicine, all of this is not at all his thing. However, doing prevention so that the animals are doing better, there is no problem, I have enough trust in him. That is why I don't hesitate to do everything that is hoof trimming, things like that, there are others…I could make others do that. But he comes for the ultrasounds, hoof trimming, and everything. So we have a good relationship. And when he is here, well we discuss. Nevertheless, he gives advice.*

One farmer (IF7) suggested setting up a contract with the veterinarian in which health objectives would be stated, aiming at developing a different type of partnership with the veterinarians. As he stated: *'if the veterinarian is very good, he must be a partner of the farm, for me he must be more than a caregiver (…) To anticipate health problems of the herd, that, is for me the place of the veterinarian.*' IF8 already uses the payed advisory services of another veterinarian than his local veterinarian to provide him with advice regarding the production and reproduction performances of the herd.

2.2.3.4 Appreciation of continued education and farmer experience exchange groups

Most farmers participated regularly in farmers' education and/or exchange groups, except for two farmers who preferred to inform themselves in another way, such as reading or informal exchange with colleagues. Farmers participated in courses given by a specialist on a specific topic that are organised by local Chambers of Agriculture and/or other (organic) farmers' organizations. Farmer experience exchange groups were also considered by several farmers as important sources of information for the management of their farm and herd health. These groups have in common that the farmers visit in turns each other's farms and discuss the project and/or problems of the farmer in

question. Sometimes, other topics are discussed as well with an invited expert or the economic figures of the farms are compared. Some of the interviewed farmers were participating in several different groups at the same time and farmers were not always in groups specific to organic farming.

Aspects of these courses and groups that are highly valued by the farmers are; the opportunity it creates to exchange on experiences and on the results of practices and products used. Moreover, it is considered by some farmers as an opportunity to collect external opinions on their farm or problems and thus to step out of their daily routine and view with a renewed look at his or her farm and practices.

> ***IF13:*** *Yes, well, I believe that working in a group is more rewarding than having a personal advisor (…) I meet people that are organic, but in all kinds of [farming Ed.] systems. So, with a lot of different things and you have to take the best…*

Several farmers expressed that they select from the information received what they consider most appropriate for their farm situation. Another positive aspect of these groups, sometimes mentioned by farmers, is that they consider the invited experts as independent and not participating with the aim to sell something.

2.2.3.5 Farmers' optimism in the new generation of veterinarians to meet their expectations better

Some farmers had already experienced that the new generation of veterinarians seemed more open to exchange of information in general and/or showing more openness towards organic farming. This made some farmers express the hope that the new generation of veterinarians would meet their expectations to a larger extent compared to the generation of veterinarians close to their retirement.

> ***IF8****: So veterinarians, in general, they say: 'The organic [farms, Ed] when we go there, it is always bad'. That is the first thought. For the guys that have 50-55 years, it is: 'Where is it going?' Gradually, we relax. (…) The young ones are different, also because there are more people in organic. It has been growing, so they have more experiences working in the farms, technical farms or not, but in different systems. So the organic are gaining importance in the clienteles, in terms of numbers. Not in terms of sales but in numbers. So obviously, they ask themselves different questions when that happens.*

So some farmers explain the differences between generations by the fact that veterinarians nowadays will have more experiences with organic dairy farmers than veterinarians had in the past. Furthermore, farmers reflected on the fact that certain young veterinarians showed personal interest in organic farming e.g. by eating or producing organic themselves.

2.2.3.6 Understanding why farmer's perceived approach to veterinarians to health might not correspond to that of farmers

Several points could be identified were veterinarian's approach of animal health, as farmers perceived it, did not meet organic dairy farmers' health approach (Figure 2.2.1). From organic dairy farmers' point of views their veterinarians' approach of health did not correspond to theirs at several levels. First, organic farmers seem to have a long term strategy that is focused on animal health

promotion. Whereas farmers experienced that veterinarians mostly focus on curing disease and that they, in their eyes, do not have a pro-active approach to find, more sustainable solutions to disease problems (having an advisory posture) and question the credibility of their advice on animal health promotion when at the same time earn money from selling drugs. In addition, sometimes veterinarians' solutions to disease problems are not in line with organic dairy farmers' objectives of minimizing the use of chemical solutions and they cannot provide veterinarians with other solutions. Farmers participating in continued education and/or farmers' experience exchange groups had very positive experiences with this. The characteristics of these activities can, at least partially, explain why they were perceived as positive by farmers and why they sometimes were in contrast with the approach of veterinarians (Figure 2.2.1, grey circles). Advisors invited to participate in these groups were often regarded as independent, in other words not selling veterinary treatments. Moreover, these groups are a source of information for farmers on different practices to manage the farm and the herd. The exchange of experience on practices amongst farmers, but also with the advisors is highly valued and was often missed in their collaboration with their veterinarian.

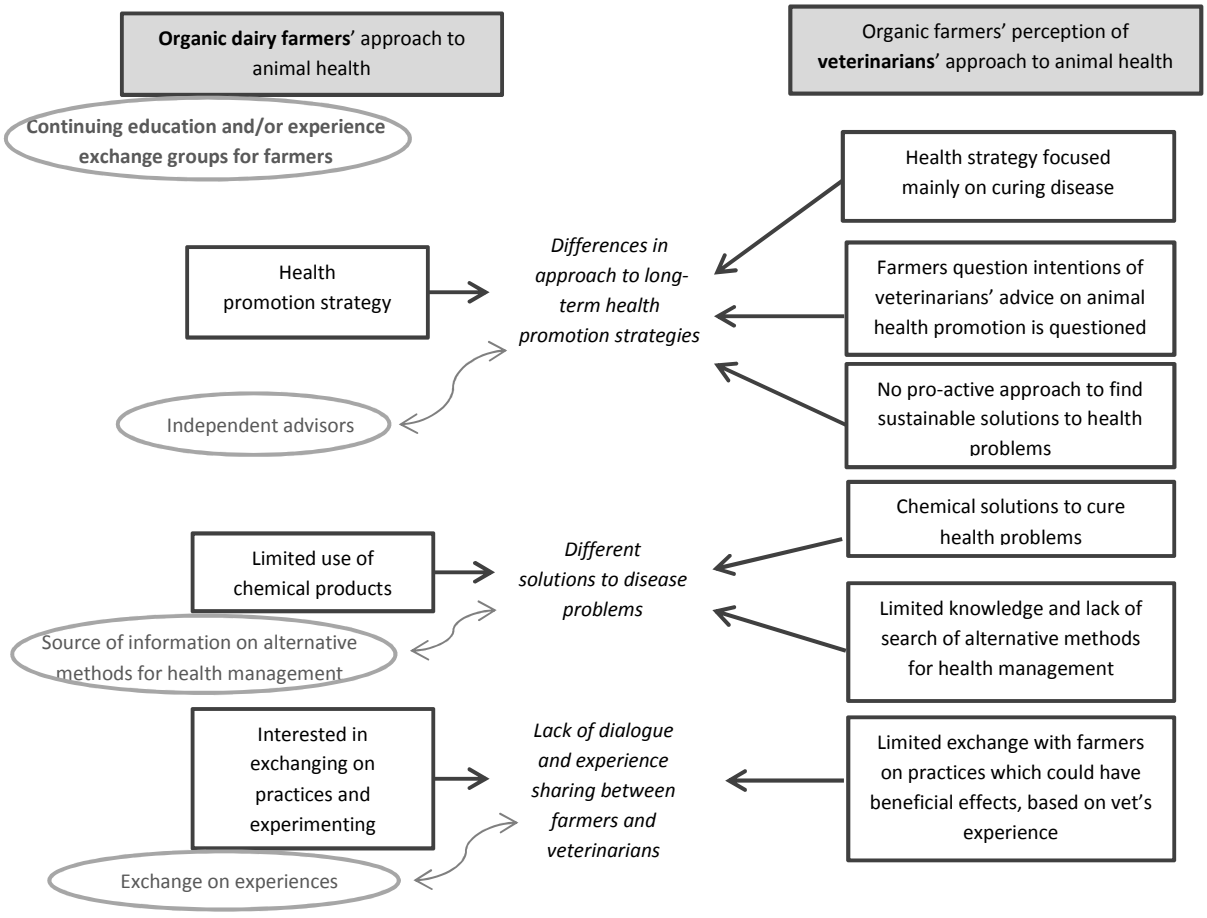

Figure 2.2.1: Model of understanding illustrating how organic dairy farmers perceive veterinarians' approach to animal health, and why they sometimes find difficult to see how veterinarians could fit in with their approach of animal health (in the boxes). General approaches of animal health of organic dairy farmers and veterinarians are depicted (grey boxes). Farmers' focus regarding animal health management is depicted (white boxes on the left-side) and examples of why the perceived animal health practices do not correspond to farmers' approach are given (white boxes on the right side) Furthermore, it explains, at least partially, farmers' appreciation of continuing education and/or farmer exchange groups because it is often more in line with farmers' approach of animal health management presenting the characteristics of continuing education and farmer exchange groups (in the circles).

2.2.4 Discussion

Added value of the study to the existing body of knowledge

This is, to our knowledge, the first study conducted to explain, from the perspective of French organic dairy farmers, the interplay between what role veterinarians are taking in the organic farms and the role veterinarians are given by farmers. In previous studies, the role of the veterinarian was not the main focus of the study, but one of the elements raised by farmers when discussing their animal health strategies. A detailed understanding of what characterised the dynamics of their collaboration has been lacking. Furthermore, the results of this study allow us to put into perspective the results of a recent qualitative research study in the same geographic area and period in time, studying private veterinary practitioners' point of view on their role in organic dairy farms (Chapter 2.1).

The role of veterinarians on organic dairy farms

The veterinarians had mainly a therapeutic role on organic dairy farms studied. In earlier studies organic dairy farmers already pointed out that veterinarians do not have an advisory role in their animal health promotion strategies (Vaarst et al., 2003). Veterinarians, in the same geographic region and time period, explained that they were not always able to have an advisory role on organic dairy farms, even on farms with animal health situations that were below their expectations (Duval et al., 2016a). In this light, it is interesting to underline the fact that certain organic dairy farmers interviewed in this study, without important health problems on their farms at the time of the interview, expressed a need for veterinarians' support in disease prevention and reported a lack of veterinarians' pro-activeness to be able to add to their therapeutic role an advisory role. Moreover, some of the interviewed farmers expressed that when they trusted the quality of the advice given, they were not opposed to paying advisors for advisory services. Some farmers already used payed services in animal health but from advisors other than their local veterinarian.

To give or take an advisory role?

The question remains thus on what is determinant in farmers' decision to involve or not the veterinarian in his or her animal health promotion strategies. As reported earlier by organic and conventional dairy farmers (Kleen et al., 2011; Vaarst et al., 2006), also in this study farmers acknowledged veterinarians' capabilities in their therapeutic role. However, an advisory role requires different knowledge and skills, and veterinarians' qualifications for that role can be questioned by farmers (Kristensen and Enevoldsen, 2008). Kleen et al. (2011) described two types of roles that need different types of communications and levels of mutual trust and shared knowledge between farmer and veterinarian. First, a transitory problem-focused role is described, in relation to emerging and acute problems that need to be resolved quickly. Second, a role dealing with the long-term prevention of health problems, which is more labour intensive and requiring, amongst other, the identification of goals, data analysis and a continuous process of herd health monitoring and intervention when needed. Both roles are built upon established permanent interpersonal communication between farmer and veterinarian aiming at reaching a state of mutual trust and understanding (Kleen et al., 2011).

Organic farmers perceived a lack of interest of veterinarians to take the opportunities to understand their farm and to reflect with farmers on animal health problems. Farmers explained this mostly to be due to the busy work days of veterinarians. However, rural veterinarians, from the same geographic area and providing dairy farmers with advisory services in animal health, also declared they did not see how they could profit sufficiently from investing in developing special advisory service for organic dairy farms. Moreover, veterinarians did not always find value in organic farming, since their primary focus is animal health and some veterinarians experienced disease level on organic dairy farms which was below their expectations (Chapter 2.1) . This is in contrast to farmers, who found organic farming interesting and were motivated to convert because they wanted to develop their farm with regard to environmental, health related and economic perspectives.

Organic farmers' aim for animal health promotion goes beyond veterinarians' therapeutic approach

Clearly, farmers perceived that veterinarians had a focus on disease which did not correspond to farmers' animal health management practices aiming at animal health promotion. Farmers' approach was in line with the organic principles and regulation and health issues required thus a whole farm approach. When adopting a holistic approach to health, like in organic farming, the use of pesticides, fertilizers and chemical drugs is considered to be potentially harmful to health (IFOAM, 2005). The focus on disease might explain why veterinarians did not hesitate to use chemical solutions when faced with animal health problems. Organic dairy farmers on the contrary might be more reluctant to use these due to their objective to produce more environmental friendly. These different objectives result in different, sometimes opposing practices by organic dairy farmers and their veterinarians. In Chapter 2.1 the example was shown of the conflict between farmers' aim for naturalness as a precondition for health with veterinarians' priority for physical health. Opposing practices, originating from a different approach to health, have been identified during the interviews with both French organic dairy farmers and veterinarians. These differences can result in difficulties encountered in their collaboration and it can sometimes lead to situations in which communication is reduced to the bare necessities, with no exchange of experience and lack of trust in veterinarian's role as an advisor in animal health. This is possibly due to lack of understanding and reflection upon the nature and origin of these differences.

Farmers would like to be able to trust veterinarians' independence and expect them to be pro-active

In addition, certain farmers experienced a lack of trust in veterinarians' independence towards the pharmaceutical industry or veterinarians' dependence of treating ill animals. This can lead to situations of lack of trust in the advice given, since farmers question veterinarians' intentions. Kleen et al. (2011) recommend clearly separating the advisory services aiming for the prevention of health problem from the problem-focused services, in order to assure the quality and suggest that it might facilitate billing for advisory services. However, this is not easy for veterinarians in the usual collaboration with farmers as their will be always problem-focused interventions, as was also acknowledged by the interviewed farmers such as calving problems or individual ill animals. Furthermore, these reasons for interventions are a potential important 'point of entry' for veterinarians on organic dairy farms from which they can develop an advisory role. In contrast to the interviewed veterinarians, the farmers have mentioned spontaneously alternative organizations of advisory services possibly between farmer and veterinarians, such as contracts or collaboration with veterinarians that only provide advisory services on herd health management and production.

Indeed, since a couple of years there has been a rise in France in the number of farmers' organisations that have developed veterinary services. In a recently published work by Ruault et al. (2016), two cases were presented. The reasons for contracting veterinary services were to assure the continuity of veterinary services in a remote area for one case and a need to create an environment to find and exchange and technical advice for farmers who aim to develop low-input farming systems. Farmers did not pay veterinarians' interventions but payed an annual fee based on their herd size. In exchange, veterinarians provided farmers with; 1-3 visits a year, interventions when needed, advice by telephone, training and excursions. Farmers' appreciation of this organization of the collaboration was the result of the quality of the relationship they had with their veterinarian. Farmers emphasized on the quality of the dialogue with their veterinarian; focused on the understanding of the disease and which is an equal discussion between farmer and veterinarian on the possible origin of problems or practices to prevent disease. This was in contrast to other relationships that farmers had encountered, which resembles situations described in this study were the veterinarians comes in, does not explain the origin of the problem and imposes a solution to farmers (Ruault et al., 2016).

Organic dairy farmers reproached veterinarians a lack of pro-active approach to identify and comment on problems on the farms. Veterinarians might be not aware of their approach towards farmers, in the past veterinarians showed not to have a realistic view concerning having a pro-active approach in herd health management activities in comparison to the opinion of dairy farmers on this subject (Hall and Wapenaar, 2012). Having a pro-active approach has been identified as a crucial element in the transfer of knowledge and motivation in order for dairy farmers to successfully adopt preventive measures to ensure e.g. udder health (Lam et al., 2011). French veterinarians have indeed identified having a more pro-active approach to try to change their collaboration with organic dairy farmers as one of the solutions to evolve from the therapeutic role on these farms, either during farm visits for an intervention for an individual ill animal, during the annual mandatory visit or be being more involved in farmer education (Chapter 2.1). Other methods have been described to initiate the dialogue between organic dairy farmers and their advisors in animal health. A participatory approach has been described to design a herd health monitoring system adapted to farm specific situation and which stimulates at the same time the dialogue between farmer and advisor, on e.g. farmers' objectives (Chapter 4).

Organic dairy farmers' taste for learning with peers

The transfer of information and learning with peers seemed to be important to the interviewed organic dairy farmers, although we could not compare whether it is more important than in conventional farming systems. Farmers can have different learning styles, thus ideally for the transfer of knowledge, different learning styles should be bared in mind (Lam et al., 2011). Vaarst et al. (2007) also showed Danish organic farmers' appreciation for situations of common learning to reach a common goal, in that case phasing out the use of antimicrobials. Learning in farmer groups proved to be a positive experience for farmers, they appreciate for example the fact that individual farmer' goals and values are recognized and are the starting point for searching solutions within that framework. Other positive elements were the opportunity to learn from positive experiences of other farmers and the mutual trust and the feeling of equality between participants (Vaarst et al., 2007). Although the farmers interviewed in this study often invited an external expert to their farmer groups, a similar appreciation of farmer groups by farmers was found in the French context.

Historically, organic agriculture has received relatively little support, compared to conventional innovations in agriculture, from governments, the scientific community and agricultural extension organizations. Organic farmers have mainly found support from each other to develop their farming system and practices (Padel, 2001). Even though the organic dairy sector has been growing and is now more widely spread, veterinarians still considered organic dairy farming as a niche market in their practice. As discussed above, even today, this influences veterinarians' motivation to invest themselves in the support of the organic sector, e.g. it can influence veterinarians' willingness to adapt their advisory services to organic farming (Chapter 2.1). In situations in which farmers do not find references for their alternative production methods, exchanging with colleagues has been showed to be a way to construct knowledge. It has been shown that from the observation, analysis of individual experiences and its reconstruction in more general lessons learned, farmers can learn from peers, when exchanging knowledge in groups (Goulet, 2013). The farmer groups to which farmers referred to did not have a common goal, like the Stable Schools described by Vaarst et al. (2007) and had different compositions, promoters and objectives. It would be interesting to study further the farmer groups on animal health management to be able to understand its value; identifying what kind of learning processes occur, determining what kind and in which way knowledge is constructed and which factors contribute to its perceived success (social aspects, bottom-up approach, advice adapted to the context, etc.).

Importance of the dialogue between farmers and advisors

When comparing the results of Chapter 2.1 and 2.2 organic dairy farmers and veterinarians seem to be stuck in a situation in which farmers expect veterinarians to more pro-actively show that they can be pertinent advisors in animal health. Veterinarians on the other side expect farmers to ask for support. Both seem to be waiting for the other to take action. The importance of dialogue, an open and mutual exchange of experiences is of importance to organic dairy farmers in their relationship with veterinarians. The (lack of) dialogue influences their perception on veterinarians' capabilities to have an advisory role on their farms. Moreover, promoting dialogue could improve their mutual understanding of each other's animal health objectives and related animal health practices, understanding the differences between animal health promotion versus an approach focused on disease. Rather than looking for solutions to animal health problems using practices from both their 'worlds', the dialogue could be a starting point for a collaboration in searching for innovative solutions.

2.2.5 Conclusion

In the interplay between veterinarians and organic dairy farmers, veterinarians are mainly taking and given by farmers the role of therapists in the animal health management on organic dairy farms. That is despite a demand from certain farmers for more involvement of veterinarians, mainly in disease prevention and/or alternative treatments. In general, it seemed that both parties are waiting for the other to take action. The key to break this impasse could be to improve the dialogue between organic dairy farmers and veterinarians, starting taking time to exchange on their experiences. Veterinarians seem in need to improve their understanding of farmers' (organic) objectives and adapt their advisory services in order for it to be acceptable to farmers. Understanding organic farming principles and farmer's objectives requires an investment by the veterinarians. Farmers

would benefit from understanding veterinarians' background and reason for action. Reinforcement of the dialogue between the two 'worlds' could be a good starting point, to move forward in search for innovative solutions in animal health management. Although certain farmers would appreciate advice from veterinarians on alternative medicine, this should not be the only focus of the dialogue between organic farmers and their veterinarians. Due to the importance of continuing education and experience exchange groups to organic dairy farmers, it would be of interest to study further their value in animal health management.

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Chapter 3: A participatory research approach to design a Herd Health Management and Production program for organic dairy farms

3.1 Introduction

This PhD project was partially embedded in one of the work packages of the European Union's Seventh Framework Programme project 'Impact Matrix analysis and cost-benefit calculation to improve management practices regarding health status in organic dairy farming' (IMPRO). Our research team was leading this work package, which had the objective to improve monitoring and prevention at herd level, by developing proactive disease monitoring and prevention tools adapted to organic dairy production in France and Sweden. The combined use of the two tools functions as a herd health and production management (HHPM) program. Other objectives of the work package were to evaluate, under commercial conditions in France and Sweden, the feasibility of the use of the tools and their effectiveness in terms of animal health improvements (these results will be presented in chapter 4 and 5).

A promising way to improve herd health on organic dairy farms would be to promote the use of herd health planning activities by farmers, as is discussed in detail in the general introduction of this thesis and suggested by two previous projects dealing with health on organic dairy farms (Vaarst et al., 2011). However, as we have seen, an important condition for the uptake of advisory activities and recommendations on animal management by farmers is its perceived pertinence by farmers. A dialogue between farmers and their advisors is necessary to understand the factors that will determine this perceived pertinence. Thus, in order for the tools to be used and their effectiveness ensured, they should not only be complete and based on scientifically sound knowledge. They should also promote the dialogue between farmers and advisors and be adapted to field-use.

Using a participatory research approach for the design of the HHPM program seemed a promising approach to improve the programs' relevance on the field. It was in this functional perspective that the participatory approach was used, aiming for an acceptable tool, to be known and used by the targeted end-users (Lilja and Bellon, 2008). Furthermore, to promote innovation it is considered needed to supplement scientific knowledge with local knowledge from stakeholders. Using a participatory research approach, bringing together dairy farming stakeholders and scientists, has been shown to foster the dialogue between the two groups and was considered as effective to develop innovative solutions for sustainable agriculture (Padel et al., 2015).

The objectives of this chapter are: (i) to describe the participatory process of the genesis of the HHPM program and (ii) to describe the version of the HHPM program that will be tested and evaluated in chapter 4 and 5.

3.2 Main steps in the conception of the HHPM program

Design of a prototype of the HHPM program based on literature and expert consultation

First, the main health disorders that are considered to have a negative influence on cows' health, welfare and production were identified as targets of the HHPM program. Based on their importance in terms of possible negative impact on animal welfare, the following health topics were chosen by the research team: reproductive health and performances, udder health, locomotor disorders and metabolic disorders. Calf health was included too, as it was considered as an area that receives relatively little attention in advisory programs in both France and Sweden, even though important calf mortality rates can be found on certain farms and veterinary drugs are used to treat sick calves.

The research team proposed to use the concept of a HHPM program as a basis for the proactive disease monitoring and prevention tools. The general concept of a HHPM program is to create an interaction between a herd health monitoring and prevention activities, as in a feedback loop. Regular and frequent herd health monitoring activities are put in place and, for health topics identified as weak, putative causes are sought and preventive or corrective action implemented using the prevention tool. The monitoring results that follow will show whether the installed prevention activities improved the situation or not. Prevention activities will be planned according to the monitoring results and so on.

The two research teams involved drew up a first draft for a herd health monitoring tool, which consisted of a set of health indicators with suggested alert levels and monitoring frequency. Different sources of information were used to develop the monitoring tool, examples of indicators were drawn from the Welfare Quality® protocol for lameness, from the 'Cow signals'-method and from the literature available on HHPM programs (Argenté, 2002; Bareille and Roussel, 2011; Brand et al., 2001; Green et al., 2012; Hulsen, 2006; Roussel et al., 2011).

Also a first draft of the preventive tools was designed for the five health topics, listing the risk factors per health domain (Argenté, 2002; Bareille and Roussel, 2011; Green et al., 2012; Roussel et al., 2011).

Various experts in animal health acted as reviewers of the monitoring and prevention tools. These experts were animal health scientists, veterinarians and advisors from France and Sweden who were consulted for their technical knowledge of the health topic in question. The reviewers were asked to assess the tools on the following points; their scientific pertinence, whether elements where missing, if they were feasible for use in the field and to verify the level of details required. At least one expert was assigned to each protocol, however in general several reviews were preformed to complement the tools.

Users' workshops to identify key issues that could impair compliance to the HHPM program

Potential end-users of the HHPM program and accompanying tools were invited to a workshop to give their feedback on the proposed first draft of the HHPM concept and the tools. The aim was to identify key issues that could impair the compliance of users, in particular farmers, to the designed

HHPM program. A HHPM program, in general, is expected to be used by farmers and their advisor(s) in animal health management (Noordhuizen and Wentink, 2001). Therefore, as potential end-users, both farmers and different kinds of animal health advisors were invited to participate in the design of the HHPM program. As national conditions could differ, in terms of existing farm system and advisory services, both in France and Sweden workshops were held.

The workshops were organized in 4 parts. First the IMPRO project was briefly introduced and the objectives of the day presented. It was explained to the participants that the ultimate aim would be to obtain a health monitoring and improvement program that would be effective and useable by animal health advisors, also outside of the research context. The participants were therefore invited to give their opinion on the pertinence of the HHPM program proposed and the conditions needed to optimize its use. Second, the concept of the HHPM program was presented and an udder health problem was used as an illustration of its use. This included time to initiate the discussion with the participants on the concept of the HHPM program. Third, there was a time-slot for a round of discussion on the conditions needed to optimize the HHPM programs implementation. Fourth, particularities of the fact that the tool would be used in a research setting were presented and potential difficulties to be expected of the use in this context were exchanged with the participants. This related for example to the organization of data collection during the intervention study.

Adaptation of the HHPM program and research strategy and protocols

The participants' recommendations, from both workshops, were combined and integrated, when possible, in the version of the HHPM program that was to be tested. The aim was to ensure both the feasibility of the implementation of the HHPM program by the participants in their daily work context and fulfilling the research objectives. For that purpose not only the HHPM program was adapted, but also the research strategy and protocols.

3.3 Outcomes and lessons learned from each step

First version of the HHPM program

The HHPM program would function as follows (Figure 3.1): a standard list of herd health monitoring indicators and their thresholds indicating a herd health problem would be provided to farmers and their advisors. At the start of each visit the monitoring indicators would have to be verified. When one or more monitoring indicators reached the alert threshold indicating a problem, this was supposed to trigger the farmer and the advisor to open the corresponding prevention protocol to help them to identify risk factors present on the farm and corresponding actions to correct the situation.

The prevention tool was thought of as a 'good practices' guide, organising the comprehensive list of risk factors for the five health topics into risk factors per farm area, such as nutrition, housing, milking technique and health management. This would connect the monitoring protocol to the prevention protocol. The proactive approach for disease monitoring and prevention requires regular monitoring of the indicators during the year (four times per year), allowing the farmer to anticipate and react before the health situation severely deteriorates.

The various experts updated the first version of the monitoring protocol by providing suggestions for indictors that are practical to use in real-life conditions. Furthermore, regarding the prevention tool, they help determining the level of details required and completed areas of improvement.

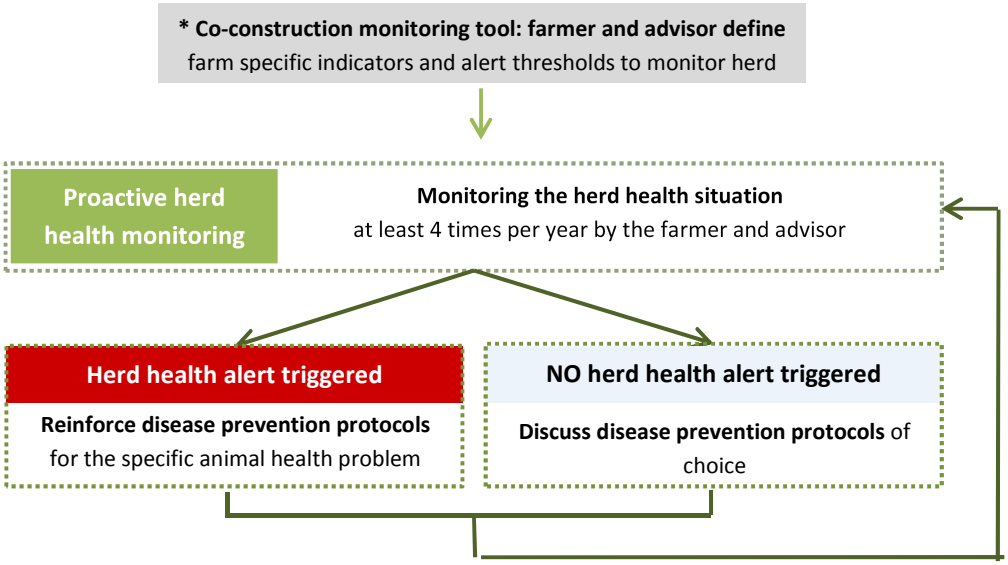

Figure 3.1: General framework of the Herd Health and Production Management (HHPM) program.
*One of the steps added to the initial HHPM program after end-users consultation.

End-users recommendations to improve the HHPM program

In France, 11 persons participated in the workshop; including organic dairy farmers, veterinarians and organic advisors. In Sweden 7 persons were present, including organic dairy farmers, veterinarians and persons from the Swedish Board of Agriculture and the Swedish dairy organisation.

The users agreed with the concept of the HHPM program as proposed by the scientists, namely the feedback loop between monitoring and prevention activities. It was recognised that the HHPM program could be used in a reactive and preventive way. Reactive when the monitoring activities detect a deviation of the health status of the herd, triggering disease prevention activities. A preventive use when herd health levels are satisfying, by reviewing and reinforcing disease prevention measures.

A more adaptable monitoring tool was recommended during the end-users meetings. According to the participants the monitoring tool must allow the farmer to use different health indicators than those proposed in the standard list, as long as the indicators measure the same health disorder. A simple example to show this need was that not all the farmers have the same amount of data on herd health available for their farm and across countries this could also differ. It was hypothesized that advisors' knowledge and experience would allow them to correct farmers' choice in indicators if the advisors deemed it was not pertinent to monitor the health topic using the suggested indicator(s) by farmers. In addition, it became clear during the meetings that a farm specific alert threshold would be more suitable than a fixed alert level. Especially, in organic farming systems, the references values used in non-organic dairy farming systems were presumed to be sometimes irrelevant to

organic dairy farmers' objectives and farm systems. However, participants asked for the standard list of indicators and reference values for their alert thresholds to be provided in order to have a benchmark value and a starting point for the definition of farm specific references.

Regarding the proposed preventive tool, participants suggested two main considerations. First, participants stressed that providing a list of control actions to implement on the farm does not allow any adaptation to the specific farm context. During the discussion, it appeared that formulating objectives to attain, instead of listing control actions to implement, could be a good alternative. The participants stressed the importance of recognizing that an objective can be reached using different management practices. In addition, it was regarded as a way to identify potential 'innovative' practices found in organic dairy farms, in terms of animal health management, that other farmers, advisors and scientists could possibly identify and learn from. Second, initially the protocols were structured in 4 domains (milking, housing, feeding and health management), but the participants expressed their preference towards a structuration in health topic. It was expected that practically a farmer would mostly use the protocols when confronted with a specific health problem on the farm, thus in a reactive way. Consequently, the farmer may want to find all the objectives related to a particular health problem in a unique document.

Version of the HHPM program to be tested

To improve the monitoring tool, workshop participants' thoughts on that subject were taken into account in the test version of the HHPM program and its tools; at the start of the HHPM program, farmers were allowed to choose freely indicators, corresponding alert thresholds and monitoring frequency for the herd health monitoring of their herd, together with their advisor (Figure 3.1). Figure 3.2 describes the proposed method to co-construct a farm specific monitoring tool.

Prevention protocols were organized per health topic and were subdivided in more specific health problems. For example, calf health would be subdivided in neonatal mortality, diarrhoea, respiratory diseases and umbilical infections (Table 3.1). All risk factors of disease were listed, marked as major or minor risk factors (in red or white, respectively) and organized in themes, such as feeding, housing and hygiene (Figure 3.3).

The prevention tool test version displays participants' recommendations in the sense that it is organized in 'objectives to attain', rather than proposing a detailed list of recommendations of good management practices (Figure 3.4).

The complete versions of the protocols can be found on the website of the IMPRO-project (http://www.impro-dairy.eu/index.php/de/2012-10-04-16-49-49/deliverables-2/96-deliverables-wp3/154-d-3-2-final-monitoring-and-preventive-protocols)

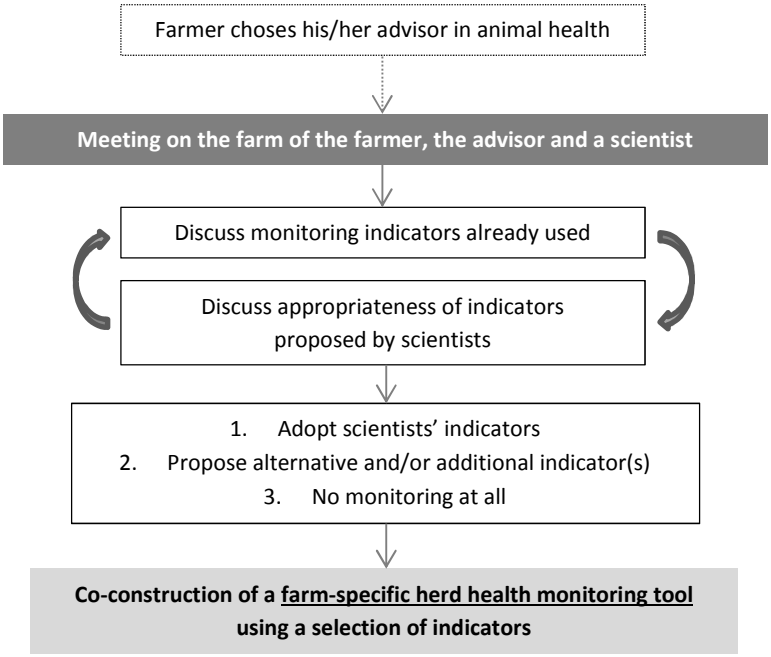

Figure 3.2: Method proposed for the co-construction of farm specific herd health monitoring tool by the farmer and animal health advisor and with a researcher facilitating the process.

Not all workshop-participants' suggestions for improvement could be fulfilled. For example, several participants, both farmers and advisors, asked for monitoring indicators and a prevention tool for parasitological diseases. The research team agreed on this need. However, due to the non-availability of good indicators and a lack of time to create a prevention tool, these suggestions were not included in the test version of the HHPM program at that moment in time.

Nature of the disease	Area at risk	Nature risk factor	Classification risk factor
Laminitis	Housing	cows spent too much time standing on a hard surface L1	**Major** risk factor
		occurrence of traumatisms obtained while the cows are moving L2	Secondary risk factor
	Nutrition	subacute ruminal acidosis L4	**Major** risk factor
		negative energy balance L5	Secondary risk factor
		important mineral deficiencies L6	Secondary risk factor
	Health management	preventive measures are non-existent or non-adapted L7,8,9	**Major** risk factor
		treatments are non-existent or not adapted L10	**Major** risk factor
Interdigital dermatitis	Housing	cows spent too much time standing on a hard surface L1	**Major** risk factor
		occurrence of traumatisms obtained while the cows are moving L2	Secondary risk factor
		humidity and defaults in hygiene in the living areas of the cows L3	**Major** risk factor
	Nutrition	negative energy balance L5	Secondary risk factor
		important mineral deficiencies L6	Secondary risk factor
	Health management	preventive measures are non-existent or non-adapted L7,8,9	**Major** risk factor
		treatments are non-existent or not adapted L10	**Major** risk factor
Digital dermatitis	Housing	humidity and defaults in hygiene in the living areas of the cows L3	**Major** risk factor
	Nutrition	negative energy balance L5	Secondary risk factor
		important mineral deficiencies L6	Secondary risk factor
	Health management	preventive measures are non-existent or non-adapted L7,8,9	**Major** risk factor
		treatments are non-existent or not adapted L10	**Major** risk factor
Interdigital Phlegmon	Housing	occurrence of traumatisms obtained while the cows are moving L2	**Major** risk factor
		humidity and defaults in hygiene in the living areas of the cows L3	**Major** risk factor
	Health management	treatments are non-existent or not adapted L10	**Major** risk factor

Figure 3.3: Example of the organization of the prevention tool, the example of the risk factors for locomotor disorders in dairy cows in a straw yard housing system (L= identification number of the risk factor)

Nature of the risk factor		Objectives prevention protocol	
Claw health problems due to the fact that the cows spent too much time standing on a hard surface	comfort of the lying area	**L1:** Prevent that the time spent standing on a hard surface is too important	**L1.1:** by ensuring that the cows can lie down easily on the deep litter lying area
			L1.2: by ensuring that the cows can lie down on a comfortable surface
	difficult access to the lying area		**L1.3:** by permitting all the cows to lie down dispersed homogenously over the different lying areas
	duration of the milking and fixation at the head gate		**L1.4:** by limiting the time cows spend standing before and during milking and the time the animals spend fixed at the head locks
	repartition of the time spent indoors and on pasture		**L1.5:** by limiting the time the animals spend under indoor housing conditions over the year

Figure 3.4: Detail of the prevention tool 'lameness-interdigital dermatitis'. The outer left column presents the overall risk factor and the second column from the left presents the corresponding sub-risk factors. The columns on the right present the corresponding overall objectives (L1) and its sub-objectives (L1.1-1.5) to attain to prevent disease.

Table 3.1: Content and organization of the prevention tools designed for the Herd Health Management and Production program for organic dairy farms

Main health topic with subtopics			Number of overall risk factors	Number of sub-objectives
Reproductive health and performances				
Age at first calving				13
Calving to first service interval			5	11
First service conception rate			6	14
Interruption of pregnancy			1	2
Udder health				
Cows in lactation	Contagious mastitis model	High mastitis incidence	7	11
		Weak cure during lactation	2	5
	Environmental mastitis model		9	14
Dry cows	Contagious mastitis model	Weak cure during the dry period	3	8
	Environmental mastitis model		7	13
Primiparous cows	Environmental mastitis model		6	10
Calf health				
Neonatal mortality			3	7
Diarrhoea			18	37
Respiratory disorders			12	25
Umbilical disorders			5	9
Locomotor disorders				
Laminitis			6	24
Interdigital dermatitis			7	25
Digital dermatitis			5	15
Interdigital phlegmon			3	6
Metabolic diseases				
Milk fever			7	8
Ketosis			6	8
Acidosis			3	8
Grass tetany			4	4

Implementation of the HHPM program in the context of the research project

The implementation of the HHPM program in the field was linked to certain research objectives, which evolved during the course of the IMPRO project. The fact that each farmer would have the possibility to co-construct a farm-specific monitoring tool and the use of the prevention tool would be adapted to farm specific health situations, required revision of the research objectives. Initially, a 'classical' intervention study was planned, measuring the effect compliance and effectiveness of the use of a HHPM program on herd health. However, at this stage in the participatory process, the research objectives were revised by the research team. It became an objective to evaluate how farmers would use the possibility to design a farm-specific herd health monitoring tool and to evaluate the HHPM programs use and effectiveness on advisory services and herd health. The details of the research strategies chosen for evaluation are presented in Chapter 4 and 5, respectively.

A general choice made by the scientists was to let farmers and advisors implement the program themselves, after introduction to the tools by a scientist, to mimic as closely as possible real-life advisory situations. This choice was validated by the participants of the workshop, considering its future relevance for application in the field.

Nevertheless, data collection during the implementation would be needed to fulfil the scientific objectives and it was anticipated that it might interfere with the implementation of the HHPM

program as it would require additional time of the participants to report their activities to the research teams. In order to minimize the workload of farmers, who would implement the HHPM program, it was decided, based upon the recommendations made during the workshop, that it would be the participating advisor providing feedback to the research teams on the program' implementation. As this additional recording should be minimized as much as possible, the scientists designed a format for reporting back to the research groups by advisors that was close to the report sent back to the farmer after the farm visits. Furthermore, the advisors were provided with paper and electronic versions templates of the documents used for recording.

3.4 Discussion

The co-construction of such a program by scientists and stakeholders from 2 countries resulted in significant changes compared to the first draft produced by scientists. In this process, the two workshops were an important step in the design of the protocols as they provided the research team with new and relevant orientations to improve the tools in a short period of time, bringing together different perspectives (farmers, advisors and vets' point of view). The second version of the HHPM program became more adapted and adaptable to local real-life and farm specific situations, respectively. This contributed to fulfil the functional aim of the participatory approach (Lilja and Bellon, 2008).

Initially in the IMPRO-project try-out visits were proposed to discuss the prototype of the HHPM program with 6 farmers in each country. We decided, despite the very tight planning of the research project, to abandon this idea and opt for the option of having a workshop in each country with the different stakeholders. The initial reasons for this were that we considered that the farmers would not be the only ones working with the program and thus we needed also the opinion of other potential users. In addition to that, we considered that it would be difficult for an individual farmer, who has not been involved in the project, to express his or her opinion only after an explanation sort of 'out of the blue' on the whole concept. Even from an ethical point of view, I consider it as inappropriate to put farmers on the spot like that, questioning on a topic were there are not familiar with. From personal experience I know that farmers in general try to co-operate the best they can, but they can feel very uncomfortable being questioned on topics they are not well familiar with and often they will not want to answer questions on which they feel themselves not experienced enough. The interactions that were created by bringing the different types of stakeholders together in the same room promoted an exchange of knowledge, which was probably richer than would have been possible by interacting with each participant one-by-one. The participants questioned other stakeholders (including the scientists), personal experiences were exchanged and used to stimulate and widen discussions. It was reported that interactions between different groups of stakeholders could broaden individuals' existing knowledge by exchanging viewpoints with others. In addition, different stakeholder groups were confronted with the reality of others which encouraged participants to be reflective about their own strategies. Moreover, a common reflexion process between different groups can aid to express tacit knowledge, exchange experiences and create an environment to omit ideas and 'test' gut-feelings (Schneider et al., 2009)

The workshops did not only fulfil their functional aim, the changes proposed to the HHPM program by the participants have influenced the research objectives of this thesis. Studying farmers' use of

herd health indicators (Chapter 4) would not have occurred if participants had not expressed the importance of having an adaptable and farms specific monitoring tool. Furthermore, the introduced flexibility of the HHPM program required an adaptation of the initial research strategy. As it would be very difficult to compare the different farm situations only measuring health outcomes in a controlled trial with a limited number of farms (Chapter 5).

In addition, like the work done by Schneider et al. (2009) the lessons learned from this work influenced two national research projects, which adopted the participatory research approach and which also acknowledge the need of adaptable advisory tools in herd health management and will further develop this (project 'Equibio' on maintaining the equilibrium, a concept and approach for health and welfare in organic farms with ruminants and the project 'Otoveil' for the development of technical and management advisory tools for the surveillance and prevention of disease in organic farms)

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Chapter 4: A participatory approach to design monitoring indicators of production diseases in organic dairy farms

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A participatory approach to design monitoring indicators of production diseases in organic dairy farms

J.E. Duval[a,*], C. Fourichon[a], A. Madouasse[a], K. Sjöström[b], U. Emanuelson[b], N. Bareille[a]

[a] *BIOEPAR, INRA, Oniris, La Chantrerie, 44307, Nantes, France*
[b] *Swedish University of Agricultural Sciences, Department of Clinical Science, Division of Ruminant Medicine and Veterinary Epidemiology, P.O. Box 7054, SE-750 07 Uppsala, Sweden*

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ABSTRACT

Production diseases have an important negative effect on the health and welfare of dairy cows. Although organic animal production systems aim for high animal health levels, compliance with European organic farming regulations does not guarantee that this is achieved. Herd health and production management (HHPM) programs aim at optimizing herd health by preventing disease and production problems, but as yet they have not been consistently implemented by farmers. We hypothesize that one reason is the mismatch between what scientists propose as indicators for herd health monitoring and what farmers would like to use. Herd health monitoring is a key element in HHPM programs as it permits a regular assessment of the functioning of the different components of the production process. Planned observations or measurements of these components are indispensable for this monitoring. In this study, a participatory approach was used to create an environment in which farmers could adapt the indicators proposed by scientists for monitoring the five main production diseases on dairy cattle farms. The adaptations of the indicators were characterized and the farmers' explanations for the changes made were described. The study was conducted in France and Sweden, which differ in terms of their national organic regulations and existing advisory services. In both countries, twenty certified organic dairy farmers and their animal health management advisors participated in the study. All of the farmers adapted the initial monitoring plan proposed by scientists to specific production and animal health situation on their farm. This resulted in forty unique and farm-specific combinations of indicators for herd health monitoring. All but three farmers intended to monitor five health topics simultaneously using the constructed indicators. The qualitative analysis of the explanations given by farmers for their choices enabled an understanding of farmers' reasons for selecting and adapting indicators. This is valuable information for scientists involved in the design of HHPM programs. Advisors in the field also can benefit from this participatory approach because it transforms monitoring tools provided by scientists into farm-specific tools.
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1. Introduction

Production diseases have an important negative effect on the health and welfare of dairy cows (EFSA, 2009; LeBlanc et al., 2006). European regulations on organic production state that animal health should be promoted by the use of preventive measures, for example by the appropriate choice of breeds, ensuring adequate housing conditions, and the use of alternative therapies in place of chemically synthesized allopathic veterinary treatments when possible (Commission, 2008). Although the production conditions on organic farms aim to promote animal health, the health situations are not always better than on conventional farms (Sundrum, 2001).

A lack of implementation of herd health management practices, and not a lack of knowledge about herd health management, prevents improvements in animal health (LeBlanc et al., 2006). EFSA's Scientific Opinion recommended that research results should be used to design codes of practices and monitoring protocols addressing the major health threats to dairy cattle welfare, such as mastitis, lameness and leg injuries (EFSA, 2012). However, one of the main challenges to reduce or prevent disease is to transform the extensive amount of knowledge generated through research on animal health management into effective and consistently implemented

* Corresponding author.
E-mail addresses: julie.duval@oniris-nantes.fr, julie.duval@gmail.com (J.E. Duval), christine.fourichon@oniris-nantes.fr (C. Fourichon), aurelien.madouasse@oniris-nantes.fr (A. Madouasse), karin.sjostrom@slu.se (K. Sjöström), ulf.emanuelson@slu.se (U. Emanuelson), nathalie.bareille@oniris-nantes.fr (N. Bareille).

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practices on each farm (LeBlanc et al., 2006; Tremetsberger and Winckler, 2015). Insufficient compliance by farmers and advisors with management practices proposed in disease control plans is one reason that these plans fail to improve herd health (Bell et al., 2009; Green et al., 2007).

It is conceivable that herd health management practices need to be farmer and farm-specific to ensure farmer compliance. The implementation of management practices relies largely on farmers' intention and perception of their own capacity to do so. The latter can be influenced, for example, by farm-specific constraints and/or a farmer's habits. A farmer's intention to implement management practices can be influenced by multiple factors, such as knowledge of recommended preventive practices and the farmer's attitude towards disease risk (Garforth, 2011). Moreover, management style, defined as the specific combination of a farmer's objectives, motivation, and production environment, is known to influence the implementation of measures to prevent disease (Barkema et al., 1999). Additionally, certain objectives specific to organic dairy farming could influence herd health management in these herds. For example, organic farmers might prioritize maintaining conditions close to those found in nature over securing animal health (Vaarst et al., 2001). Veterinarians are not always aware of the objectives specific to organic dairy farmers or their approach to animal health management (Vaarst et al., 2007). Also, in conventional farming systems, veterinarians are not always aware of farmers' herd health management priorities (Derks et al., 2013b). Thus, to enhance farmer compliance, plans to promote animal health should be designed so that they can be adapted to each farmer's objectives and farm context.

Regular monitoring of herd health is an indispensable component of herd health and production management (HHPM) programs (Brand et al., 2001). Monitoring allows an assessment of whether different elements of the production process are under control and work correctly. This information is obtained by conducting regular planned observations or measurements of these elements (Noordhuizen et al., 2008). The first hurdle is thus to convince farmers to monitor herd health. One hypothesis for poor farmer compliance with HHMP programs is that farmers use different indicators to monitor health than those designed by scientists for HHMP programs. Mathieu et al. (2004) discussed the limits of scientific reasoning in research that aims at changing practices in agriculture; solutions offered by scientists are not always the best solutions in every situation. Moreover, scientists can have other purposes in mind when designing indicators, such as evaluating health at a large population level or for between-farm comparison (EFSA, 2012; Tremetsberger and Winckler, 2015). Indicators relevant for between-farm comparison and within-farm decision-making may differ. Overall, to our knowledge no information is available on farmers' use of indicators for dairy herd health monitoring.

Participatory approaches can be used to design farm-specific tools that are accepted by farmers. The principles of these approaches are to i) include all of the people in the decision-making process whose lives will be affected by the decisions made, ii) acknowledge that local people (in this case, farmers) possess much more knowledge about their own situation (here, their farms) than any outside person could ever obtain, and iii) create an environment to reflect on and analyze information (Whay and Main, 2010). Using a participatory approach creates an opportunity for dialogue between farmers and their animal health advisors on the farmers' goals and objectives (Vaarst et al., 2011). It ensures that the tools are farm-specific, in agreement with the (organic) production system, and based on the farmer's perception of the problems currently on his or her farm. Therefore, we hypothesized that the use of a participatory approach could result in a set of herd health monitoring indicators which would be more farm-specific. This corresponds also with the aim of HHPM programs to support farmers in reaching their farming objectives and in which the farmer is at the center of the decision-making process. These HHPM programs are different from Quality Assurance (QA) programs that set standards aiming at ensuring quality demands from the general public by granting farmers with a license to produce when the standards set are met (Noordhuizen and Wentink, 2001).

The objectives of this study were threefold: (i) to evaluate whether, with the use of a participatory approach, farmers intend to monitor simultaneously major health and welfare indicators associated with production diseases in dairy cattle, (ii) to assess whether the use of a such an approach results in farm-specific indicators to monitor herd health, and (iii) to understand the reasons underlying farmers' selection of indicators.

2. Material and methods

2.1. Approach and general study design

A survey was performed on a total of 40 organic dairy farms in France and Sweden. The two countries were chosen to represent two different existing contexts regarding the use of health indicators for benchmarking purposes. Scientists designed a prototype of a herd health monitoring tool for the monitoring of five health areas (reproductive health and performance, udder health, calf health, locomotor disorders and metabolic disorders) using 16 indicators. A participatory approach was used to allow farmers and their advisors to adapt the prototype to each farm. The indicators selected by the farmers and advisors from both countries were recorded and analyzed, as well as French farmers' reasons for the adaptations made to the indicators.

2.2. Selection of organic dairy farmers and advisors

In France, 20 organic dairy farmers were recruited in the west of the country (the departments of Loire-Atlantique and Morbihan) and in an eastern region (Lorraine). The two geographic areas were chosen to represent different agro-ecological regions and farming systems. The farmers were recruited by local (organic) farmers' organizations. Swedish farmers were recruited by the Swedish co-authors. Invitation letters were sent to 300 organic dairy farms spread over almost half of Sweden and in the area where a relative large proportion of Swedish dairy farms are located. Out of all of the farms which agreed to participate, 20 farms were selected to reflect Swedish farms in structure and herd size.

To be included in the study, the farm had to have been certified for at least one year as an organic dairy farm, and all of the farm owners had to provide their consent with regard to participating in the study and the use of farm data. Participants were informed that the data would be treated anonymously. When several people worked on a farm, the participants were the main decision makers regarding animal health management on the farm.

Prior to the start of the study, the farmers were contacted by telephone to discuss their choice of an animal health advisor. The farmers were allowed to choose anyone they deemed to be appropriate (veterinarian or other). All advisors selected by the farmers agreed to participate.

2.3. Context of the survey in both countries

The EU Council Regulation (EC) No 889/2008 does not impose standards with regard to either animal health and welfare levels or monitoring methods (Commission, 2008). In Sweden, there are additional national constraints. All organic dairy farms are certified as organic by the Control Association for Organic Agriculture (Kontrollföreningen för Ekologisk Odling, KRAV). About 77% of Swedish organic dairy farms deliver milk to the major

dairies (unpublished data). KRAV standards for animal production follow the EU regulation but have stricter regulations in several areas, including herd health and welfare. This requires systematic recording of health and welfare. KRAV standards compel organic dairy farmers who have chosen to participate in the Swedish Official Milk Recording Scheme (SOMRS) to use the 'Animal Welfare Signals' tool (Signaler Djurvälfärd) for active systematic preventive herd health and welfare management activities. Farmers can obtain a wide range of information from the 'Animal Welfare Signals' tool, from claw trimming reports and economic effects to more specified areas such as reproduction. Often not all information is used, but mainly the overview indicators (Appendix I) (http://www.vxa.se/Radgivning-service/Djurhalsa/Djurvalfard8/Signaler-DJurvalfard/) (Anonymous, n.d.). If the animal welfare quality standards are not met, organic farmers are obliged to have their herd welfare status assessed by a trained inspector applying animal-based welfare measures. After the assessment, farmers are provided with an action plan and they must meet regularly with their veterinarian over the next two years to follow-up on the preventive measures. About 77% of the organic dairy farms in Sweden take part in SOMRS. Farmers who have chosen not to participate in SOMRS must nonetheless maintain a recording system to monitor the following welfare indicators: culling rate and cause, mortality in different age groups, total numbers of cases of illness, and claw health (The KRAV Association, 2015). In France, there are no standardized, commonly accepted methods for herd health monitoring, nor are there centralized efforts to develop these. The role of the veterinarian is not described or formally laid down in the regulations. However, this is in line with the European regulation, which does not define the role of veterinarians on organic dairy farms.

2.4. Design of the participatory approach

A prototype of a comprehensive herd health monitoring tool for monitoring the main production diseases in dairy cows was designed based on indicators and alert levels identified through a review of the literature and discussions with 10 animal health experts (veterinarians and epidemiologists from the two involved research groups) (Table 1). The choice of indicators made by scientists was a compromise between what is considered scientifically to be valid indicators and alert levels for herd health, the herd data available in the field, and what was expected to be an attainable health level in each country. The main aim of these indicators and alert levels was to engage and stimulate discussion between farmers and their advisors on what they wanted to use on their farms.

A meeting was organized on each participating farm with the farmer, his or her advisor, and a researcher (one in France and one in Sweden) to discuss the prototype monitoring tool. The indicators proposed by scientists were discussed by the farmers and advisors and accepted or rejected by the farmers. In the case of rejection, farmers could propose one or more alternative indicators to measure the same health condition. Farmers could also decide not to monitor a certain health topic at all, by choosing no indicator. Additional indicators could also be proposed. An additional indicator was defined as an indicator that measures not the same health condition as the initially proposed indicator but a related condition.

2.5. Data collection

Twenty semi-structured discussions were conducted on the participants' farms by the first and fourth author of this article, one working in France, the other in Sweden. In both countries, the interviewers played the role of facilitator, structuring and stimulating the discussion between the farmer and the advisor without sharing or imposing opinions. The farm visits were conducted from mid-September to the end of December 2014. All of the participants accepted recording of the discussion. The length of the discussions varied from 60 to 150 min.

The visits were conducted in a standardized way in both countries. First, the aims of the visit and of the herd health monitoring plan were explained to the participants. The herd health indicators then were discussed per health topic (udder health, lameness, reproductive failure, metabolic disease and calf health). The farmer was asked first to describe the types of herd health indicators that were already being used on the farm for herd health monitoring. If the farmer did not understand what was meant by the concept of a herd health indicator, or if s/he did not use any indicators, then the researcher presented the proposed herd health indicators. Otherwise, these were presented after the farmer finished explaining his/her existing monitoring methods. Finally, the farmer decided together with his/her advisor which indicators and alert thresholds to retain for herd health monitoring.

Indicators from the prototype accepted by farmers were recorded as well as the alternative and additional indicators proposed. To understand the reasons for the adaptations of the prototype, the discussions were recorded on the French farms and fully transcribed. Budget limitations prevented the same from being done in Sweden.

After the visit, the researcher sent a summary of the visit to both the farmer and the advisor. It included the list of indicators chosen, their corresponding alert thresholds, and the frequency by which indicators would be calculated.

2.6. Analysis of the indicators used in farmers' herd health monitoring plans

Firstly, the different herd health indicators retained by the farmers were described. For all health topics, the average number of indicators used was calculated. For each individual indicator, the number of times it was accepted and the number of proposed alternative and additional indicators were described.

Secondly, the alternative and additional indicators proposed by farmers for two health topics, calf health and reproductive health and performance, were compared with those proposed by scientists and classified in categories based on their characteristics. Calf health indicators were selected for two reasons: the highest average number of indicators chosen on Swedish farms concerned calf health, and calf health had never been included in a monitoring plan in France prior to the start of the study. Reproductive health and performance indicators were chosen for analysis because it was the topic for which the highest number of alternative indicators was proposed.

In Table 2, the categories used to classify the differences between the indicators proposed by farmers and those proposed by scientists are presented alongside corresponding examples of the indicators proposed by farmers during the study. This classification was constructed based on the alternative indicators obtained in this study. As one goes down the table, the characteristics become more farm-specific, less suitable for general use, and further away from what was initially proposed. Category M was added since it became obvious during the analysis that Swedish farmers used animal welfare indicators already recorded in the Swedish 'Animal Welfare Signals' tool.

Thirdly, the discussions on herd health monitoring indicators between farmers and advisors in France were analyzed in detail to gain a better understanding of a farmer's reasoning when designing his/her indicators. For this purpose, across the different interviews, the reasons stated were labeled with key words which were later grouped into larger categories (using Sonal® and Mindmanager® software.

Table 1
Initial list of indicators to monitor dairy herd health proposed by scientists.

Reproductive health and performance
Average age at first calving
Average calving to first service interval (of cows inseminated in the last 3 months)
Percentage of re-insemination within 60 days after first service
Percentage of abortion(s) during the last 3 months
Udder health
Bulk Milk Somatic Cell Count
or Average prevalence level individual somatic cell count >250.000 cells/ml
Incidence of clinical mastitis cases during the last 3 months
Incidence of cows with clinical mastitis with general signs of disease during the last 3 months
Calf health
Calf mortality rate within 24 h after birth (among all full term calves, include calves which died during calving, exclude abortion) of the calves born during the last 3 months
Mortality rate of female calves from 24 h old to 1 month old, born in the last 3 months
Occurrence of episodes of respiratory disease in the last 3 months (yes/no)
Locomotor disorders
Locomotion scoring, percentage of severely lame cows. Definition severely lame: Unable to walk as fast as a brisk human pace (cannot keep up with the healthy herd) and signs of uneven weight bearing on a limb that is immediately identifiable and/or obviously shortened strides (Green et al., 2012)
Metabolic disorders
Prevalence of subacute ruminal acidosis: difference between individual milkfat and milk protein contents levels
Prevalence of subclinical ketosis: levels of individual milk fat contents and individual milk protein contents
Occurrence of clinical cases of milk fever (yes/no)
Occurrence of clinical cases of hypomagnesemia (yes/no)

Table 2
Classification of differences between alternative and additional herd health monitoring indicators proposed by organic dairy farmers and indicators proposed by scientists.

	Characteristics of the indicators	Examples of indicators proposed by farmers compared to the indicators proposed by scientists
A	Timing of the indicator changed	Age of heifers at start of breeding, instead of age at first calving.
B	Animal-based observation instead of the use of data-based observations	>20% of the cows in early lactation (0–90 days) with a strong body condition loss, rather than using an indicator based on milk fat and milk protein contents
C	Indicator takes an additional criteria into account	Number of cows with an interval calving-first service of >120 days and a milk production of ≤20 kg per day
D	Indicator for monitoring of aberrant situations	Percentage of cows with ≥3 artificial inseminations, rather than percentage of re-insemination within 60 days after first service
E	More overall indicator of the health problem under investigation	Percentage of cows culled with infertility as the culling reason, rather than percentage of cows re-inseminated within 60 days after first service
F	Period at risk is different in the definition of the indicator	Calf mortality from 1 day old to weaning (weaning at 4 months) rather than mortality rate of female calves from 1 to 30 days
G	Indicator targets a different sub-group of animals	Percentage of primiparous cows with an individual somatic cell count of >300.000 cells/ml at the first milk recording after calving, rather than prevalence of cows in the herd >300.000 cells/ml
H	Difference due to definition of the specific cause of the health problem in the definition of the indicator	Number of cases of neonatal diarrhoea causing mortality, rather than mortality rate of female calves from 1–30 days
I	Indicator to monitor a specific health problem which was not included in the proposed list of indicators	Number of cases of endometritis (additional indicator)
J	Indicator intended to further diagnose an identified problem	Write down the types of lesions that are found during hoof trimming (additional indicator)
K	Indicator that takes into account the farmer's herd health management practices	Percentage of cows not pregnant of those that are inseminated and checked using ultrasound for gestation, rather than percentage of cows re-inseminated within 60 days after first service
L	Indicator to monitor the effect of a new practice on herd health	Evaluate the effect of preventive claw trimming on the incidence of lameness prior to previous year (additional indicator)
M	Indicator part of overview indicators of the Swedish 'Animal Welfare Signals' tool	See Appendix I for the list of overview indicators from the 'Animal Welfare Signals' tool

3. Results

3.1. Farmers' choices of animal health advisors and existing monitoring activities on the farms

The participating farmers chose most often their private veterinary practitioner as the person to implement the monitoring plan (Table 3). In some cases, they chose advisors from the regional Chamber of Agriculture (France only) or from a local milk recording company or dairy. The reasons behind the farmers' choice of advisor were not recorded. In France, monitoring activities were already in place on 5 of the 20 farms. This included at a minimum the monitoring of herd reproductive health and performance, but never included calf health. In France, all five health topics were never monitored simultaneously. In contrast, only three Swedish farms had no monitoring activities at all. Of the 17 farms with monitoring activities, 13 farmers considered that they had monitoring activities on all five health topics.

3.2. Results of the analysis of indicators used in farmers' herd health monitoring plans

3.2.1. Number of herd health indicators per health topic

After discussing the prototype, nearly all of the farmers agreed to monitor the five health topics, including farmers whose monitoring activities prior to the study had been minimal to non-existent

Table 3
Herd characteristics, results of farmers' choices of animal health advisors and pre-existing monitoring activities on organic dairy farms in France and Sweden.

	Country	
	France (n = 20)	Sweden (n = 20)
Herd characteristics		
Average number of lactating cows	54 (min 18; max 82)	86 (min 35; max 403)
Average amount of milk sold per year (kg) per cow	5858 (min 4500; max 7900)	7169 (min 6960; max 9400)
Type of animal health advisor chosen by the farmer		
Veterinarian	Private veterinary practitioners (n = 13)	Private and district veterinary practitioners with additional education in advisory services regarding preventive herd health management (n = 18)
Other type of advisor	Advisor of the regional Chamber of Agriculture on organic farming (n = 4),advisor regional milk recording services (n = 2), advisor milk factory (n = 1)	Advisor Swedish milk recording services (n = 2)
Existing herd health monitoring activities on the farm		
None	n = 15	n = 3
Yes, on one health topic	monitoring reproduction only (n = 2)	monitoring udder health only (n = 4)
Yes, on more than 1 topic	n = 3	n = 0
Yes, on all topics	n = 0	n = 13

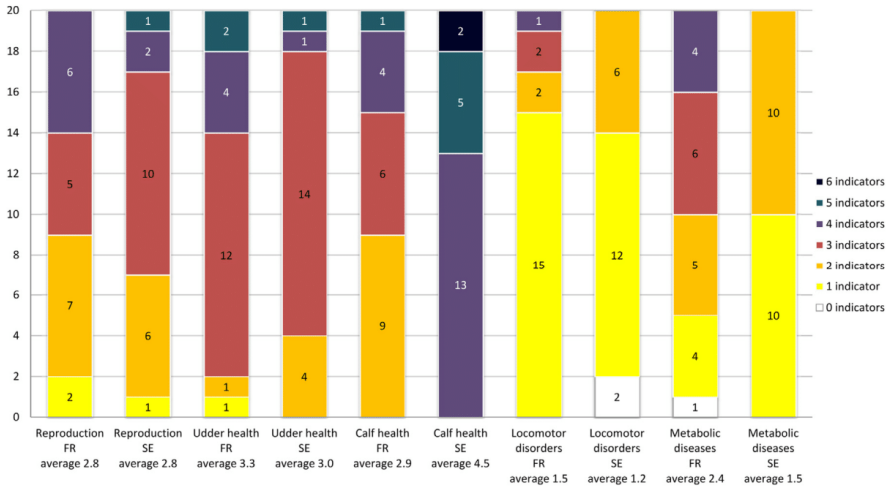

Fig. 1. Number of monitoring indicators chosen by organic dairy farmers per health topic in France (FR) and Sweden (SE).

(Fig. 1). The only exceptions were two Swedish farmers who chose not to monitor locomotor disorders and one French farmer who did not adopt an indicator for metabolic disorders. French farmers generally used a higher number of indicators than Swedish farmers except for two topics, calf health and reproductive health and performance. In the case of calf health monitoring, there was a distinct difference in the average number of indicators used between countries; Swedish farmers used 4–6 indicators (average of 4.5 indicators), whereas French farmers used 2–5 indicators (average of 2.9 indicators). For monitoring reproductive health and performance, farmers from both countries used an average of 2.8 indicators. In both countries, the lowest average number of indicators was used for monitoring locomotor disorders, with farmers most often using only one indicator.

3.2.2. Description of the herd health indicators proposed by scientists that were retained by farmers

Of the indicators proposed by scientists, 'mean age at first calving', 'bulk milk somatic cell count' and 'occurrence of an episode of respiratory disease (calves) in the last three months' were the most accepted indicators in both France and Sweden (Table 4). The least accepted indicators, and for which no alternative indicators were proposed, were 'the percentage of cows with clinical mastitis that showed general signs of disease', 'the percentage of abortions per year' and 'the occurrence of grass tetany'. The indicator 'locomotion scoring, percentage of severely lame cows' was rejected by all of the farmers but replaced by at least one alternative indicator on all 20 farms in France and 18 out of 20 farms in Sweden. Even though the number of different alternative and additional indicators was lower in Sweden, in both countries the combination of indicators adopted was unique to each farm (data not shown). Furthermore, no farmer in either country accepted the combination of indicators exactly as they were proposed by scientists.

3.2.3. Comparison of alternative and additional indicators proposed by farmers to those proposed by scientists

Swedish dairy farmers in many cases proposed to use indicators from the 'Animal Welfare Signals' tool as alternative indicators, but

Table 4
Results of organic dairy farmers reactions to the indicators proposed by scientists on 20 farms in France and 20 farms in Sweden.

Indicators proposed by scientists	Number of farms where indicator was accepted		Number of farms where atleast 1 alternative indicators was chosen		Number of farms where no indicator was chosen		Number of different alternative indicators chosen	
	FR	SE	FR	SE	FR	SE	FR	SE
Reproductive health and performance								
Mean age at first calving[a]	11	18	4	2	5	1	6	2
Average calving to first service interval (of cows inseminated in the last 3 months)	10	2	5	0	5	17	3	N/A
Percentage of re-insemination within 60 days60 days after 1st service	2	0	19	9	0	11	8	2
Percentage of abortion(s) during the last 3 months	9	2	0	0	11	18	N/A	N/A
Udder health								
Bulk Milk Somatic Cell Count[1]	15	20	2	0	3	0	1	0
or Average prevalence level iSCC >250.000 cells/ml	15	0	5	16	3	4	5	3
Incidence of clinical mastitis cases during the last 3 months	12	0	6	20	2	0	4	1
Incidence of cows with clinical mastitis with general signs of disease during the last 3 months	2	0	0	0	17	20	N/A	N/A
Calf health								
Calf mortality rate within 24h after birth (among all full term calves, include calves which died during calving, exclude abortion) of the calves born during the last 3 months	7	20	2	0	11	0	2	N/A
Mortality rate of female calves from 24h old to 1 month old, born in the last 3 months	2	0	11	20	7	0	7	1
Occurrence of episodes of respiratory disease in the last 3 months (yes/no)	12	20	1	0	7	0	1	N/A
Locomotor disorders								
Locomotion scoring, percentage of the herd severely lame	0	0	20	18	0	2	13	7
Metabolic diseases								
Prevalence of subacute ruminal acidosis: difference between individual milkfat and milk protein contents levels	3	0	6	10	11	10	5	1
Prevalence of subclinical ketosis: levels of individual milk fat contents and individual milk protein contents	3	0	10	1	7	10	10	1
Occurrence of clinical cases of milk fever (yes/no)	16	0	1	20	3	0	1	1
Occurrence of clinical cases of hypomagnesemia (yes/no)	1	0	0	0	19	20	N/A	N/A

FR = France; SE = Sweden; N/A = not applicable; iSCC = individual Somatic Cell Count.
[a] Part of the 'overview' indicators of the Swedish 'Animal Welfare Signals' tool (Appendix I).

not all of these indicators were used and some were used more frequently than others (Tables 5 and 6).

All but one of the proposed indicators for monitoring calf health (Table 5) has at least one characteristic that suggests that farmers were focused on specific health disorders and on the specificities of disease patterns on their farm. The indicators proposed by farmers aim to monitor a specific health disorder (I, Table 2), sometimes include a cause of disease (H), and can be specific to a group of animals at risk (G) and/or a period at risk (F).

A common feature of the proposed reproductive health and performance indicators (Table 6) was that many of them seem to facilitate farmers' decision making by helping to identify aberrant situations (D). An example of this is the indicator, 'Percentage of heifers that have not started reproduction and that are older than 17 months old'. Another common feature is a difference in the timing involved (A) compared to the initially proposed indicator. This results in farms sometimes having an earlier indicator, for example in the monitoring of the start of the breeding period of heifers. More often, however, the change resulted in the indicator being measured at a later point in time than that proposed by scientists, especially for the monitoring of the outcomes of insemination.

Like the proposed indicators for calf health, most of the additional indicators proposed for reproductive health and performances showed that farmers were interested in monitoring specific health problems and disease patterns.

3.3. Analysis of the discussions on herd health monitoring indicators between farmers and advisors in France

3.3.1. Farmers' reasoning for refusing to monitor certain areas regarding calf health and reproductive health and performance

Some farmers did not accept the proposed indicators and did not propose any alternatives. Different reasons were evoked by farmers to explain why they do not want to monitor a specific area.

Certain farmers thought that the health problem did not occur on their farm, or occurred sometimes but they did not consider it to be a problem.

> *Farmer 1: Well okay, this one [referring to the indicator for calf mortality in the 24 h after birth] we can leave it out. We don't have problems at calving.*
>
> *Researcher: So you don't have problems in the first 24 h?*
>
> *Farmer 1: Anyway, in the case when a calf is born and the calf is dead, I arrive and that is it! Why is it dead, we do not know. So yes, we do have some mortality but I would say it is the normal 2 percent mortality at birth.*

Furthermore, in some cases the farmer believed that the situation was not likely to change and therefore not worthwhile to monitor. Farmers sometimes reached the same conclusion when they felt unable to do something to improve the health situation, or when farmer interference was not beneficial.

Table 5
Results of characteristics of the alternative and additional indicators proposed by organic dairy farmers for the monitoring of calf health in 20 farms in France and 20 farms in Sweden.

Country	Indicators proposed by farmers	Characteristics alternative indicators[a]
Alternative indicators for 'Mortality within 24 h after birth'		
FR	Calf mortality at birth (n = 1)	F
FR	Calf mortality within the 12 h after birth (n = 1)	F
Alternative indicators for 'Mortality rate of female calves from 24 h old to 1 month old'		
FR	Calf mortality female calves between 0 days of age and 1 month old, cases that cannot be explained excluding mortality due to calving difficulties (n = 1)	F, H
FR	Calf mortality (male and female calves) between 1 day of age and 1 month old (n = 4)	G
FR	Calf mortality (male and female) from 12 h after birth on (n = 1)	F, G
FR	Calf mortality (male and female) after 24 h (n = 1)	F, G
FR	Calf mortality (male and female) from 1 day old to weaning (n = 2)	F, G
FR	Calf mortality (male and female) due to diarrhoea 3 weeks after weaning (n = 1)	F, G, H
SE	Mortality rate female calves 0–60 days (n = 20)	F, M
Alternative indicators for 'Respiratory disease'		
FR	Occurrence of an episode of respiratory disease with calves having fever (n = 1)	C
Additional indicators		
FR	Percentage of calves with an umbilical infection (n = 3)	I
FR	Cases of neonatal diarrhoea (mainly alimentary causes) without cure in 48 h (n = 1)	G, H, I
FR/SE	Percentage of calves with diarrhoea (FR n = 6, SE n = 20)	I
FR	Percentage of heifer calves with diarrhoea (n = 1)	G, I
FR	Number of cases of diarrhoea in calves that are less than 1 month old (n = 2)	F, I
FR	Diarrhoea morbidity female calves 0–3 months old (n = 1)	F, G, I
FR	Number of cases of diarrhoea 3 weeks after weaning (n = 1)	F, I
FR	Number of cases of diarrhoea of calves that are more than 1 month old (n = 1)	F, I
FR	Occurrence of an episode of health problems in the herd (respiratory, ringworm, etc.) (n = 2)	E, I
FR	Percentage of stillbirths (n = 1)	I
SE	Percentage of calves with impaired growth (n = 1)	B, E
SE	Mortality rate female calves from 2 months-6 months old (n = 6)	F, I, M
SE	Mortality rate female calves from 6 months-15 months old (n = 2)	F, I, M

[a] For definitions see Table 2.

Table 6
Results of characteristics of the alternative and additional indicators proposed by organic dairy farmers for the monitoring of reproductive health and performance in 20 farms in France and 20 farms in Sweden.

Country	Indicators proposed by farmers	Characteristics alternative indicators[a]
Alternative indicators for 'average age at first calving'		
FR	Age at start of reproduction (n = 2), average age heifers at fecund insemination (n = 1)	A
SE	Percentage of heifers that have not started reproduction and that are older than 17 months old (n = 1)	A, D, M
FR/SE	Average success rate at first service in heifers (FR n = 2, SE n = 1)	A, H
FR	Success rate of the first and second artificial insemination combined in heifers (n = 1)	A, H
FR	Average number of artificial inseminations per pregnancy in heifers (n = 1)	A, H
FR	Occurrence of heifers calving in May and/or June (n = 1)	A, D
Alternative indicators for 'average interval calving-1st service'		
FR	Percentage of cows with a prolonged interval calving – first heat (n = 3)	A, D, F
FR	Percentage of cows with a prolonged interval calving – first service (n = 2)	A, D
FR	Number of cows with an interval calving – first service of >120 days and a milk production of <20 kg per day (n = 1)	C, D
Alternative indicators for 'average percentage of cows re-inseminated after 1st service'		
FR	Average success rate first service (n = 7)	A
FR	Success rate of the first and second artificial insemination combined (n = 2)	A, E
FR	Percentage of cows not pregnant of those that are inseminated and checked using ultrasound for gestation (n = 1)	K
FR	Cow that returned into heat after third insemination (n = 4)	A,D
FR	Individual cow that returned into heat >120–150 days after insemination (n = 1)	A, D
FR/SE	Average interval calving- last insemination (FR n = 1, SE n = 1)	A, F, M
FR/SE	Average number of inseminations per pregnancy (FR n = 4, SE n = 9)	A
FR	Percentage of cows culled with infertility as the culling reason (n = 4)	A, E, M
No alternative indicators were proposed for the indicator 'percentage of abortions'		
Additional indicators		
FR	Measuring the effect of a new monitoring system for detecting cows in heat (n = 1)	L
SE	Monitoring the occurrence of reproduction problems (n = 2)	I
FR	Percentage of cows treated for metritis with antibiotics (n = 1)	C, G, I
FR	Occurrence of cases of metritis (n = 1)	I
FR/SE	Average calving interval (FR n = 1, SE n = 16)	E, M
SE	Percentage of calvings with calving difficulties (n = 2)	I, M

[a] For definitions see Table 2.

Farmer 2: Well, I do have some calf mortality. But often· · ·I don't have the impression that we can do something about it. . ..I have decided not to assist cows at calving as much anymore since the day. . . Before, I assisted at almost every calving and one day when we had to go somewhere there was a cow that was supposed to calf, but who didn't, so I got the calf out but I watched the calf die and several days later the cow died too. That was the trigger. I said 'now I leave the cows calving by themselves'. And they are not doing badly. They are doing better in general.

With regard to monitoring reproductive health and performance, a farmer's management objectives could influence the decision to reject monitoring activities in certain areas. This decision was influenced, for example, by an objective for seasonal calving, the feeding system on the farm, or the farmer' personal planning.

Farmer 9: Age at first calving is always around 30–33 months on our farm, because we have seasonal calving at a certain period during the year, so it would be at 2 or 3 years. So, I don't want it to be at 2 years, because it would force us to have a stricter heifer management · · ·They would need concentrates, and it is more difficult to maintain the pasturing schedule the way we do it now. So we forget that, as an indicator "age at first calving".

3.3.2. Farmers' reasoning in their choice of alternative and additional indicators for monitoring calf health

The analysis of the discussions on alternative indicators showed that farmers used their knowledge of disease patterns which were specific to their farms when they changed the proposed indicators.

Advisor 11: What do we take [as indicator for the monitoring of calf health]? Do we keep the mortality rate? Do we keep this criterion? I don't really know what else to propose. Farmer 11: To me, mortality rate doesn't seem to be enough. I have a mortality rate that is correct for sure, but I have a lot of sick calves.

Farmer 3: We keep the male calves, we fatten them. It is a way for us to improve the financial worth of the calves. And we have many male calves. Advisor 3: So in fact you would count all calves, male and female, when monitoring? Farmer 3: Yes, all the calves that we raise. The male calves leave at 4 months for slaughter. And actually it is often the male calves that have small health problems.

Additional indicators were proposed as well and were either related to a specific animal health problem on the farm which was bothering the farmer or problems in the (recent) history of the farm.

3.3.3. Farmers' reasoning behind their choice of alternative and additional indicators for monitoring reproductive health and performance

When farmers choose to adapt indicators for monitoring reproductive health and performance, this can be related to the strategic choices made on the farm, such as the type of farm system (organic), specific practices, and the farmer's objectives. Using natural service rather than artificial insemination is a practice that is expected to occur more frequently in organic production systems compared to conventional ones.

Farmer 6: Indeed, when I look at the interval calving to first service I also look at the milk production level of the cow. This morning I inseminated a cow in her first lactation that produces 22 kg. I said to myself 'it is ok, she is at a little bit less than 60 days in lactation, and her first heat was perfect, so I inseminated her'. But if it had have been a cow that produces on average 8000 per lactation and she is still at 35 kg of milk per day I would not inseminate her even though she started her lactation at the same time. The idea behind this is that we have cows here that produce a lot of milk, but who suffer negative energy balances due to the fact that they are in an organic system. So we have understood quickly that there is no point in inseminating the high producing cows at sixty days in lactation, it is not successful.

Furthermore, indicators might also be used to identify aberrant cases for which the farmer has to make a decision.

Farmer 10: The percentage of cows re-inseminated in the 60 days after artificial insemination. Advisor 10: Usually it is a maximum of 3 artificial inseminations that is used, isn't it? Farmer 10: Yes, yes. The cases with 4 inseminations, if you have one or two cases per year. . ..3 inseminations, that is an indicator to decide whether we want to keep the cow or not.

In addition, ergonomic factors were taken into account by farmers. Some indicators were changed because certain data were unavailable on the farm, rendering it impossible to calculate the indicators, or because the farmer was accustomed to using another indicator.

Additional indicators were chosen when a specific health topic identified by the farmer as a problem was not addressed in the list of proposed indicators, such as the number of cows treated for metritis with antibiotics. Certain indicators also were chosen due to their economic importance to the farmer.

Farmer 14: I think that the calving interval is quite good as an indicator. But maybe that is because we. . .well, for us, economically it is the indicator which interests us most because, on average, our cows do not have a high production level.

4. Discussion

The results of this study show that following the use of a participatory approach, organic dairy farmers intended to monitor multiple animal health topics simultaneously. Farmers planned to do so even on farms where no monitoring activities were present prior to the start of the study. Except for two Swedish farmers who chose not to monitor locomotor disorders and one French farmer who chose not to monitor metabolic disorders, all of the other farmers planned to monitor the five health topics.

Another significant result was that all of the farmers made use of the possibility to adapt the indicators proposed by the scientists, and this resulted in 40 unique herd health monitoring plans. The adaptations made to the indicators were very farm-specific. It therefore appears crucial to take into account farmers' experiences when designing farm-specific indicators, a task enabled by the use of a participatory approach. This is in line with the work of Mathieu et al. (2004), in which they state that scientists should aim to design decision support models which are based on sound biotechnical references and pertinent to farmers. However, scientists should not aim to provide each individual farmer with a perfect model because scientists will never be able to fully capture how farmers consider the use of the tool in question. The argument for tools which can be adapted to each farmer's use is supported even more strongly by the results from Sweden. In this country, where herd health indicators are used on a large share of farms and are provided with reference values, farmers also chose unique sets of indicators for herd health monitoring on their farms. Another striking example is the fact that not one farmer adopted the indicator proposed by scientists for locomotor disorders, but with the exception of two Swedish farmers, all agreed to monitor locomotor disorders after the indicator was adapted. The use of an adaptable tool thus seems pertinent. Describing the most frequently accepted indicators and using them for the design of general monitoring plans consequently appears irrelevant and suggests that the design of 'one-size fits-all' tools should be abandoned.

Country differences were found and were likely due to the different contexts. It is not likely that the use of two different interviewers had an important effect on the outcome, since the study was performed in a standardized way across countries and the interviewers played a facilitating rather than an expert role. The differences between countries might have different reasons. Firstly, the country difference in terms of the advisory services available at the start of the study may be one reason. Despite the low number of participating farms, the results regarding the existing monitoring activities indicate indeed that veterinary herd health management programs are not common on organic dairy farms in France. In Sweden, a contrasting situation exists, one which is closer to that of The Netherlands, for example (Derks et al., 2013a). This country difference might be related to the fact that in Sweden, the role of a veterinarian on organic dairy farms and in disease prevention strategies is defined in organic production regulations. We know that local or national conditions are not always comparable and might affect the implementation of management measures (Sundrum, 2001). Secondly, we might also assume that the widespread use of the 'Animal Welfare Signal' tool plays a role. For example, the fact that the alternative and additional indicators chosen by Swedish farmers were in general more overall indicators can probably be at least partially explained by the fact that the farmers are familiar with these indicators and their reference values through their use of the tool. The exception to this was the monitoring of calf health, for which Swedish farmers used a high number of indicators. A possible explanation for this is the fact that the advisory services related to this issue are comparatively less developed than those dedicated to other health topics in Sweden. It would be interesting to study the influence of such a widely implemented tool on the animal health and welfare situation and its use by farmers in order to further understand the effect of such a large diffusion and availability of herd health data.

The results of this study seem to indicate that farmers use indicators differently than scientists. Health indicators have often been proposed to be used for benchmarking purposes (Tremetsberger and Winckler, 2015). These can be used by farmers, advisors, decision-makers and scientists for between-herd comparisons. In general, farmers have a different point of view of technical tools than scientists due to the fact that they live in different social environments and work on a regular basis with these tools. To be able to understand farmers' practices, scientists have to understand the perceptions of farmers which explain and justify their actions. When aiming to design relevant decision support tools for farmers, it is thus essential to understand their vision and goals and to have an understanding of the indicators that motivate their practices (Mathieu et al., 2004). Little research has been done on indicators that farmers use to monitor production diseases and their validity for early disease recognition and prevention. Scientists, in general, analyze data from many herds, for between herd comparison and sometimes use complex conceptual frameworks to make sense of this data. The indicators proposed by scientists in this study were overall indicators, e.g. aiming to monitor mortality rates at different ages without including details such as cause of death. Farmers, on the opposite, use data for decision making on a daily basis. They have more data than scientists on events that are not recorded in databases. They have considerable information about what happens in their own herds but much less about what happens in other herds. From the analysis of the interviews, it became evident that farmers adapt the indicators to specific health problems occurring on their farms, and use them to analyze whether their objectives are being reached and in their decision-making processes. Thus the indicators seem to be used for within-herd comparisons rather than for between-herd comparisons. The fact that each Swedish farmer also chose unique combinations of indicators underlines this. Nevertheless, we remain aware that the different kinds of indicators (for within-herd and between-herd comparisons) all have their own utility but have to be used in the appropriate context (daily management, benchmarking, quality assurance, research purposes).

The qualitative analysis of the discussions enabled an understanding of the meaning of herd health indicators to the farmers themselves. The analysis confirmed the function of the characteristics identified when describing the alternative and additional indicators proposed by farmers. The indicators proposed for monitoring calf health are based on farmers' knowledge of local disease patterns and a prioritisation of health problems as described above. The indicators designed for reproductive health and performance were also adapted to farmers' objectives and strategic management. In the context of the development of disease surveillance programs, integrating farmers' knowledge has proven to be of value to clarify the clinical picture and epidemiology of diseases under local conditions, to identify livestock owners' animal health priorities, and to improve the relationship between farmers and animal health professionals by respecting farmers' knowledge (Catley et al., 2012). For example, participatory disease surveillance played a major role in the eradication of rinderpest (cattle plague). Livestock owners' knowledge was crucial in the identification of the final foci of infection, the development of guidelines to control infection, and the process of certifying countries as being free of rinderpest (Jost et al., 2007). The results of our study also show that in the construction of the monitoring plan, the farmers used their farm-specific (local) knowledge to prioritize the health problems to be monitored and to design indicators which monitor the specific diseases that occur on their farm.

The participatory approach encouraged farmers and advisors to engage in a dialogue during which animal health was discussed as a component of the whole farm system. The selection of indicators proposed by scientists was not chosen to represent the gold standard for monitoring herd health. Proposing indicators was part of the participatory approach and aimed at initiating discussion on at least five topics that represent major threats for dairy cattle health and welfare. The analysis of the discussions showed that this dialogue was not only an important source of information for advisors on farmers' use of indicators, but also a means to acquire detailed knowledge on (recent) health problems on the farm, and the farmers' objectives, priorities and practices. In the past, organic dairy farmers expressed the view that veterinarians did not always respect their goals and that veterinarians did not support them in developing practices that were more in line with organic production principles (Vaarst et al., 2007, 2006). In this study, we have shown examples of situations in which specificities of the organic farming system influenced the choice of indicators. Animal health should be considered as an integral part of the farm system and farmer objectives on not only organic farms, but every farm. If advisors want to be able to contribute to farmers' animal health planning activities in general, such as in HHPM programs, they will have to adopt systemic approaches and consider herd health as a part of the farm system. They must not only have profound technical knowledge on health management, but other domains such as feeding and housing as well, and take into account the organization of the farm and the farmer's objectives when recommending practices (Brand et al., 2001; LeBlanc et al., 2006; Vaarst, 2011). Whay and Main (2010) also recognise the value of farmers' knowledge, and the importance of understanding how a specific farm functions and the reasons for which certain routines and practices have been adopted before giving advice. The discussion provoked by the participatory approach allowed advisors to obtain a view of animal health as an integral part of the farm system and the farmer's objectives. This information is crucial if advisors want to recommend practices that are accepted by farmers. The

importance of discussion between farmers and advisors thus should be recognised.

This study did not assess the long term effectiveness of the use of farmer-designed monitoring tools on improving animal health. However, the participation of advisors is expected to minimize the probability that farmers adopt inappropriate indicators. Nevertheless, we recommend that the validity of the monitoring plans designed by farmers to be evaluated in terms of their health promotion capacities in future research. Farmers' long term compliance with monitoring activities was not assessed, but the first hurdle – engaging farmers in planning the activity – was successfully taken. Furthermore, by employing a participatory approach, known preconditions for sustainable animal health and welfare planning activities on organic dairy farms were met; e.g. farmer ownership of the process was assured, the approach stimulated dialogue between farmers and advisors, the indicators were farm-specific and included farm-specific knowledge and data. It has been recognised that stakeholders' commitment to disease surveillance and control activities can be promoted by having them participate in the prioritisation of disease problems and in the development of the activities. The co-construction experience is expected to improve trust between actors, improve compliance, and thus, in the end, result in a positive impact on animal health. Although participatory approaches have been used most often in developing countries, they can be valuable in the design of disease control activities in developed countries (Catley et al., 2012).

5. Conclusion

The participatory approach used led to the design of indicators that permit farmers to monitor simultaneously the major health and welfare indicators associated with production diseases in dairy cattle. Furthermore, the indicators were farm-specific, as they were adapted to the farmer's objectives, herd health situations and/or decision-making processes. Therefore, when designing decision support tools for farmers, scientists should not aim at 'one-size fits all' tools. The analysis of the discussions between farmers and advisors on the indicators revealed that scientists and farmers use herd health indicators differently. While scientists use indicators for between-herd comparisons, farmers are interested in within-herd comparisons. Moreover, the participatory approach provoked a dialogue between farmers and advisors which allowed advisors to understand animal health management as an integral part of the farm system and the farmer's objectives. This understanding is crucial for advisors aiming to contribute to animal health planning activities of all farmers.

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Appendix I.: Overview of the indicators in the Swedish 'Animal Welfare Signals'-tool

Calves
Mortality rate calves between 1–60 days
Mortality rate calves between 2–6 months
Young stock
Mortality rate young stock between 6–15 months
Percentage of heifers older than 17 months that have not started breeding
Mean age at first calving
Calving
Calf mortality rate within the 24 hours after birth
Percentage of difficult calving
Feed balance
Paralysis or cramps (includes milk fever, grass tetany)
Other feeding disorders (includes acidosis, ketosis)
Abnormal urea values
Low urea values
Diseases
Total reported cows with disease
Treatments for mastitis
Calculated Bulk milk cell count
Monitoring and care
Percentage of cows with a calving-first insemination interval of more than 70 days
Percentage of cows with an interval calving-last insemination interval of more than 120 days
Percentage of cows culled due to fertility problems
Average calving interval
Sustainability
Percentage of claw and leg disorders
Percentage of primiparous cows culled 1–90 days after calving
Total percentage of culled cows
Percentage of unassisted death/euthanized cows

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Chapter 5: Evaluation of the use and effectiveness of a dairy herd health management tool on advisory services and herd health

Chapter 5: Evaluation of the use and effectiveness of a dairy herd health management tool on advisory services and herd health

J.E. Duval[1], N. Bareille[1], A. Madouasse[1], M. de Joybert[1], K. Sjöström[2], U. Emanuelson[2], C. Fourichon[1]

[1]BIOEPAR, INRA, Oniris, 44307, Nantes, France

[2]Swedish University of Agricultural Sciences, Division of Ruminant Medicine and Veterinary Epidemiology, Department of Clinical Sciences, P.O. Box 7054, SE- 750 07 Uppsala, Sweden

Abstract

Animal health planning activities are not always providing a satisfactory positive impact on herd health and welfare. Moreover, the evaluation of the impact of advisory programs is difficult due to multiple interacting elements that influence its outcome. Therefore, measuring solely health outcomes is not sufficient; the whole process of its implementation and use should be evaluated. An intervention study was performed to evaluate the impact of a Herd Health and Production Management (HHPM) program, which was designed and implemented at farm level using a participatory approach. The program was implemented by 20 pairs of organic dairy farmers and their advisors in animal health in France and 20 pairs in Sweden. The impact of the HHPM program was evaluated based on; users' compliance to the HHPM-program, the programs' effectiveness in terms of improving herd health, the program's ability to fulfil its intended use concerning monitoring and prevention activities, the programs' ability to influence herd health management practices and to stimulate dialogue between farmers and advisors. Complete compliance to the program was fulfilled by 21 out of 40 pairs. Results from the questionnaire, filled in by users of the program, showed that the programs functioned as intended, it stimulated change in farmers' herd health management practices and the dialogue between farmers and advisors on several topics. Even though the majority of the users perceived that the program contributed to herd health improvements, no significant differences in health outcomes were found in participating farms when compared to control farms. Although the program allowed creating an environment promoting the exchange of information between farmers and advisor necessary to define pertinent advice in a farm specific situation, we could not evaluate if and how advisors used this information. Nor could we evaluate the quality of the information given. We recommend that future research should aim for improving methods for the evaluation of the effect of advisory programs, by identifying early indicators for effective advice and the development of methods to evaluate the quality of advisory situations without interfering with them.

Keywords: dairy cattle, animal health planning, farmers' decision-making, extension services, complex interventions

5.1 Introduction

Results of animal health planning activities have not always been satisfactory in the improvement of animal health and welfare. The plan's effect depends, amongst others, on the participants' compliance to the program and/or to the resulting implementation of recommended measures. Furthermore, successful planning processes require mutual trust between involved actors (Tremetsberger and Winckler, 2015).

The use of Herd Health Production and Management (HHPM) programs seems promising to reach the goal of herd health improvement through disease prevention and animal health promotion strategies, adapted to each farmer. HHPM programs aim to support farmers in their decision-making in reaching their farming goals, taking into account the farmers' sociological style. Thus, HHPM programs put farmers at the centre of the decision-making process and are tailored to farmers' style (Brand et al., 1996).

Recommending measures, acceptable for farmers, requires a certain degree of communication between farmer and advisor in animal health. Farmers' decision-making process to implement practices is complex and influenced by at least: farmer' objectives and constraints, previous experiences, understanding and perception of animal disease risk and the expected affectivity of corrective practices (Garforth, 2011). This can be a challenge for veterinarians as they have not always been found to be well aware of dairy farmers' goals and priorities (Derks et al., 2013; Vaarst et al., 2006).

As described in Chapter 3, a HHPM-like program was developed, using a participatory approach. The designed monitoring and prevention tools have characteristics that are expected to promote the program's effectiveness in terms of herd health improvement in organic dairy farms, such as the possibility to adapt the monitoring indicators to farm specific situations and the design of the prevention protocols listing objectives to attain, rather than prescribing, corrective measures. These features are expected to promote farmer ownership of the process. It could also help to stimulate the dialogue between farmer and advisor. These functions are expected to promote compliance to the HHPM program and the implementation of recommended measures, and could thus ultimately improve herd health.

However, the implementation of the HHPM program as an advisory service to the participating farms can be regarded as a complex intervention. Complex interventions were defined by Craig et al. (2008) as 'interventions that enclose several interacting elements, but they have other characteristics that evaluators should take into account. Namely, there are a number of interacting components within the experimental and control interventions, a degree of flexibility or tailoring of the intervention is allowed, a number and variable outcomes are possible, different groups or organisational levels are targeted by the intervention and the number and the difficulty of the behaviours needed by those that convey or receive the intervention' (Craig et al., 2008). Characteristics of a complex intervention can be identified in the context of the present study; i.e. flexibility in the use of the tool is allowed (e.g. choice of indicators for herd health monitoring, there are no predefined recommended measures), both the farmer and his advisor are targeted, the outcomes can be numerous based on the heterogeneity of the farms and advisors and the farmers' decision-making processes are complex.

Complex interventions are often difficult to evaluate and the outcomes of evaluation studies can be difficult to interpret, reproduced or replicated in a specific context. Therefore, it is important to evaluate the complete process of an intervention and not only its outcomes: to assess the level and quality of implementation, to identify causal mechanisms and contextual factors that can explain variation in results (Moore et al., 2015). Hawe et al. (2004) suggested allowing adaptation of the form of the intervention to the specific context. Hence, rather than evaluating the form, one should aim for the evaluation of the steps that, in theory, would facilitate change. Moreover, allowing the tailoring of the form could improve the effectiveness of complex interventions, which in general are disappointingly low (Hawe et al., 2004). Furthermore, a dialogue between designers and end-users, that have tested a prototype, creates a learning environment in which the response of the tool to 'real-life' working situations can be discussed. Debriefing with users can provide understanding of whether the tool allows to do what it was conceived for, to identify areas in which further research might be needed and to show discrepancies between the way the designers and users theorize action (Cerf et al., 2012).

The HHPM program designed in this thesis is expected to be a useful tool for farmers and advisors to prevent disease and promote animal health. However, due to the fact that the intervention with the HHPM can be regarded as complex, evaluation of its effectiveness requires the evaluation of the factors that could facilitate the process towards pertinent herd health advisory services and not solely changes in herd health outcome. Therefore, the objectives of this study are to evaluate the use of the HHPM program and its effectiveness on herd health advisory services and herd health.

5.2 Material and methods

General study design and evaluation process

An intervention study was performed in a total of 40 farms in France and Sweden. The choice of the two countries was motivated by the fact that they represent different contexts in terms of existing organic farming systems and animal health advisory services. Using a participatory approach, a HHPM program targeting five health areas (reproductive health and performances, udder health, calf health, locomotor disorders and metabolic diseases) was designed by stakeholders and scientists. After researchers' introduction to the use of the HHPM program, the program was implemented by farmers and their advisors in animal health on the farms during a period of 12 months, without the presence of researchers.

In order to improve future HHPM programs, we need to have a detailed understanding of how these HHPM activities are implemented in the field. Especially, when there appears to be no effect on herd health, one can wonder why that is, and whether parts of the process were not followed. The impact of an intervention with a HHPM-program on herd health is an effect that will be expected at a relatively late stage (Figure 5.1). In addition, the impact of an intervention like the HHPM program is the result of a chain of events, including the quality of the implementation of the tool and the tools abilities. It seems therefore relevant to measure elements of the tools implementation and intermediary effects, as we might not always be in the disposition to measure the long term effects on herd health situations. Thus, the impact of the HHPM program was evaluated based on; i) users'

compliance to the HHPM-program, ii) the programs' ability to fulfil its intended use, concerning monitoring and prevention activities, iii) to stimulate dialogue between farmers and advisors iv) the programs' ability to influence animal health monitoring and disease prevention practices and v) the programs' effectiveness in terms of improving herd health (Figure 5.1, orange boxes).

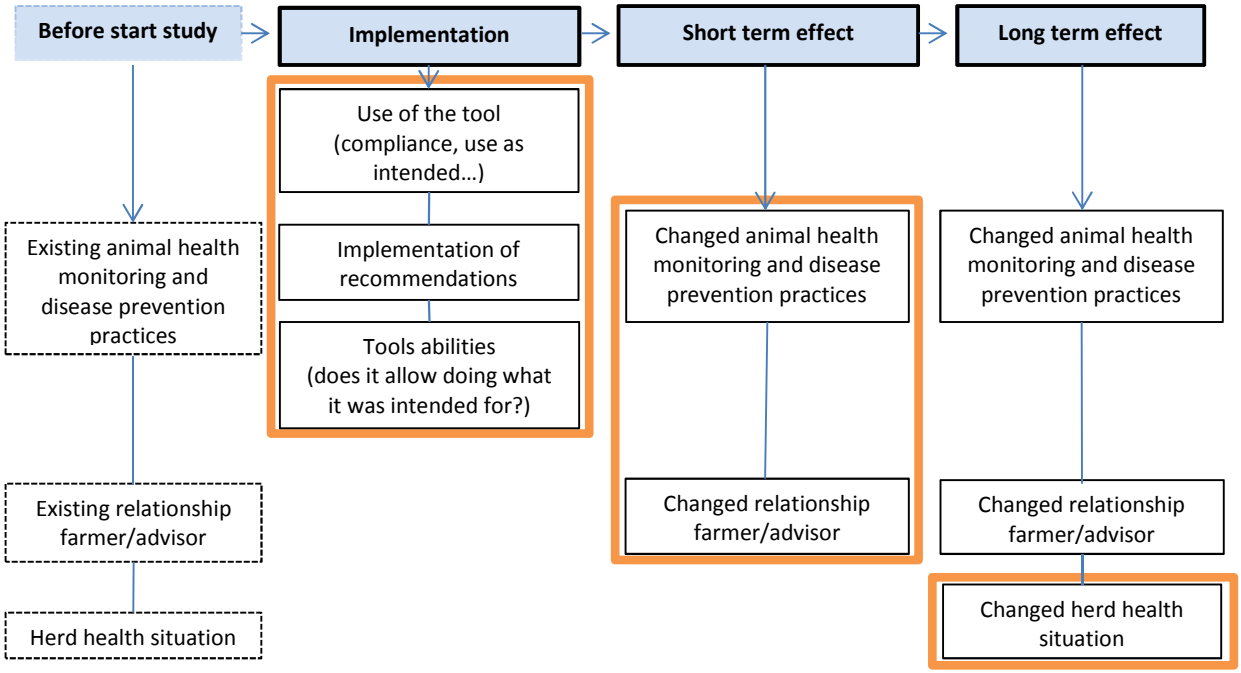

Figure 5.1: Possible elements to be measured to evaluate the implementation and possible short and long term effects of a herd health management tool (the focus of the evaluation of the HHM tool in this study will be on the elements depicted by the orange boxes).

Selection of participants

In France and in Sweden, organic dairy farmers that were involved in the IMPRO-project were asked whether or not they would be willing to participate in the current study. The farms had to be certified as organic and participate in the milk recording scheme for the entire study period.

Farmers had the liberty to choose the advisor to accompany them in the implementation of the HHPM program (Table 5.1). This strategy was motivated by the fact that the success of herd health planning activities is known to be influenced by the level of trust between farmers and advisor. Advisors could be asked to accompany multiple farmers, as was the case for 1 veterinarian in France and 5 in Sweden. Advisors were paid 1000 euros to accompany farmers in implementing the HHPM program during one year. Participating farmers did not receive any payments.

Table 5.1: Number of participating organic dairy farmers and number of advisors of their choice for implementing the Herd Health Management and Production program

		Type of advisor		
	Farmers	Veterinarians	Herd management advisors	Dairy production advisors
France	20	14	4	1
Sweden	20	14	2	0

Concept of the HHPM program

The HHPM program proposed to the 40 farmers and their advisors (detailed explanation in chapter 3) lasted about 12 months. Farmers and their advisors were provided with the adaptable monitoring and preventive protocols that aim to monitor the main production diseases and enhance prevention by good farming practices in relevant farm areas (Figure 5.2). As explained in chapter 3, these protocols are not static in their usage but adaptable to the specific herd health situation. If health problems are identified by the monitoring protocol in a certain area, a reasoned intervention will be triggered using the preventive protocols. Not all components of the preventive protocol will always be activated. For example, udder health problems in the lactating herd caused by pathogens from the environment demand different corrective actions compared to udder health problems due to udder pathogens. Farmers and their advisors should be able to identify the risk factors specific to the problem present on the farm and select appropriate corrective actions to improve the health situation using the disease prevention protocol. The prevention protocols can also be used to start a dialogue on a certain health topic without a herd health alert, with the aim to reinforce existing disease prevention strategies.

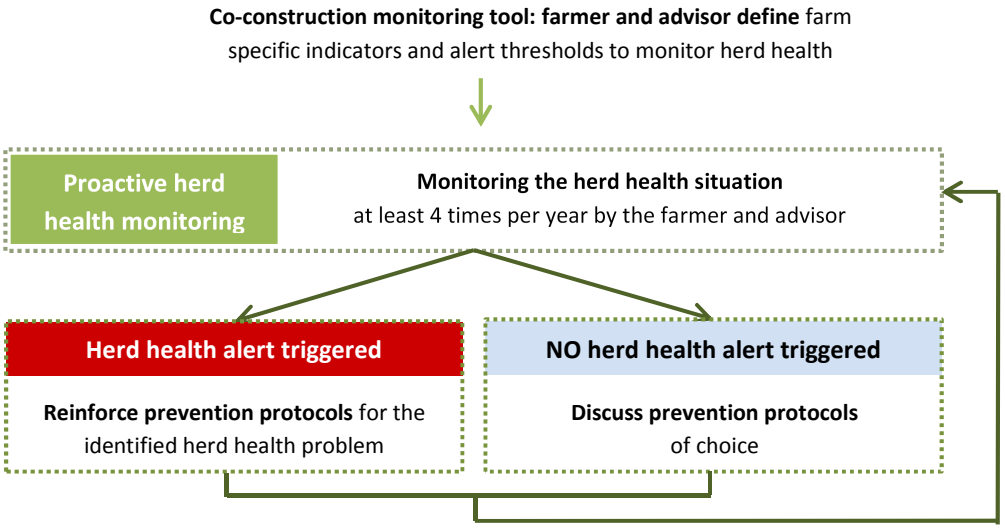

Figure 5.2: General concept of the Herd Health and Production Management program

Introduction of the HHPM-program to the participants

On each participating farm, the concept and use of the HHPM program was introduced and explained during the first farm visit (visit 0), by a member of the French and Swedish research team, to the farmer and his/her advisor. The objectives of visit 0 were: to present the concept of the HHPM-program, to co-construct with the farmer and advisor the farm specific monitoring tool (results in Chapter 4), to discuss each person's role in the HHPM-program and plan the next visit.

Within the framework of the proposed HHPM-program, participants were asked to implement the HHPM program and have at least 3 farm visits per farm in a period of 12 months in Sweden and 4 in France, following visit 0. These visits would be conducted in the absence of a researcher with the objective to mimic as much as possible a field situation, without the influence of an observer (Figure 5.3).

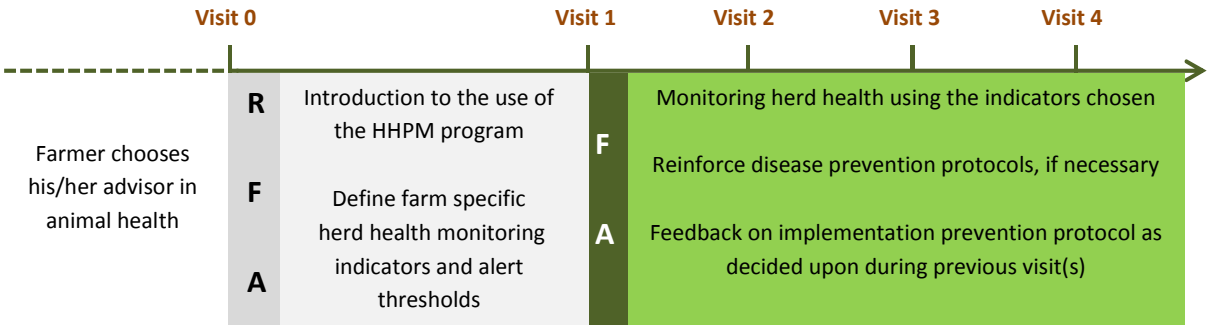

Figure 5.3: Proposed protocol for the implementation of the Herd Health Management and Production program on the participating farms (R=researcher, F= organic dairy farmer, A= advisor in animal health)

Evaluation of the HHPM-program

Evaluation of the compliance to the HHPM program

As researchers were not present during the visits following visit 0, to be able to evaluate which elements of the HHPM-program were implemented, the advisor sent to the research team a report after each visit (See Annex 5.1 for the template provided for the report). Participants compliance to the HHPM program was evaluated, based on the number of visits performed, the implementation of monitoring activities as planned, the use of the preventive protocols after a herd health alert, the proposition of recommendations to improve a deteriorated health situation, the presence of a discussion on recommendations made during the previous visits and implementation of recommended measures of previous visits if there were any.

Evaluation of the HHPM program' impact on herd health

To assess the effectiveness of the HHPM program in terms of improvement in herd health, health situations before and after the intervention were evaluated and compared to the evolution of the herd health situation in control herds from the corresponding countries (Figure 5.3). In addition, differences between French and Swedish farms were assessed.

Herd health and (reproductive) performance indicators were calculated for two distinct periods. Period 1 is the reference period, from the 1st of January 2012 to the median date of visit 0 (13 October 2014). Period 2 covers the implementation of the HHPM program from the median date of visit 1 (10th of December 2014) to the 15th of March 2016. Data from farms in the HHPM group without a visit 1 were excluded from the analysis.

The evolution of the herd health indicators from Period 1 to Period 2, within the two farm groups, was analysed by using linear models. The normality of the outcomes was checked leading to the modelling of their natural logarithm when relevant. In addition, between groups and between countries situations were compared.

The French control farms were certified organic dairy farms located in the same geographic areas, with comparable feeding practices, herd size and milk production level. Swedish control farms were

randomly selected out of the organic farms present in Sweden.

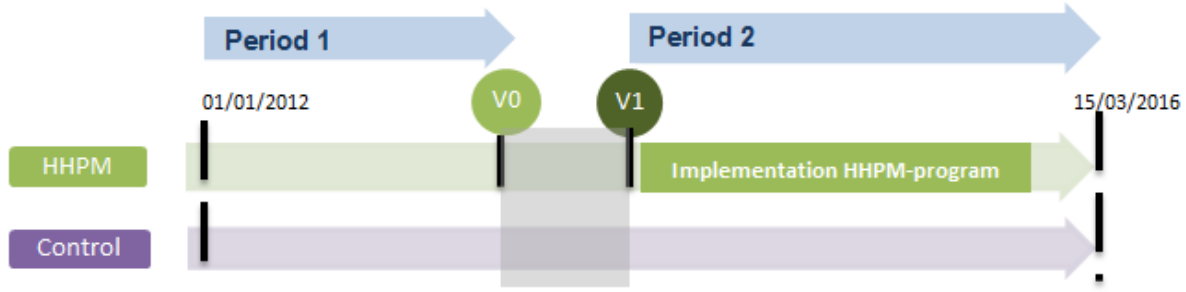

Figure 5.4: Definition of the study periods and the group of farms used for the comparison of the health indicators (HHPM = Herd Health Management and Production)

Farm data from the national recording systems was retrieved to calculate herd health and production indicators. Data was obtained from the official milk recording schemes, artificial insemination databases and the animal identification and registration databases. The national recording systems are not harmonized and record keeping is different across countries, including the amount of information that is recorded. Therefore, the choice of herd health indicators was determined by data availability in both countries. For example, in contrast to Sweden, in France there is no information available on lameness. As a consequence, this health disorder was excluded from the evaluation even though lameness was one of the five health domains targeted by the HHPM program. The following 9 indicators were retained to measure herd health and production performances:

Milk production indicator:
- Kg milk: average daily milk yield produced per cow per herd, during the time period of interest.

Udder health indicators:
- Prevalence of high somatic cell count (SCC): proportion of records with a SCC-value >200 000 cells/ml, during the time period of interest
- Incidence of increased SCC: proportion of cows with a SCC-value <200 000 cells/ml that change to >200 000 cells/ml between consecutive test-days, during the time period of interest.

Reproductive health and performance indicators:
- Calving interval: median interval between the last and the previous calving date, for the calvings occurring during the time-period of interest.
- Calving to first artificial insemination interval: median duration interval between the last calving and the first artificial insemination after calving, regarding the calvings occurring during the time-period of interest.

Indicators metabolic disorders:
- Prevalence of fat/protein ratios >1.4 (between 30 and 100 days in milk (DIM)) indicating increased risk of ketosis, during the time period of interest.
- Prevalence of fat/protein ratios <1.0 indicating increased risk for sub-acute ruminal acidosis (SARA), during the time period of interest.

Mortality indicators:
- On-farm mortality of cows: number of cows, i.e. after first calving, that died or were euthanized on farm, divided by the sum of their days at risk of death. Sold animals were censored at the day of leaving the herd.

- Calf mortality: number of calves that die between first day and 30 days of life, divided by the sum of days at risk of dying. Sold animals were censored at the day of leaving the herd.

Evaluation of the users' opinion on the HHPM program and its functions

The opinion of the participants of the HHPM program was collected at the end of the intervention period. Every farmer and advisor that had performed at least one visit after visit 0 was asked by email to fill in the questionnaire using a web (Netigate®) or a paper form. Only one farmer used the paper format. Reasons for not responding to the questionnaire were not recorded.

Questions were related to the different types of possible use that could be made of the monitoring and the prevention tool that were part of the HHPM program, possible limits in its use, the value of having regular farm visits, the influence of the HHPM program on the relationship between farmer and advisor, the perceived effectiveness on herd health, future use and cost of the HHPM program (annex 5.2). Mostly, questions with closed answers were used.

Answers to questions, where a Likert-scale was used, were transformed into agree or disagree answers for the analysis. The scores 1 to 3 were converted into disagree and scores of 4 to 6 were converted into agree. Due to the low sample size, the Fisher's test was used to identify whether significant differences existed in the results between groups; (i) French farmers were compared to Swedish farmers, (ii) French advisors were compared to Swedish advisors and (iii) the results of all the farmers were grouped and compared to the responses of all the advisors.

Statistical analysis

To compare the results on compliance, health impact and users' opinion between study groups, such as control groups vs. HHPM group, differences between countries or farmers and advisors, Fisher's test were performed.

5.3 Results

Compliance to the HHPM program

Number of implemented visits

Visit 0 was implemented in all HHPM farms. However, on 2 farms in France and 2 in Sweden no further visits in the context of the HHPM program were implemented. The reason stated by the 4 advisors was their lack of time to implement the rest of the visits.

The pairs of farmer/advisor, who performed the other visits without the presence of the researcher, did not all comply with the four visits proposed in the HHPM program. Twenty one out of the 40 farms involved completed at least the four visits (Table 5.2). The reasons given not to go further than one, two or three visits were relative to the lack of time of the advisor (4) or the satisfaction of the farmer with his herd health situation (4).

There was no significant difference in the number of farmers who completed the full number of visits proposed in France (13/20) compared to Sweden (8/20) (P= 0.3).

Table 5.2: Compliance to the Herd Health and Production Management program in terms of number of visits performed after visit 0, implementation of monitoring activities and the use of disease prevention protocols

	France	**Sweden**	**Total**
Number of implemented visits			
1	1	3	4
2	2	4	6
3	2	8	10
4	12	0	12
5	1	0	1
No data*	0	3	3
Percentage of the pairs monitoring 5 health topics on a visit, when a visit was undertaken			
Visit 1	72%	100%	86%
Visit 2	94%	87%	91%
Visit 3	80%	91%	86%
Visit 4	100%	85%	93%
Percentage of visits with a herd health alerts that lead to the use of a disease prevention protocol			
Visit 1	80%	No data*	-
Visit 2	86%	92%	89%
Visit 3	80%	78%	79%
Visit 4	64%	73%	69%

* No data due to loss of reports

The use of the monitoring tool

The percentage of the pairs that implemented the monitoring activities as planned when they had a farm visit is shown in Table 5.2. Udder health was the only health domain that was monitored at each farm visit on every farm (data not shown). Across countries, udder health is the domain with the highest number of health alerts, followed by reproduction and calf health (Figure 5.5).

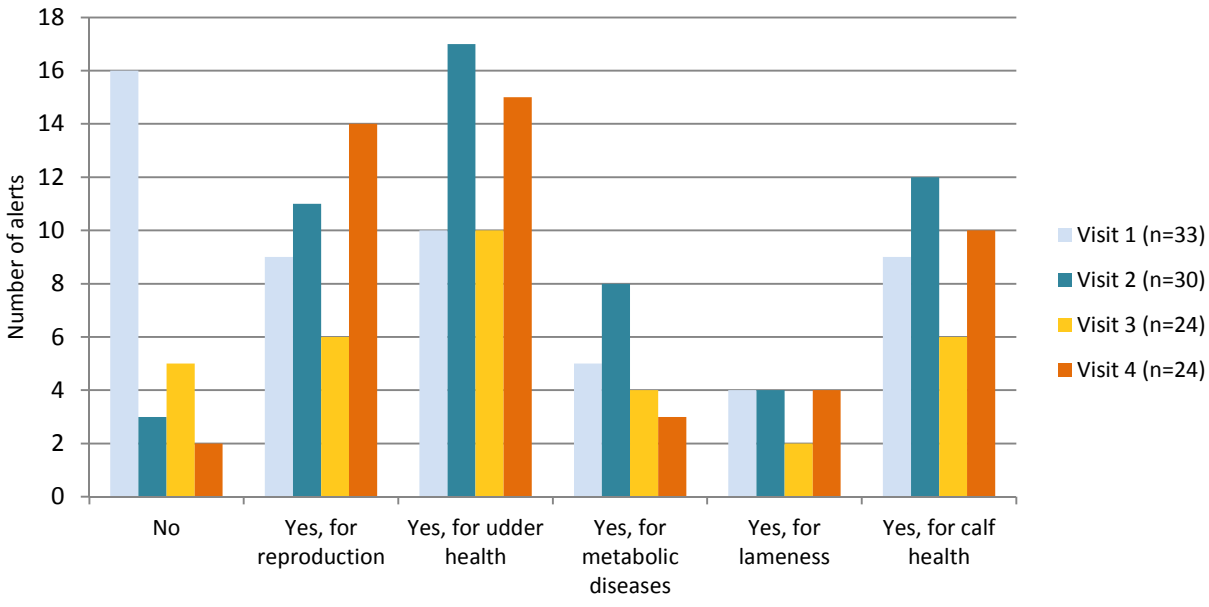

Figure 5.5: Number of alerts per health domain per visit (n= total number of farms for which data was available)

The use of the prevention tool

An alert should lead to a preventive protocol for the pair to identify risk factors present on the farm and relevant corrective actions. However, this was not always the case. No differences were found between France and Sweden in the use of the prevention protocols after a herd health alert (Table 5.2). Prevention protocols could also be used without a herd alert. Except for the first visit, about 50 % of the pairs consulted at least one protocol without alert during visits 2 and 3 (Figure 5.6).

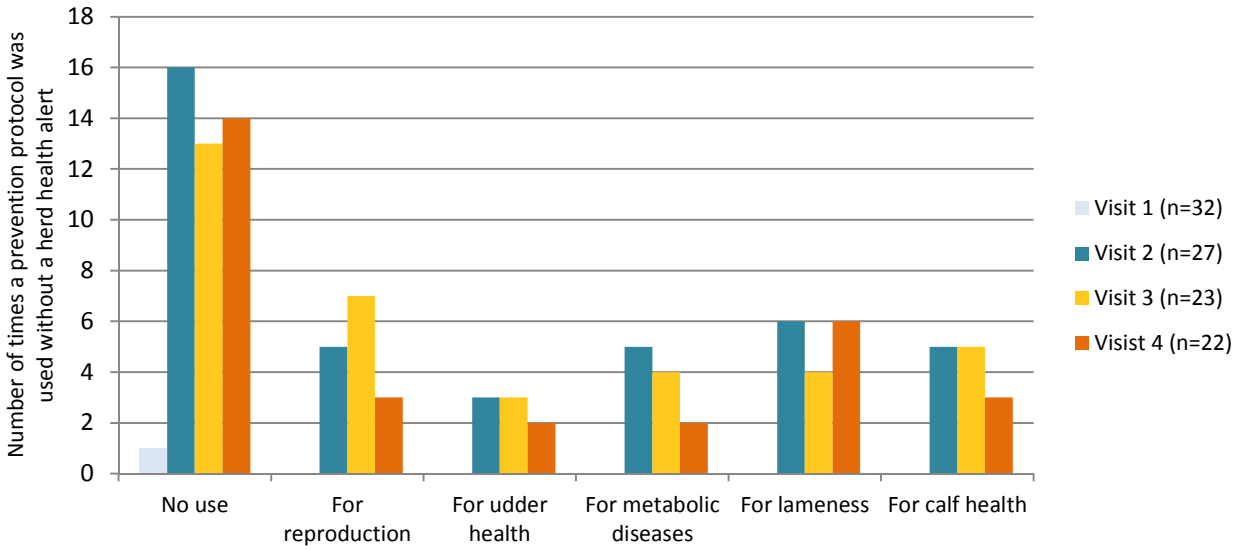

Figure 5.6: Number of times, across countries, preventive protocols were used without any herd health alert per visit (n= total number of farms for which data was available)

Identification of corrective measure to improve health

On average over the 4 visits, 100 % of the alerts led to recommendations in Sweden compared to 85 % in France (P=0.48). Moreover, when identifying the recommendations made, they were more frequently relative to udder health, reproduction and calf health and concerned less often locomotor disorders and metabolic diseases.

For the relatively few cases in France when no recommendations were made while some alerts triggered, several reasons were found in the reports:

- The farmer thought he or she already did all that was possible to prevent the health problem.
- The recommendation was not adaptable enough to his or her daily work to be implemented, such as, not implementing foremilking because it increases the duration of milking.
- The farmer had experienced the health problem as a problem that in the past had appeared and disappeared by itself. Therefore, the farmer showed no willingness to do something about it.
- The farmer was not convinced that improving the specific health domain would prove to be beneficial, e.g. male calves would be monitored less since as they were not kept on the farm and sold at a very low price.
- Sometimes measures were abandoned because their implementation was too time-consuming to the farmer in relation to the benefit they brought.

The HHPM-program's impact on herd health

Data was missing for a certain number of farms for the calculation of certain indicators in both countries, even though data availability was a selection criterion. In France, for 15 control herds and 5 herds in the intervention group, milk recording data was missing. In Sweden this data was missing for 13 control herds. For the calculation of the calving interval data from 1 intervention herd was missing in France, in Sweden this was the case for 17 control herds and 1 intervention herd. For the calculation of the indicator interval calving-first artificial insemination, data from 1 control and 1 intervention herd was missing in France, in Sweden the data missed for 3 control herds. To calculate calf mortality, the data of 4 and 2 control herds was missing in France and Sweden, respectively.

No significant effect of the HHPM program on herd health in the participating herds has been demonstrated. The statistical analysis showed no significant difference in the health status changes, before and after the start of the HHPM program, between the HHPM and the control group or between the two countries

The average daily milk production was significantly higher in Sweden than in France. The prevalence and the incidence of somatic cell count > 200 000 cells/ ml are lower in Sweden than in France. No significant differences were found between the two countries for reproductive performances and metabolic disorders' indicators (Table 5.3). And finally, calf mortality was significantly higher in France than in Sweden in contrast to the situation for cow mortality, which in turn was lower in France, but not significantly.

Table 5.3: Results of linear models for herd health indicators in the study groups and their evolution after implementation of the Herd Health and Production Management program in France and Sweden. For all models the reference modality was the reference group in France (model intercept). For the indicators calving interval, median calving to first artificial insemination interval, on-farm mortality adult cows and calf mortality 1-30 days after birth the natural logarithm of the indicator was modelled. For these indicators the coefficient estimates must be exponentiated to get back to the original scale, and the effects are multiplicative. For example, the calving interval in the control group in Sweden is exp.(6.03)*exp.(-0.03) = 403.4 days.

	Evolution herd health indicators															
Groups	Milk yield per cow per day per herd (kg)		Prevalence of high somatic cell count		Incidence of increased somatic cell count		Ln calving interval (days)		Ln median calving to first artificial insemination interval (days)		Prevalence of fat/protein ratios >1.4 (30- 100 days in milk)		Prevalence of fat/protein ratios <1.0		Ln on-farm mortality adult cows (%)		Ln calf mortality 1-30 days after birth (%)	
	Esti-mate	*P-value*	*Esti-mate*	*P-value*	*Esti-mate*	*P-value*	*Esti-mate*	*P-value*	*Esti-mate*	*P-value*	*Esti-mate*	*P-value*	*Esti-mate*	*P-value*	*Esti-mate*	*P-value*	*Esti-mate*	*P-value*
Country FR and control group	+17.83	***	+31.76	***	+15.71	***	+6.03	***	+4.62	***	+0.11	***	+0.05	***	+0.92	***	+1.34	***
Country SE	+8.96	***	-4.51	***	-2.38	**	-0.03	*	-0.11	**	-0.01	n.s.	+0.01	n.s.	+0.08	n.s.	-0.79	***
Intervention group	+1.54	**	-0.31	n.s.	-0.51	n.s.	-0.02	n.s.	-0.02		-0.00	n.s.	+0.01	n.s.	+0.02	n.s.	-0.04	n.s.
Study period 2	+1.04	*	-0.33	n.s.	-0.18	n.s.	-0.01	n.s.	-0.08	*	+0.01	n.s.	-0.00	n.s.	+0.29	***	+0.10	n.s.

FR= France; SE=Sweden; ***P-value <0,001;**P-value <0.01;*P-value <0.05; n.s. = non-significant; Ln = natural logarithm

Results of the questionnaire regarding participants' opinion on the HHMP program and its functions

Seventeen out of the 18 eligible French farmers answered the questionnaire. In Sweden 11 out of 18 farmers answered to the questionnaire. All French advisors (17) answered the questionnaire and in Sweden 8 out of 13 advisors did.

Participants' time investment in the HHPM program and its cost

The time spent by advisors preparing, performing and summarizing the farm visits varied between participants (Table 5.4). The preparation of the visits in France was on average shorter than in Sweden.

Table 5.4: Average time spent by the advisors to perform the farm visits

	France *(min; max)* (n=16)	**Sweden** *(min; max)* (n=7)
Average number of hours needed to prepare a visit	0.3 *(0;1)*	1 *(0.3;2)*
Average number of hours needed to perform a visit	2 *(1;3.5)*	1.8 *(1;4)*
Average number of hours spent to write the summary of the visit	1 *(0.1;3)*	1 *(0.5;1.5)*

Advisors were asked whether the amount they were paid to implement the HHPM program corresponded to what they would ask of farmers for this kind of services (Table 5.5). Only a relatively small proportion of the advisors would ask a higher amount of money for similar advisory services.

Table 5.5: Advisors' opinion on the justness of the amount paid for their work in HHPM program

	France % (n=17)	**Sweden** % (n=8)
I would ask more	17,6	12,5
I would ask less	47,1	25,0
I would ask an equivalent amount	35,3	62,5

Farmers who answered to be possibly willing to pay their advisor for this kind of services were asked which amount they would accept to pay per year. In France this varied from 150 to 1500 euros per year. Some farmers expressed to be willing to pay the hourly wage of a veterinarian or to look for a format based on a fix amount per year per cow. Swedish farmers proposed varying amounts ranging from 105-525 euros per year.

General appreciation of the tool

Both farmers and advisors were asked whether they were of the opinion that the implementation of the tool during the study had a positive impact on the health of the herd (Table 5.7). Farmers were more positive than advisors on the health impact of the HHPM program that has been tested, however this difference was not significant. Not all the farmers were willing to pay advisors for these kinds of services and a significant difference was observed between the farmers in the two countries (p-value = 0.042). Participants in the different countries did not reply with a significant difference to the other questions presented in Table 5.6.

Table 5.6: Participants' perception on the effect of the tool on herd health and possible future use

	Farmers			Advisors		
	FR (n=17) %	**SE** (n=10) %	*p-value*	**FR** (n=17) %	**SE** (n=8) %	*p-value*
The implementation of the advisory service, as proposed, has contributed to improve the health of the herd	64,7	90	n.s.	58,8	62,5	n.s.
I am ready to pay the advisor for this kind of service	47,1	90	*	-	-	-
I will keep using the tool						
yes, both the monitoring and the prevention tool	58,8	80	n.s.	64,7	62,5	n.s.
yes, but only the monitoring tool	5,9	0	n.s.	5,9	0	n.s.
yes, but only the prevention tool	5,9	0	n.s.	5,9	25	n.s.
I would recommend the monitoring and/or prevention tools to colleagues	65	100	n.s.	71	88	n.s.

FR= France; SE=Sweden; *P-value <0.05 : n.s. = non-significant

Although not all French participants expected an improvement of the herd health situation of the participating herds, the percentage of participants answering they would keep using (certain elements of) the tool is higher than the percentage of participants estimating a positive effect on herd health. When comparing farmers as a group to advisors no significant differences were found either, thus these will not be further commented in the remaining parts of the results section.

Participants' opinion of the monitoring tool

Participants were asked whether the intended objectives of the monitoring tool were fulfilled by the tool. The aim was to assess whether the tool allows doing what it was intended for. The main difference that can be found between the two countries is regarding the statement that the implementation of the tool was a way to have regular contact between farmer and advisor. This seemed to be more important in France than in Sweden, although this was not significantly different either (p= 0.08) (Table 5.7). Nor were any significant differences observed between farmers and advisors across countries.

Allowing each farmer to choose the indicators considered appropriate for herd health monitoring in his/her farm, was done with the intention to improve the shared understanding by farmer and advisor on several aspects; the herd health situation of the farm, farmers' focus areas regarding herd health, the way the farmer monitors health. Participants' experiences related to these objectives are presented in Table 5.7. Differences between the two countries can be observed, but within country differences also exists between farmers and advisors. Farmers were in general more positive about the effect of the tool on the shared understanding between farmer and advisor, but these differences were not significant. The only significant difference observed between French and Swedish advisors was concerning the effect of the chosen indicators on improving their knowledge on the way farmers monitor health and farmers' focus areas.

Table 5.7: Participants' agreement on the fulfilment of intended uses of the monitoring tool

	Farmers			Advisors		
Agreement with the following statements:	**FR** (n=17) %	**SE** (n=13) %	*p-value*	**FR** (n=17) %	**SE** (n=8) %	*p-value*
The herd health monitoring was useful because…						
…it allows for the early identification of herd health problems	82	69	n.s.	88	75	n.s.
…it allows to secure herd health	77	46	n.s.	77	75	n.s.
…it is a way to have regular contact with my advisor/ the farmer	77	46	n.s.	94	63	n.s.
…it gave me a better idea of how I can use data …for herd health monitoring/it gave me more access to herd health data of the farm	71	62	n.s.	59	63	n.s.
Choosing indicators adapted to the farm…						
…changed my perception of the herd health situation of the herd	53 (n=17)	23 (n=13)	n.s.	-	-	
…improved the advisor' understanding of the way the farmer monitors herd health	82 (n=17)	50 (n=12)	n.s.	82 (n=17)	25 (n=8)	**
…improved the advisor' knowledge on the herd health situation of the farm	82 (n=17)	67 (n=12)	n.s.	94 (n=17)	63 (n=8)	n.s.
…improved the advisors/my knowledge on your/ the farmers focus areas regarding herd health	82 (n=17)	67 (n=12)	n.s.	94 (n=17)	25 (n=8)	***
…led to a list of indicators that was appropriate for herd health monitoring on the farm	77 (n=17)	75 (n=12)	n.s.	77 (n=17)	75 (n=8)	n.s.
Choosing indicators adapted to the farm was difficult in its use because I lacked references to interpret with the indicators whether the herd health situation was satisfying/ or not	47 (n=17)	50 (n=12)	n.s.	41 (n=17)	0 (n=8)	n.s.
I did not have enough data to be able to check all health indicators	6 (n=17)	31 (n=13)	n.s.	18 (n=17)	29 (n=7)	n.s.
The monitoring is difficult to keep doing over time	56 (n=16)	36 (n=11)	n.s.	59 (n=17)	38 (n=8)	n.s.

FR= France; SE=Sweden; ***P-value ≤0,001;**P-value ≤0.01; n.s. = non-significant

Another aim of the scientists was to allow adaptability of the tool, for example by adapting indicators to changing animal health situations during the course of the study. In most cases, the chosen indicators were indeed adapted (Figure 5.7).

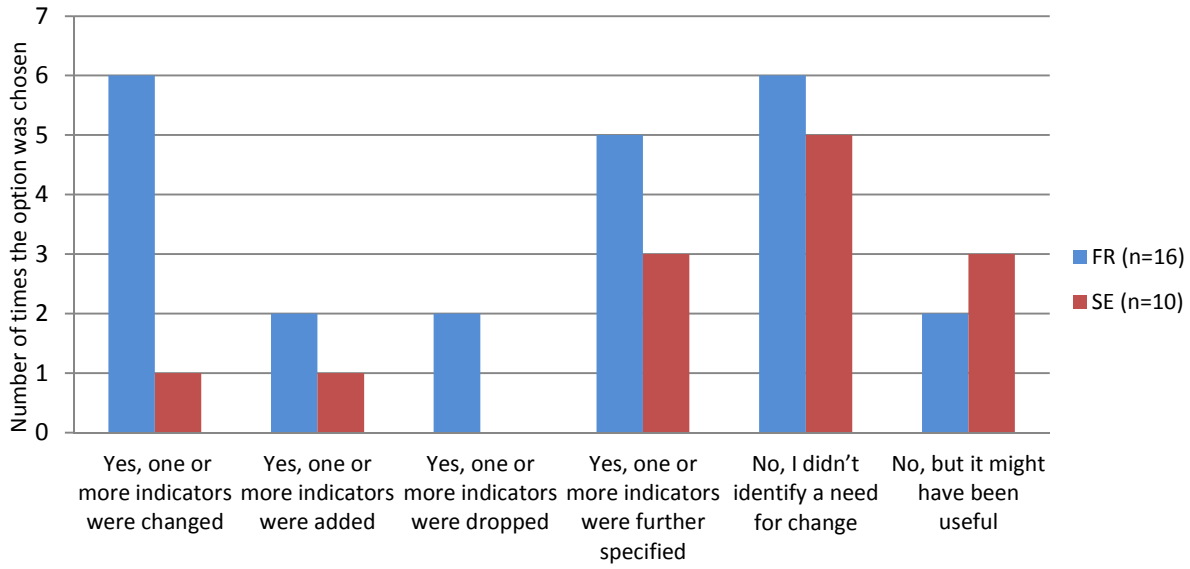

Figure 5.7: Farmers' use of possibility to adapt indicators during the course of the study (multiple answers) (FR = France; Se= Sweden; n= total number of farmers for which data was available)

Possible difficulties in the use of the tool were anticipated due to its adaptable nature and/or regarding the participants' varying experience with herd health monitoring and planning activities in general. Table 5.7 shows participants' opinions on the possible constraints in the use of the tool, without indicating whether or not it is a motive to stop using it. No significant differences were found comparing the participants in both countries nor when comparing farmers with advisors.

Participants' opinion of the prevention tool

Like the monitoring part, the prevention part of the tool was designed to serve different purposes; the identification of risk fa ctors of disease, showing the link between practices and health outcome, identifying corrective measures to improve or secure health and to stimulate discussion between farmer and advisors on management practices. Table 5.8 presents participants' agreement to whether or not these functions are fulfilled by the tool.

Table 5.8: Participants' agreement to the fulfilment of intended uses of the prevention tool

	Farmers			Advisors		
Agreement with the following statements:	**FR** %	**SE** %	*p-value*	**FR** %	**SE** %	*p-value*
In general, when a herd health problem was identified, the prevention protocol helped to identify relevant risk factors present on the farm	82 (n=17)	91 (n=11)	n.s.	59 (n=17)	88 (n=8)	n.s.
Using the prevention protocol allowed to show the link between management practices and animal health outcome	82 (n=17)	80 n=10)	n.s.	82 (n=17)	88 (n=8)	n.s.
In general, it was possible to identify correctives actions on the farm corresponding to risk factors identified with the advisor/farmer	88 (n=17)	91 (n=11)	n.s.	82 (n=17)	88 (n=8)	n.s.
The use of the prevention protocol stimulated discussion farm management practices	(n=17)	(n=10)	n.s.	(n=17)	(n=8)	n.s.
yes, we discussed more than we usually did	70	40	n.s.	47	75	n.s.
yes, but in the past we already discussed farm management practices	18	60		35	25	
no	12	0		18	0	

FR= France; SE= Sweden; n.s. = non-significant

In general, according to the participants, the prevention tool meets the functions it was intended to accomplish. No significant differences in perception were found between countries or groups of participants.

Identified corrective actions to improve animal health situations were always implemented, according to 35% and 27% of the farmers in France and Sweden, respectively. This difference was not significant. Reasons stated by farmers for not implementing the recommendations in France were mainly the fact that they were not adapted to farmers' working routine and a lack of time. In addition, Swedish farmers also expressed that they were not convinced of the effect on herd health as a reason not to implement recommendations (Figure 5.8).

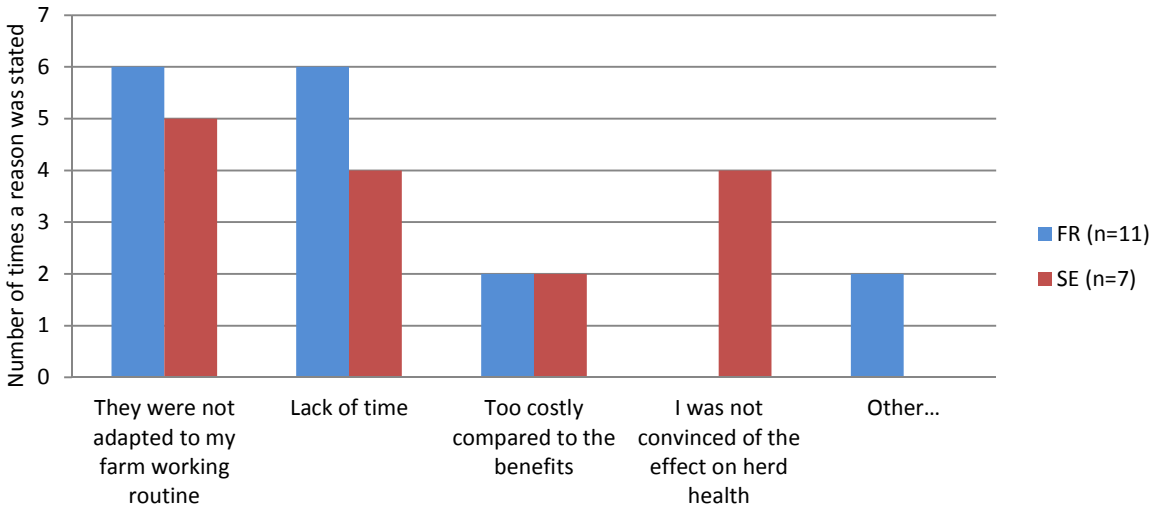

Figure 5.8: Reasons stated by farmers for not implementing the recommendations (multiple answers were possible) (n= total number of farms for which data was available)

The visits were considered, by the participants, as an opportunity to discuss; the animal health situation of the farm, questions of the farmer on animal health and animal health management practices (Table 5.9). Farmers and advisors agreed on this in both countries, as no significant difference could be found between these groups.

Table 5.9: Participants' agreement regarding the effect of regular farm visits imposed by the study

	Farmers			Advisors		
Agreement with the following statements: *Having regular visits (for reasons other than emergencies) during the year was an opportunity…*	**FR** (n=17) %	**SE** (n=10) %	*p-value*	**FR** (n=17) %	**SE** (n=8) %	*p-value*
… to take more time to discuss the animal health situation on the farm	100	80	n.s	100	87,5	n.s
… to have more time to discuss the questions the farmers have on animal health to the advisor/ veterinarian	100	80	n.s	94,1	87,5	n.s
…to discuss animal health management practices	100	80	n.s	100	87,5	n.s

FR= France; SE= Sweden; n.s. = non-significant

Furthermore, French and Swedish advisors acknowledged that during the farm visits of the study they discussed topics which they would not have discussed in the setting of their normal collaboration. French advisors learned most often about farmers' objectives and farmers' farm and animal health management practices. Swedish farmers learned most often about farmers' farm and

animal health management practices and of certain herd health problems (Figure 5.9). Farmers and advisors were not always of the same opinion.

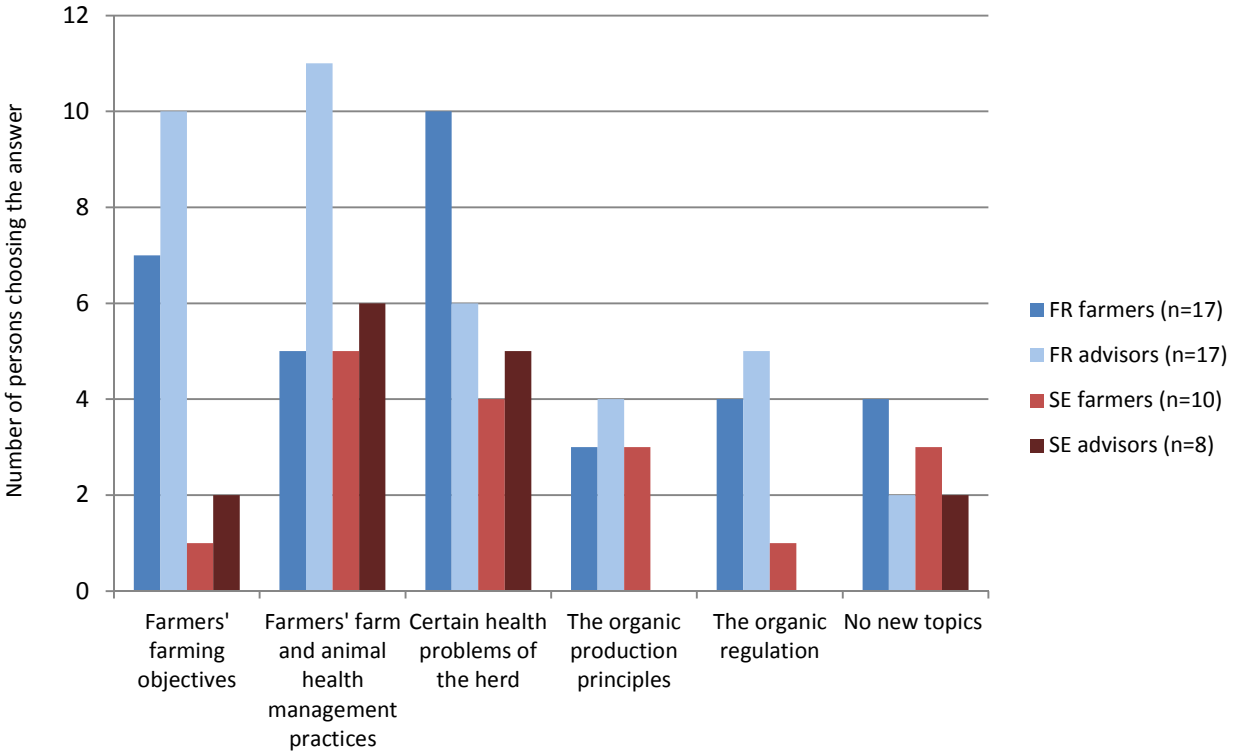

Figure 5.9: Farmers' expectations and advisors' experiences of areas in which advisors learned new information (n= total number of persons for which data was available)

Advisors' opinion on animal health in organic dairy farms or on the organic production principles did not change during the course of the study, they all had a positive opinion and that remained so (data not shown).

In addition, in 88.2% and 75% of the cases in France and Sweden respectively, advisors agreed with the fact that the collaboration was an opportunity to make farmers more aware of the knowledge and services they can offer them. The percentage of farmers agreeing to that was lower (Table 5.10). In addition, 41.2% of the French advisors thought to have more knowledge after the study of what the farmers expect from them, compared to 37.5% in Sweden (data not shown).

Table 5.10: Proportion of farmers with changed knowledge of services/information advisors can provide them due to the collaboration during the intervention study

	France (n=17) %	Sweden (n=10)%	*p-value*
Yes	41,2	50,0	n.s
No, I already knew	29,4	40,0	
No, I don't know more about it	29,4	10,0	

n.s= non-significant

Overall characterization of the tool by the participants

Participants were asked to tick the boxes that correspond to how they would characterise the tool. Most often the labels 'thought provoking', 'helpful in communicating' and 'instructive were used by French participants (Figure 5.10). Thirteen French advisors classified it as time consuming in contrast

to only two Swedish advisors. Swedish participants used most often 'helpful in communicating', 'motivating' and 'instructive'.

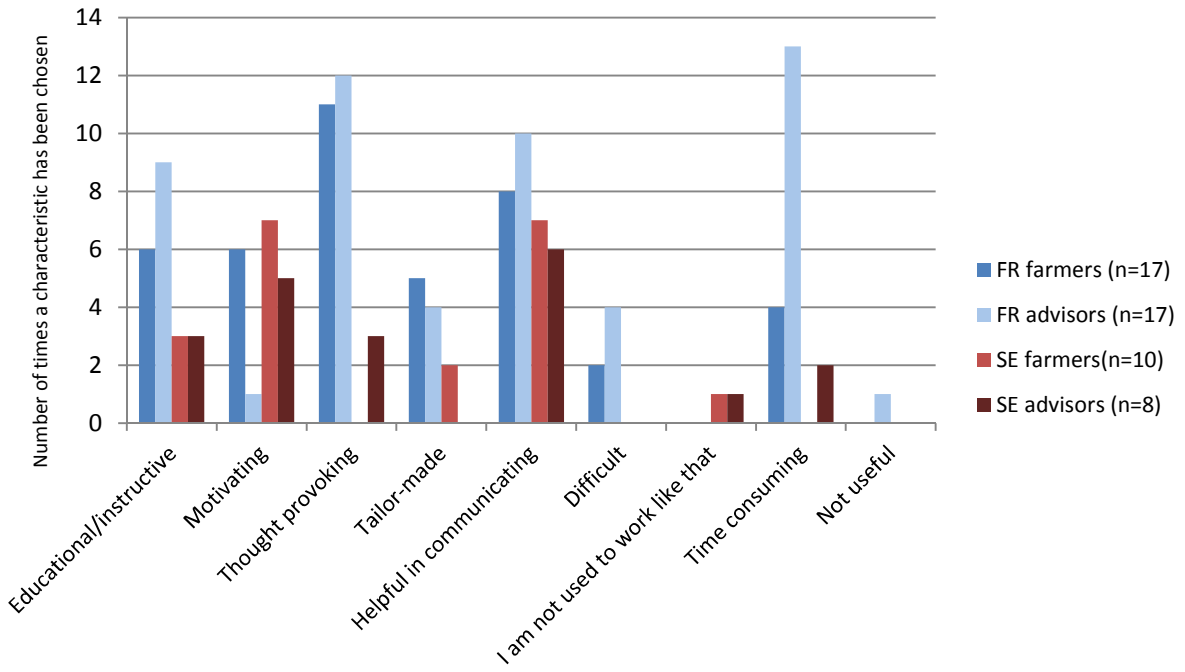

Figure 5.10: Illustration of how participants characterise the tool (n=total number of persons for which data was available)

Advisors were asked whether they would have liked to have more training in the use of the tool. In France 35.3% of the advisors wished to have had more training, compared to 75% in Sweden, but this difference was not significant. However it might have had a higher impact than calculated, since in Sweden several advisors followed more than one farm during the IMPRO project.

The number of farm visits proposed (4 per year) was considered as appropriate by most participants (Table 5.11).

Table 5.11: Proportion of participants agreeing with the frequency of farm visits proposed in the study

Right number of visits:	**FR** (n=17) %	**SE** (n=10) %	*p-value*
yes	94,1	80,0	n.s.
no, too few	5,9	10,0	
no, too many	0,0	10,0	

FR= France; SE= Sweden; n.s.=non-significant

For future development of this tool or others, it was considered of interest to understand whether the participants identified functionalities that would have been useful but that could not be assured by using this tool or areas of interest that were lacking.

Table 5.12: Participants' opinion on the completeness of the tools in terms of information

	Farmers			Advisors		
Percentage of participants agreeing with the following statements:	**FR** %	**SE** %	*p-value*	**FR** %	**SE** %	*p-value*
It would have been useful to monitor other health domains than the ones proposed (reproduction, udder health, lameness, metabolic diseases and calf health)?	24 (n=17)	30 (n=8)	n.s.	24 (n=17)	25 (n=8)	n.s.
I missed information in the prevention tool	35 (n=17)	18 (n=11)	n.s.	47 (n=17)	38 (n=7)	n.s.

FR= France; SE= Sweden; n.s. =non-significant

French farmers proposed as additional areas (Table 5.12) for monitoring feeding (3), tick-borne diseases (1). The Swedish farmers did not specify which new area(s) should be added. French advisors proposed to monitor feeding (1) and parasitic diseases (3). Swedish advisors proposed in addition mortality and culling reasons (1) and calving problems (1).

Six French farmers considered that information was missing in the prevention tool (Table 5.12). In detail it concerned; missing risk factors (3), missing objectives to attain (2), and missing health topics (1). In Sweden one farmer was of the opinion that objectives to attain were missing and another farmer considered that a health topic was missing. These participants did not further specify exactly what they were missing.

Participants' opinion on the format prevention protocol

A major anticipated constraint or possible discouragement in the use of the tool was its format. The format in which the tool was tested was a paper format (87 pages for the prevention protocols plus a few pages for the monitoring and reporting supports). The prevention tool was structured per health area, which was further subdivided in areas of interest (feeding, housing, and etcetera). Participants were asked whether they would prefer the tool in a different format (Table 5.13). They were presented with three options (multiple answers were possible): digital format, a different structuration of themes or other. In the category 'other', two French farmers asked for simplification and one for a lower amount of pages. French advisors asked as well for simplification of the tool, e.g. by reducing the number of pages.

Table 5.13: Participants' preferences for improvement of the tool' format

	Farmers		Advisors	
Options proposed	**FR** (n=13)	**SE** (n=9)	**FR** (n=13)	**SE** (n=9)
Digital format	6	6	13	4
A different structuration of themes	4	3	4	1
Other	4	0	3	1

FR= France; SE= Sweden

5.4 Discussion

The need for a comprehensive evaluation of the impact of the HHPM program

The evaluation of the intervention of the HHPM program, using a total process evaluation, allowed us to understand and explain the outcome of this complex intervention in a situation were a lot of variation in results is expected. This was an innovative approach in the field of animal health management, as often interventions are evaluated based solely on measured animal health improvements and results are sometimes explained by evaluating compliance to the intervention (e.g. Bell et al., 2009; Green et al., 2007).

Interventions might not be successful for numerous reasons that need to be understood, such as a lack of implementation or failure of one of the components of the intervention (Waters et al., 2011). For the evaluation of complex interventions requiring the interaction between different actors, such as the implementation of an adaptable HHPM program to the different farm specific conditions, an adapted type of research strategy is thus recommended (Hawe et al., 2004).

Compliance to the HHPM program

The compliance to the program was not completely assured; the number of planned visits was not performed on all the farms. Still, more than half of the pairs completed the program as planned. In general, when visits were implemented, herd health was monitored and prevention tools were used in a reactive way after a herd health alert. When an alert was triggered, the approach lead thus to the identification and consultation of the relevant prevention protocol, as well as to the identification and recommendation of corrective actions. Surprisingly, the prevention tools were also used in a pro-active way.

Tools abilities to function as intended

Both farmers and advisors agreed that both the monitoring and the prevention part of the tool fulfilled certain 'technical' functions it was expected to fulfil, such as allowing the early identification of herd health problems, securing herd health and the identification of relevant risk factors and corrective actions. Farmers also agreed to the statement that the tool gave them a better idea of how they can use data for in herd health monitoring.

Perceived effectiveness of the HHPM program by its users

The concept for the HHPM program, recommended by the research team, seems to be able 'to work' under field conditions. The HHPM-program seemed to be appreciated by most users of the tool, based upon the perceived effectiveness of the intervention on herd health, according to a majority of the respondents of the questionnaire improvement of herd health and their willingness to continue the use of (certain elements) of the tool.

HHPM programs' impact on herd health is difficult to evaluate

Although in this study no significant effect of the HHPM program on the herd health was found, it does not necessarily mean the tool was not effective since several limits of the study design chosen have to be taken into account. The diversity of alerts across farms during the year made the sample

stratified as there were five health domains (even if we saw that udder health and reproduction performances had the highest number of alerts). The reporting allowed us to follow what recommendation was proposed in a farm but not the implementation itself, and how and for how long it was implemented by the farmer. Moreover, it was not possible to check whether the recommended measures were appropriate for the identified problem. The control strategies could not be accounted for in an analysis of potential effects. Furthermore, the initial herd health situations differed and were not all poor. If the only objective of the study was to measure the effectiveness of the intervention on herd health, a different type of study design would have been more appropriate. For that purpose it would have been more appropriate to test the tool in e.g. herds with severe udder health and reproduction problems, with farmers highly motivated to improve the health situation. Other studies reported more improvements in animal health in herds with a poorer health level at the start of the intervention (e.g. Green et al., 2007; Ivemeyer et al., 2009). Also, the sample size was very small so the statistical power limited. Finally, the testing period may have been too short to see an effect of the program based on the indicators chosen. Indeed, depending on the recommendations, they may have needed more time to have a real effect. In other intervention studies similar difficulties were identified (Bell et al., 2009; Ivemeyer et al., 2012). Moreover, using more morbidity indicators for example on calf health and lameness might be an option to observe better changes in herd health situations. Concerning the length of the testing period, we can also imagine the farmer and the advisor need time to establish a relationship of trust and that the effectiveness of their cooperation could depend on that. The methodological difficulties in evaluating the impact of interventions like these supports thus further the idea to perform a whole process evaluation rather than looking solely at the impact on health.

HHPM programs' impact on the dialogue between farmer and advisor

The HHPM program proved to have characteristics facilitating the development towards advisory services that are adaptable and farm specific and based on a dialogue and mutual understanding between farmer and advisor. The HHPM program stimulated the dialogue between farmers and advisors. A striking example is that the majority of the participants perceived that it improved advisors knowledge of the health situation on the farms. The farmers appreciated the fact that the prevention protocols were different from the good practice guides produced in general. No detailed recommendations were listed, but the prevention protocols described objectives to attain to prevent health problems. This, in theory, should have promoted the discussion between farmer and advisor on the preventive practices already installed, possible corrective actions the farmer could implement to attain the objective and to show the link between practices and health outcome. The transfer of knowledge occurred thus in both directions from farmer to advisor and the other way around. Also in the Swedish context, both farmers and advisors learned from each other, even though the advisory situation was expected to be more often turned towards disease prevention than in France (Chapter 4).

The quality of the dialogue between farmer and advisor is considered as a key to success of animal health planning activities (Vaarst et al., 2011). For example, when veterinarians did not take into account farmers' goals into consideration this could lead in certain cases to the dismissal of veterinarians' knowledge by organic dairy farmers for their animal health promotion strategies (Vaarst et al., 2007). Furthermore, certain advisors expressed to have learned about the organic

principles and regulation during the intervention study. The lack of veterinarians' knowledge on the organic regulation was identified, in earlier a study, as a weakness (Vaarst et al., 2007).

Regular and frequent visits within a year could have been a step forward in itself to stimulate an advisory role for advisors in herd health management on organic dairy farms. French veterinarians have been found to be rarely invited to organic dairy farms and find it difficult to make their role in organic dairy farmers animal health management evolve from a therapeutic role towards an advisory role (Chapter 2). This might be true for other countries. Also, in Denmark veterinarians were not much involved by organic dairy farmers in their animal health promotion strategies (Vaarst et al., 2006). Despite the fact that in the Danish context of organic farming the veterinarian is the only person allowed to treat animals, with the exception that the veterinarian can dispense medicine for pig and calves younger than 6 months if the initial treatment is started by the veterinarian (Vaarst and Bennedsgaard, 2001).

Adaptable herd health management tools' advantages and possible drawbacks

The results of this study indicate the need for adaptable HHPM programs. Participants used the possibility to adapt the program to the their farm specific situation (J. Duval et al., 2016) and not all farms encountered the same health problems and thus used different elements of the tools in the HHPM program provided. Although we could not compare the situation before and after the start of the study, adaptability could lead to greater compliance to control measures. It was also questioned whether adaptability would not lead to 'quick and easy solutions' (Beekhuis-Gibbon et al., 2011). In this study the freedom to choose indicators, at least, did not seem to lead to situations in which farmers set health standards that are relatively easy to achieve, as the results show that visits without an alert were rare. Also the prevention protocols did not seem to be a set of static documents since the different elements are actively used, depending on the needs identified (in reactive or preventive way). Vaarst et al. (2011) recommended that animal health planning activities needs to become a dynamic process; this requires a dialogue between farmers and advisors as to make the connection between the plan and the advice given. Adaptability of the indicators to farm specific situations can be beneficial to advisory situations. As shown by Duval et al. (2016) it stimulates e.g. the dialogue between farmer and advisor on herd health, farmer' objectives and constraints in some cases, thus rendering, in theory, the monitoring activities and proposed advice pertinent to the farm specific situation. However, it requires that the advisors are able to adapt to the use farm specific indicators and let go of standardized advice. We can argue that advisors need a certain level of expertise to be able to do so. Expertise is a dynamic process of continuous learning; requiring integrating different kind of knowledge and experiences in a specific domain, reorganizing information and problem-solving efforts that are not routine. It is recognised that not everybody is an expert and expertise is not equal to a lot of experience (Herling, 2000).

Difficulties encountered when evaluating the advisory relationship between farmer and advisor

It is not possible to evaluate in detail the advisory action since the research strategy chosen did not include the presence of researchers during the farm visits, with the aim to test the tool as close as possible to 'real-life' situations. However, the consequence was that an important amount of reporting by the advisors to the research team was necessary to be able to evaluate the tool in the end. Certain advisors found this reporting too detailed, and too time consuming. In the advisors' evaluation, there may have been confusion between the real time needed for the implementation of

the program and the extra time due to the reporting required by the researcher. People reporting that the tool was time consuming may have thought about the amount of time they dedicated to the reports. In real life conditions, they probably might not have spent so much time on reporting.

Even though, written record keeping of farm visits is part of HHPM programs in general (Cannas da Silva et al., 2006), not all participating advisors might have been used to it in their daily work.

Even with a detailed reporting, there are elements of the visit we could not measure. Using reporting by advisors does not allow us to evaluate how the farmer and the advisor interacted with each other and whether the interaction led to the adaptation of recommendations to the farm specific context for example. Furthermore, there must have been as many ways of working together as farms involved in the study and only the presence of a researcher during the visits could have captured this.

In theory, the analysis of data using theoretical knowledge will lead to information that is context specific and for the purpose of decision-making (Wolf et al., 2001). Klerkx et al. (2010) hypothesize that information will only be of significance to the receiver if it is built upon his/her existing knowledge. Hence, this underlines the importance of the dialogue between farmer and advisor to exchange information with the aim to build new knowledge (co-constructing the advice) rather than only exchanging information (the advisor gives the farmer the solution to the problem, like a recipe) (Klerkx and Jansen, 2010). The results of this study show that both farmers and advisors perceived that they have acquired knowledge that was new to them. However, the research strategy chosen does not allow to measure if and how that knowledge and experience of farmers and advisors was used to adapt it to farm specific advice. For example, we could not identify whether corrective measures to improve health where pertinent to the farm specific situation. Insufficient integration of farmers' knowledge might be a possible explanation for the fact that not all recommended measures were implemented. It has been shown that long-term collaborations between farmers and their advisors can be created when both are knowledgeable and have a proactive approach, but at the same time they are ready to learn from one another and integrate each other's knowledge (Ingram, 2008).

Testing a tool under field conditions to improve its relevance to practice

The feedback from the users' to the researchers allowed to identify improvements possible to the HHPM program and to understand which elements of the program did not work well. A dialogue between designers (in this context, the research team) and users during the development phase of tools can support the construction of tools that are relevant to real-life conditions (Cerf et al., 2012). Therefore, testing the HHPM program under conditions as close as possible to the field was considered as a must and receiving feedback from participants that interacted with the tool crucial to further improve the tool for future use. Moreover, testing the tool and reporting on the context of its implementation should make the report more useful for future users and decision-makers, e.g. by understanding which resources or actors are needed (Waters et al., 2011). The users of the tool were not always satisfied with its user-friendliness. Certain users found it difficult to use and the format not adapted to a use on farm (paper format with too many pages). The important number of documents could have made it difficult to manipulate and to find the needed information. A digital format could be a solution to optimize its use, as proposed by several users. Some health domains showed certain limitations in order to be able to monitor them, e.g. regarding locomotion disorders, the lack of precise data made the monitoring difficult. Furthermore, propositions were

made to add prevention protocols for certain health domains, e.g. for parasitological diseases which is a problem farmers are facing in organic dairy farming.

5.5 Conclusion

Although compliance to the HHPM program was not fully ensured and no significant effect of the intervention on herd health was demonstrated, the HHPM-tool activates multiple factors that could promote the dialogue between farmer and advisor and promote farmers' decisions to implement advice on animal health management. The adaptable nature of the HHPM program was beneficial to its adaptability to the specific organic context and the dialogue between farmer and advisor. The methodological difficulties encountered for the evaluation of the HHPM programs' impact on herd health consolidates the need for specific research approaches for the evaluation of such complex interventions. The feedback from the users allowed identifying difficulties encountered in the HHPM programs use and as well as possible ways to improve of the tool.

Acknowledgements

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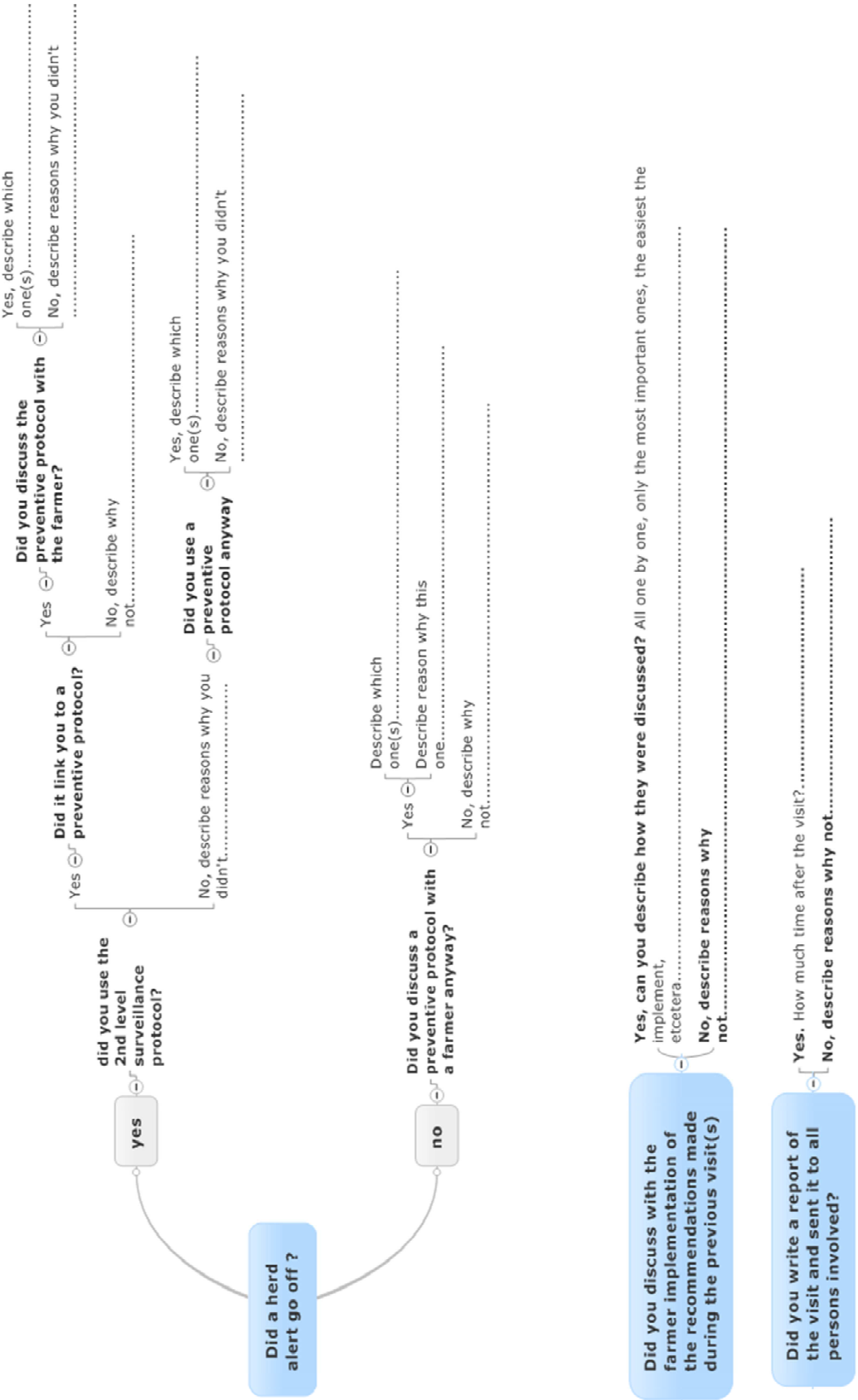
Annex 5.1: Templates for reporting of the farm visits by the advisors



<u>Framework for farm visit summary</u> (this part was also sent to the farmer)

Official farm number: ……..

Name(s) persons involved in the farm visit:

…….

Name author summary: ……

Date of the visit: …… /……. / ……..

1- Levels herd health indicators

Health domain	**Indicators used**	**Health level identified per indicator**	**Alert level crossed** Yes/No	**Improvement or degradation of the situation compared to the last visit**
Reproduction				
Mastitis				
Metabolic diseases				
Lameness				
Health calves				

2 - Diagnosis of the health problem (if one identified) and associated risk factors

It will be necessary to resume certain elements of the diagnostic procedure to explain how the origin of the health problem was identified.

The advisor explains in this part the risk factors identified and hierarchies them in order of importance:

<u>Risk factors identified:</u>

3 - Objective(s) farmer with regard to the identified herd health problem

4 - Summarize practices proposed/identified and explain how these can help to attain improvement of the herd health problem

5 - Expected implementation of proposed practices

Practices	**Expected month of implementation**					
	M+1 (January)	M+2 (February)	M+3 (March)	M+4 (April)	M+5 (May)	In 6 months, precise
Example : *Start disinfection of the teat ends after milking*		X				
Practice n°1						
Practice n°2						
Practice n°3						
Practice n°4						

Remarks on the calendar, include also feedback on the implementation of recommended practices identified during previous visits (delayed implementation of practices, abandonment of practices, etc.)

Date of the next visit:

Annex 5.2: Questionnaires for the evaluation of users' opinion on the HHPM and its functions

Farmers' version of the questionnaire

A1. Monitoring tool

The monitoring tool is the set of indicators linked to a certain alert threshold that were chosen during the very first farm visit about one year ago.

1. To what degree to you agree with the following statements? **Herd health monitoring** like this was useful (range 1-6, from I fully disagree to I fully agree)
    1. Because it allows for the early identification of herd health problems
    2. Because it allows to secure herd health
    3. Because it gave me a better idea of how I can use data for in herd health monitoring
    4. Because it changed my perception of the herd health situation of my herd
    5. Because it is a way to have regular contact with my advisor
    6. It was not useful at all.

B. Would it have been useful to monitor other health domains than the ones initially proposed (reproduction, udder health, lameness, metabolic diseases and calf health)?
    1. Yes
    2. No
    3. If yes, which one(s)?

4. Did you have enough data to be able to check all health indicators?
    1. Yes
    2. No
5. To what degree do you agree with the following statements? According to you **choosing indicators adapted** to your farm, as was done at the very first farm visit, ... (range 1-6, from I fully disagree to I fully agree)
    1. Improved your advisor understanding of the way you monitor herd health
    2. Improved your advisor knowledge on the herd health situation of your farm
    3. Improved your advisors knowledge on your focus areas regarding herd health
    4. Led to a list of indicators that was appropriate for herd health monitoring on your farm
    5. Was difficult in its use because I lacked references to interpret with the indicators whether the herd health situation was satisfying/ or not satisfying
    6. Other remarks….
6. Did you adapt indicators during the time you used the monitoring tool?
    1. Yes, indicators were changed
    2. Yes, indicators were added
    3. Yes, indicators were dropped
    4. Yes, indicator(s) were specified
    5. No, but it might have been useful
    6. No, I didn't identify a need for change
7. To what degree do you agree with the following statements? **The simultaneous monitoring** of multiple health problems is… (range 1-6, from I fully disagree to I fully agree)

1. Is more pertinent than disease per disease to ensure effective herd health monitoring
2. Difficult to keep doing it over time
3. Part of my daily work as a farmer

A2. Prevention tool

The preventive tool is the set of documents in which for each health domain (reproduction, udder health, lameness, calf health and metabolic diseases) risk factors where listed with the corresponding objectives to attain to prevent disease.

1. Did you use the prevention protocol without an alert going off?
    1. No, I never used it without an herd health alert
    2. Yes, please fill in for what purpose(s) you have used it……
2. In general, when a herd health problem was identified did the prevention protocol help to identify relevant risk factors present on your farm using the prevention tool?
    1. Yes
    2. No
    3. If no, can you describe why?
3. In general was it possible to identify correctives actions on your farm corresponding to risk factors identified with the advisor?
    1. Yes
    2. No
    3. If no, can you describe why?
4. Were identified corrective actions always implemented?
    1. Yes
    2. No
5. When identified corrective actions were not implemented what was/ were the reason(s)?
    - ☐ They were not adapted to my farm routine
    - ☐ Lack of time
    - ☐ Too costly compared to the benefits
    - ☐ I was not convinced of the effect on herd health
    - ☐ Other…
6. Do you think the objectives / goals listed in the preventive protocol gave you more possibilities to discuss and propose corrective actions adapted to your situation, compared to being provided with a list of standard recommendations telling you how to do that?
    1. Yes
    2. No
    3. Maybe
7. Did using the prevention protocol stimulate discussion between you and your advisor on your farm management practices?
    1. Yes, we discussed more than we usually did
    2. Yes, but in the past we already discussed farm management practices
    3. No

8. Did the discussion using the prevention protocol allow you to see the link between management practices and animal health outcome?
    1. Yes
    2. No
    3.
9. Did you miss information in the prevention protocols?
    - ☐ Yes, on a certain health topic
    - ☐ Yes, risk factors were missing
    - ☐ Yes, objectives to attain were missing
    - ☐ No
10. Did you find the prevention tool easy to use?
    (Slide from 1-5, not easy at all - very easy)
11. What would you like to see improved in the format of the prevention protocols?
    - ☐ Digital format
    - ☐ Different structuration of the themes
    - ☐ Other, please fill in….

A3. Regular visits

1. Was the frequency of farm visits proposed the right one (4 visits in 12 months)?
    1. Yes
    2. No, too few
    3. No, too many
2. To what degree do you agree with the following statements? **Having regular visits** (for reasons other than emergencies) during the year was…(Range 1-6, from I fully disagree to I fully agree)
    1. An opportunity to take more time to discuss the animal health situation on your farm
    2. An opportunity to discuss your animal health management practices
    3. An opportunity to have more time to discuss the questions I have on animal health to the advisor/ veterinarian

A4. Overall

1. How would you characterize this flexible approach where indicators can be adapted to the farm and that you don't have a list of standard corrective measures but objectives to attain to prevent disease?
    - ☐ Educational/instructive
    - ☐ Motivating
    - ☐ Thought provoking
    - ☐ Tailor-made
    - ☐ Helpful in communicating
    - ☐ Difficult
    - ☐ I am not used to work like that
    - ☐ Time consuming
    - ☐ Not useful

2. Is the service what you have been testing in IMPRO for the last 12 months what you expect of a herd health monitoring and disease prevention program?
   (Range 1-5, Not at all close to what I had expected – It was very close to what I expected)

3. Will you keep using the monitoring protocol? Or in the case that you have returned the documents, would you have liked to keep using the monitoring protocols if you were provided with the tools again?
   1. Yes
   2. No
4. Will you keep using the prevention protocols? Or in the case that you have returned the documents, would you have like to keep using the prevention protocols if you were provided with the tools again?
   1. Yes
   2. No
5. Would you recommend the monitoring and/ or prevention protocols to other farmers?
   1. Yes, both the monitoring and/ or prevention parts
   2. Yes, only the monitoring part
   3. Yes, only the prevention part
   4. No

B. Working relationship between you and your advisor

1. Who took the lead during the visits?
   1. You
   2. The advisor/ veterinarian
   3. Shared
2. Do you now have more knowledge of what kind of services/information your advisor can provide you (expertise in specific domains, services offered by the vet…)?
   1. Yes
   2. No
3. Did your opinion about the advisor' role in your animal health promotion strategy change because of your work with him/her during this study?
   1. Yes, he/she will have a more important role in the future
   2. Yes, he/she will have a less important role in the future
   3. No, he/she already had an important role
   4. No, he/she did not have important role and that will remain the same
4. Did you discuss topics with your advisor during the IMPRO study that you had not discussed in depth together before? (checkbox answer)
   - ☐ Yes, your farming objectives
   - ☐ Yes, your farm and animal health management practices
   - ☐ Yes, the organic production principles
   - ☐ Yes, the organic regulation
   - ☐ Yes, recurrent health problems of the herd
   - ☐ No

D. Herd health improvements

1. Do you think that the implementation of the advisory service as were proposed in this study has contributed to improvement of the health of your herd?
    1. Yes
    2. No

E. Costs using the tool

1. Would you be ready to pay for this kind of service?
    1. Yes
    2. No
2. If you were ready to pay for this kind of service, which amount per year would you be willing to pay an advisor/veterinarian per year?

If you have any further comments, please feel free to write them down below.

Advisors' version of the questionnaire

A1. Monitoring tool

The monitoring tool is the set of indicators linked to a certain alert threshold that were chosen during the very first farm visit one year ago.

1. To what degree do you agree with the following statements? **Herd health monitoring** like this was useful…(range 1-6, from I fully disagree to I fully agree)
    1. Because it allows for the early identification of herd health problems
    2. Because it allows to secure herd health
    3. Because it gave me more access than before to the herd health data of the farm
    4. Because it is a way to have regular contact with the farmer
2. Do you think it would have been useful to monitor other health domains than the ones initially proposed (reproduction, udder health, lameness, metabolic diseases and calf health)?
    1. Yes
    2. No
    3. If yes, which one(s)?
3. Did you have enough data to be able to check all health indicators?
    1. Yes
    2. No, not on all farms
    3. No, never
4. To what degree do you agree with the following statements? **Choosing indicators adapted** to the farm' situation… (range 1-6, from I fully disagree to I fully agree)
    1. Improved my understanding of the way the farmer monitors herd health
    2. Improved my knowledge of herd health problems of the farm
    3. Improved my knowledge on the focus areas of the farmer regarding herd health

4. Led to a list of indicators that was appropriate for herd health monitoring on the farm
5. Was difficult in its use because I lacked references to interpret with the indicators whether the herd health situation was satisfying/ or not satisfying

5. Did you ever adapt indicators during the course of your use of the monitoring tool?
    1. Yes, indicator(s) were changed
    2. Yes, indicator(s) were added
    3. Yes, indicator(s) were dropped
    4. Yes, indicator(s) were specified
    5. No, but it might have been useful
    6. No, I didn't identify a need for change
6. To what degree do you agree with the following statements? **The simultaneous monitoring** of multiple health problems is… (range 1-6, from I fully disagree to I fully agree)
    1. Is more pertinent than disease per disease to ensure effective herd health monitoring
    2. Difficult to keep doing it over time
    3. Part of my daily work as an advisor/veterinarian

A2. Prevention tool

The preventive tool is the set of documents in which for each health domain (reproduction, udder health, lameness, calf health and metabolic diseases) risk factors where listed with the corresponding objectives to attain to prevent disease.

1. Have you used the prevention protocol without an alert going off, if so for which purpose was it used?
    1. No, I never used it without an herd health alert
    2. Yes, please fill in for what purpose(s) you have used it……
2. In general, when a herd health problem was identified did the prevention protocol help to identify relevant risk factors present on the farm(s) using the prevention tool?
    1. Yes
    2. No,
    3. If no, can you describe why?
3. In general, was it possible to find correctives actions corresponding to risk factors identified with the farmer(s)?
    1. Yes
    2. No
    3. If no, can you describe why?
4. Were identified corrective actions always implemented by the farmer(s)?
    1. Yes
    2. No
5. According to you, when identified corrective actions were not implemented what was/were the reason(s)?
    - Not considered by the farmer to be well adapted to the farm

- ☐ Lack of time farmer
- ☐ Too costly compared to the benefits
- ☐ The farmer was not convinced of the effect on herd health
- ☐ Other, please describe…

6. Did you appreciate the fact that the prevention tool contained only objectives to attain without imposing the management practice(s) to do so?
    1. Yes
    2. No
7. Did using the prevention protocol stimulate discussion between you and the farmer(s) on his/her/their farm practices?
    1. Yes, we discussed more than we usually did
    2. Yes, but in the past we already discussed farm management practices
    3. No
8. Did the discussion using the prevention protocol have an educational function in explaining the link between management practices and health outcome to the farmer?
    1. Yes
    2. No
9. Did you miss information in the prevention protocols? If so, what would you have liked to have added? (checkbox answer)
    - ☐ Yes, information on a certain health domain
    - ☐ Yes, risk factors were missing
    - ☐ Yes, objectives to attain were missing
    - ☐ No
10. According to you, how easy was it to use the prevention tool?
    (Slide from 1-5, not easy at all - very easy)
11. What would you like to see improved in their format?
    - ☐ Digital format
    - ☐ Different structuration of the themes
    - ☐ Other, please fill in….

A3. Regular visits

1. Was the frequency of farm visits proposed the right one (4 visits in 12 months)?
    1. Yes
    2. No, too few
    3. No, too many
2. To what degree do you agree with the following statements? Having **regular visits** (for reasons other than emergencies) during the year was…(range 1-6, from I fully disagree to I fully agree)
    1. An opportunity to have more time to discuss the animal health situation on the farm(s)
    2. An opportunity to discuss farmer(s)' animal health management practices
    3. An opportunity for the farmer(s) to discuss with me questions he/she had on animal health

4. An opportunity to make the farmer(s) more aware of the knowledge and services I can offer him/her

A4. Overall

1. How would you characterize this flexible approach where indicators can be adapted to the farm and that you don't have a list of standard corrective measures but objectives to attain to prevent disease? (checkbox answer)
   - ☐ Educational/instructive
   - ☐ Motivating
   - ☐ Thought provoking
   - ☐ Tailor-made
   - ☐ Helpful in communicating
   - ☐ Difficult
   - ☐ I am not used to work like that
   - ☐ Too time consuming
   - ☐ Not useful

2. Would you have liked to have had more training in the use of the monitoring and/or prevention protocols at the start of the study?
   1. Yes
   2. No
3. Will you keep using the monitoring protocol on this farm and/or on other farms?
   1. Yes, on the farm(s) in the IMPRO project
   2. Yes, on the farm(s) in the IMPRO project and other farms
   3. No, not the farm(s) in the IMPRO project but I might use it on other farms
   4. No, I will not use it at all
4. Will you keep using the prevention protocols on this farm and/or on other farms?
   1. Yes, on the farm(s) in the IMPRO project
   2. Yes, on the farm(s) in the IMPRO project and other farms
   3. No, not on the farm(s) in the IMPRO project but I might use it on other farms
   4. No, I will not use it at all
5. Would you recommend the monitoring and/ or prevention protocols to other advisors/vets?
   1. Yes, both the monitoring and/ or prevention protocols
   2. Yes, only the monitoring part
   3. Yes, only the prevention part
   4. No

B. Working relationship with the farmer

1. Who took the lead during the visits?
   1. You
   2. The farmer(s)

3. Shared

2. During the visit, did you discuss topics that you in the way you usually met would not have been discussed with the farmer(s)?
    1. Yes
    2. No
3. Do you now have more knowledge of what the farmer(s) expect from you?
    1. Yes
    2. No
4. Did your opinion about organic farming change because of your work with the farmer during this study?
    1. I had a positive opinion of organic farming and that stayed positive
    2. I had a positive opinion of organic farming and that has deteriorated
    3. I had a negative opinion of organic farming and that stayed negative
    4. I had a negative opinion of organic farming and that changed in a positive opinion
5. Did your opinion about animal health situations on organic dairy farms change because of your work with the farmer(s) during this study?
    1. I had a positive opinion of animal health situations on organic dairy farms and that stayed positive
    2. I had a positive opinion of animal health situations on organic dairy farms and that has deteriorated
    3. I had a negative opinion of animal health situations on organic dairy farms and that stayed negative
    4. I had a negative opinion of animal health situations on organic dairy farms and that changed in a positive opinion
6. In which areas have you learned new information during the study intervention (checkbox answer):
    - ☐ farmer(s)' farming objectives
    - ☐ farmer(s)' animal health and farming practices
    - ☐ certain health problems of the herd(s)
    - ☐ the organic production principles
    - ☐ the organic regulation
    - ☐ I didn't learn any new information

C. Herd health improvements

1. Do you think that the implementation of the advisory service as were proposed in this study has or could contribute to improvement of the health of participating herd(s)?
    1. Yes
    2. No

D. Costs using the tool

1. Could you give an indication of the hours you spent on average to prepare a visit?
2. Could you give an indication of the hours you spent on average to perform a visit on a farm?

3. Could you give an indication of the hours you spent on average to write the summary of the visit?
4. For a complete follow-up of the farm(s) (4 visits in 12 months) we offered to pay you 1000 euros per farm (without taxes). Compared to that would you ask from farmers for this service…
    1. More
    2. Less
    3. Equivalent amount

If you have any further comments, please feel free to write them down below.

Chapter 6: General discussion and conclusion

6.1 Major findings

In the introduction of this thesis the problem of the non-implementation of the vast amount of knowledge on animal health management into practice at farm level was raised as an important barrier preventing the improvement of animal health on organic dairy farms. Improving the pertinence of advisory service on animal health for organic dairy farmers was the general objective chosen to address this problem. A better understanding of the perceived role of veterinarians on organic dairy farms and the development and evaluation of the use and effectiveness of a HHPM advisory tool were the two means identified expected to contribute with answers to the main research question of this thesis, namely 'how to improve the pertinence of advisory services in animal health management for organic dairy farms?'

The results presented in this thesis provide knowledge on veterinarians' perception of their role in organic dairy farmers' animal health management strategies, which had received little attention in research so far. Also, a more detailed understanding was acquired on organic dairy farmers' perception of their collaboration with their veterinarian. Their role, at the time of the interviews, was mainly that of a therapist, with limited exchange with farmers on disease prevention or animal health promotion strategies. That was despite the fact that the interviewed veterinarians were already providing advisory services to non-organic dairy farmers and were in a geographic region with a relatively high percentage of organic dairy farmers. Several reasons, related to the context of working in an organic farming system, have been identified from both farmers and veterinarians' point of view that explain the role veterinarians have. A number of these barriers could potentially be attenuated by stimulating the dialogue between organic dairy farmers and their advisors in animal health on farmers' objectives and practices. Other reasons were not specifically related to the organic dairy farming context, such as veterinarians' motivation to have an advisory role or not.

The implementation of the HHPM program designed during this thesis proved to be able to stimulate dialogue between farmers and advisors. This might well have been facilitated by certain of the adaptions made to the HHPM programs' tools during its participatory design process with potential end-users, such as the co-construction step of the monitoring indicators and the choice of 'objectives to attain to prevent disease', rather than a list of recommended measures to implement.

The participatory approach to co-construct a herd health monitoring tool tested on the 40 organic dairy farms led to the creation of unique herd health monitoring tools on each participating farm. Even in Sweden, where farmers are more used to work with standardized health indicators, all farmers chose a unique set of indicators. All farmers accepted to monitor multiple production diseases simultaneously. Moreover, the discussion on the choice of indicators proved to be a source of information on farmers' objectives and the animal health situation. This information can be used by advisors to adapt their advice and/or advisory services to farm specific situations. For advisors this method could be seen as a concrete example of how to initiate HHPM programs on farms.

The designed HHPM programs' tools serve different functions. The content of the monitoring and prevention tools provides users with documents that summarize and organise the most important information on the most common production diseases of dairy cattle. The creation of these protocols was a time-consuming process (several months of work of two persons) and required the expertise of different experts in animal health management. It can be used as a manual to look up information on

certain disease conditions, as a checklist to identify risk factors present on the farm (in a pro-active or reactive way). The HHPM program provides thus technical support for the management of production diseases. Moreover, certain of its expected functional uses were acknowledged by most of the participants, such as its ability to identify health problems at an early stage and the identification of relevant risk factors in case of herd health problems (Chapter 5).

The tool has been shown to have the capacity to influence different factors that are determining the perceived pertinence of advice by farmers, e.g. it contributes to the exchange of information on farm objectives and constraints, and connects health management practices to health outcome. The approach chosen to evaluate the HHPM program's effectiveness allowed to evaluate; participants' appreciation of the effectiveness of the tool on herd health, compliance to the program, its influence on the relationship between farmer and advisor and the tools' functionalities. An effect on herd health was not found, but this might be due to methodological difficulties of evaluating such complex interventions. The evaluation of the whole implementation process allowed showing that the program can function in field conditions. Furthermore, seen from an action perspective, feedback from the participants allowed identifying areas for improvement of the tools and provides stakeholders and decision-makers with detailed information on the context within which it was implemented.

6.2 General approach's strengths and weaknesses

The general research approach chosen in this study aimed at studying advisory services in animal health on organic dairy farms as close as possible to the field situation. For this, qualitative research interviews were used to understand how advisory situations are perceived by both organic dairy farmers and veterinarians. Participatory approaches were used in this thesis, with the aim to improve the HHPM program's adaptability to field conditions. The implementation of the HHPM program, without the presence of a scientist, by farmers and their advisors was deliberately chosen, to test as far as possible the HHPM programs' adaptability to real-life situations and transferability to the field. The choice of a multi-country approach contributed also to that aim, as it allowed testing the HHPM program in two very different existing advisory contexts.

Qualitative research interviews

The quality of qualitative research results in comparison to results originating from quantitative studies has often been questioned and it is on-going debate (Malterud, 2001). This is not the place to start again this discussion on the pros and cons of both types of research methods. However, I would like to discuss how qualitative research interviews were used in the research presented in this thesis, these methods proved to be of value in answering the research questions addressed in this thesis.

Validity of the results of the interviews

Certain research questions cannot be answered by asking them directly to farmers or veterinarians and sometimes it is only when comparing the experiences and perceptions of different interviewees that we gain a better understanding of the underlying causes to a problem.

An advantage of qualitative research interviews compared to questionnaires with predefined answers is that they allow checking whether the interviewee has understood the question as the interviewer meant it. Often within a community, a certain terminology is used and it can be assumed, sometimes wrongly, that is evident to others what it means. During this research, this became very obvious when farmers were asked about the importance of disease prevention in the management of their herd health. Indeed, disease prevention did not mean the same thing for all farmers, even if they often referred to what is considered as animal health promotion. It could be different from what veterinarians understood by disease prevention (referring to hygiene, vaccination, presence of risk factors…). If we would have used a standard questionnaire we would not have captured this difference in meaning and we would have probably misinterpreted the results.

We consider that the qualitative research interviews were well suited to answer our research questions. Quantitative approaches are well suited for different kinds of research questions, such as describing prevalence of disease or frequency of practices. In our case, we were interested in gaining a better understanding of a certain type of the phenomenon, namely the collaboration between organic dairy farmers and their veterinarians. For this objective, we deemed qualitative research interviews to be more pertinent (Malterud, 2001). Furthermore, relatively popular methods that are frequently used on animal health topics, such as the theory of planned behaviour (TPB) or adaptive conjoint analysis (ACA), impose that respondents reply within the framework set by the research team. In the context of our research, the range of answers we obtained make us question whether the range of options we could have imagined before undertaking the study could have fully characterised all the behaviours we observed. The number of categories of responses to address is limited and might not provide respondents with the most rightful answer. For example, Van Soest et al. (2015) studied organic dairy farmers' preferences for certain animal health management measures across 4 European countries, using an ACA. A limited view of farmers' preferences was obtained, as only 5 management areas (barn, pasture, calf, claw and udder management) with each 3 management measures were investigated. As can be expected, farmers had individual preferences for certain areas and measures. However, it is not possible to conclude from these results why certain areas are preferred by farmers over others or whether the organic production context played a role, as the underlying reasons for preferences are not captured. TPB studies are already providing more explanatory information as the respondents intentions towards a particular behaviour, that is at will of the individual to perform or not are studied, taking also into account the person' attitude, subjective norms felt and perceived behavioural control towards the behaviour in question (Ajzen, 1991). However, we were interested in describing and explaining the existing collaboration between organic dairy farmers and veterinarians, to find potential action levers to improve that situation. For this a detailed documentation and perceived impact of the experiences of the persons involved was necessary. This we would not have been captured using TPB. Furthermore, both these methods demand that the researchers designing the questionnaire have a complete understanding of the problem. Since there are relatively few scientific studies available on the role of veterinarians in organic dairy farms and, as a research team we had relatively little experience in this domain, at the beginning of this thesis we could not have fully anticipated all the important elements determining that role. Using qualitative interviews and a modified approach of Grounded Theory allowed having the possibility to let 'new' topics arise from the data when considered of interest.

Identifying underlying causes of unsatisfying collaboration between farmers and veterinarians

Maintaining the contact moments is indeed an important opportunity for veterinarians to start the dialogue and gain understanding of organic farmers' objectives and accompanying practices. This was acknowledged by both farmers and veterinarians in this work. Having regular contact moments might not be sufficient for veterinarians to further develop the collaboration with organic dairy farmers towards an advisory relationship, quality of the dialogue probably plays an important role as well. Lessons learned from the dialogue will need to be taken into account by veterinarians when providing farmers with advice. Previous studies, mainly Danish, discussing the collaboration between organic dairy farmers and veterinarians showed similar results regarding veterinarians' role on organic dairy farms (Vaarst et al., 2007, 2006). At that time, Denmark already had a longer history of organic farming, with important percentages of organic dairy farmers and regulation imposing that veterinarians are the persons that are allowed to prescribe and administer animals in case of illness. In France, in situations where the farmers are familiar with the health problem, they can buy the medicine from the veterinarian and treat themselves the animals. In this case however, the veterinarian delivering the medicine has a legal obligation to perform an annual visit on the farm and to provide the farmer with a herd health treatment plan. The Danish results suggest that having these contact moments is not necessarily sufficient for veterinarians to develop a more advisory relationship with organic dairy farmers.

The results of our research show that, at different levels the short and long-term solutions to health problems of veterinarians do not correspond to farmers' objectives. The understanding of what is underlying farmers' practices was thus crucial to understand certain factors that are at the origin of the mismatch with veterinarians' practices. Qualitative research interviews proved to be a suitable method to gain an improved understanding of an underlying problem. The results of this thesis showed that knowledge and recommendations from veterinarians could be rejected by organic dairy farmers. The research interviews allowed identifying that these conflicting situations could arise, because at several levels veterinarians' solutions were not in line with organic dairy farmers' farming and animal health management strategies. Knowledge, to be implemented in practice, has to be coherent with strategic decisions a farmer takes for his or her farm. Certain choices will be made over others, since they are in line with the logic of the strategy chosen at an earlier point in time (Noe et al., 2015). It is also of importance for the veterinary practitioner to be aware of this and it thus supports the need for developing tools that stimulate dialogue with farmers on their objectives and animal health management practices. Providing farmers that have e.g. the objective the treat as less possible with chemical treatment, with more knowledge on chemical treatments in disease management would probably not improve the situation. This phenomenon, also referred to as 'paradoxical knowledge asymmetry' by Noe et al. (2015), is specific to the individual farmers' strategy; as certain solutions might very well by adapted to a different farmer. Moreover, the interviews permitted to show in which way the organic production system, principles and regulation interfere with veterinarians' view of 'good animal health management practice'.

Participatory approaches used

It has been recommended that for the transfer of knowledge between farmers, advisors and researchers, in organic farming, bottom-up approaches should be used rather than using top-down extension approach. This is due to the nature of organic farming, in which innovation was, especially at first, mainly pushed, tried-out by farmers and shared amongst farmers (Padel, 2001). In this respect during the thesis we made use of participatory approaches in two ways.

First, we used a participatory research approach, in a functional perspective with the aim to design with potential end-users a HHPM-program that would be adapted to the use in the field (Chapter 3). The aim of our research was to provide 'knowledge for action', although not directly for the persons involved but to be used in their community so to speak. More conventional research provides in general 'knowledge for understanding', as was referred to by Cornwall and Jewkes (1995).

Different levels of participatory research exist, defined by the importance of the role of stakeholders in the research process (Cornwall and Jewkes, 1995). In this case, the participatory approach was limited to the involvement of stakeholders in the design of our HHPM program, on a consultative basis, with the aim to improve its pertinence to the field. Although the recommendations of the stakeholders in the design of the HHPM program stimulated a change in the choice of research questions, stakeholders were not involved in formulating these, nor in data collection and analysis or in the diffusion of the research results.

Second, a participatory approach was used for the design of herd health monitoring indicators at farm level (Chapter 4). We defined it as participatory since the farmer with their advisors could take the indicators provided by the scientists and adapt them to their needs, co-constructing a monitoring tool. We consider this as a key step in the implementation of the HHPM program, since it allows renewing or initiating the dialogue between farmer and advisor. This was especially considered of importance in the context herd health advisory services on organic dairy farms (Chapter 2). The aim was again to improve the pertinence of the HHPM program but this time to the farm specific situation. Lessons learned from participatory epidemiology in animal health surveillance showed that the approach allows to identify farmers priorities in terms of animal health and provide a precise representation of the animal health situation based on farmers knowledge (Jost et al., 2007). Moreover, the adoption of recommended disease control measures by farmers is believed to benefit from participatory approaches as it can improve veterinarians understanding of farmers' priorities and point of view (Catley et al., 2012). This was confirmed with the results of Chapter 4 and 5, as even in Sweden farm specific herd health monitoring tools were created. These promising results have stimulated our desire to test this participatory approach to co-construct monitoring tools in other contexts.

Bringing together farmers and scientists, combining context specific knowledge and science-based knowledge, is considered to be a necessary and effective way to support innovation in the development of sustainable solutions for challenges in organic agriculture (Padel et al., 2015). Indeed the results from both participatory approaches allowed to improve the mutual understanding between farmers, advisors and scientists grew on the perceived utility and use of the proposed program and allowed for adaptation to field and farm situations. Moreover, it fits well with the expressed demand of organic dairy farmers to exchange knowledge and practices with their veterinarian (Chapter 2.2).

External validity of the results

The use of the results from the qualitative research interviews

In general, results obtained from qualitative research studies should be used bearing in mind the context from which they were obtained and are not aimed to be generalized. However, the choice of

interviewees can influence the extent in which the results obtained can be used in other contexts. A choice of 'average cases' to interview is not always providing the largest amount of information to answer a particular question. For the understanding of a problem, sometimes elucidating its causes and consequences might be of greater value than describing for example its prevalence (Flyvbjerg, 2006). The number of interviewees needed will also depends on the type of research question and interviewees' characteristics (Malterud, 2001). In our qualitative research studies, the strategy was chosen to target a specific population of interest or so-called 'critical cases' (Flyvbjerg, 2006). Flyvbjerg (2006) defined critical cases as 'having a strategic importance in relation to the problem under study' or as he described in other words 'if this is (not) valid for this case, then it applies to all (no) cases'. We can consider that the geographic area chosen, with the relative high proportion of organic dairy farmers, contains the best possible conditions for a good collaboration between organic dairy farmers and their veterinarians. We have thus targeted interviewees from a 'critical target population'. In addition, farmers were living in an area where it is known that there are veterinarians providing advisory services and the interviewed veterinarians all provided these services, to some extent. In other words, if the collaboration between organic dairy farmers is not optimal in this study context, then it is likely that it is the same or even worse in more difficult contexts. The results showed that the proportion of organic dairy clients in the veterinarians' practices indeed influences the interest veterinarians see in these clients. Furthermore, it will also influence the amount of opportunities that arise for veterinarians to visit these farms and thus to get more acquainted with organic dairy farming. We can expect that in other regions in France veterinarians are even less confronted with organic dairy farms due to the lower amount of organic dairy farms. They will thus probably have less the opportunity to exchange with organic dairy farmers and would be less willing to invest in the organic dairy sector, making it even more difficult to establish an advisory role.

The interviews with the veterinarians focused very much on their work with organic dairy farmers. Certain of the difficulties encountered by veterinarians in their collaboration with organic dairy farmers were related specifically to the organic farming context, such as the fact that the principles question their own practices in animal health management. Nevertheless, sometimes veterinarians evoked that it can also be as difficult for them to develop sustainable advisory services in non-organic dairy farms. In a recent study, veterinarians in England too expressed, despite their willingness to have an advisory role on disease prevention on farms, the difficulties they encounter to establish this and the experienced competition of non-veterinarians in this domain (Ruston et al., 2016). Although the research interviews in this thesis focused on the difficulties experienced in developing advisory roles related to the context of organic farming specifically, we expect that French veterinarians in general can experience difficulties in this.

Implementation and transferability of the HHPM tool in different contexts

The use of the HHPM program was tested in organic dairy farming, since we considered that it would be interesting to study it in this context where farmers have to produce with the additional constraint of respecting the organic principles and regulation. Moreover, we had expected from literature and did indeed find suboptimal relationships between organic dairy farmers and veterinarians in France (Chapter 2). Therefore, we expected that providing advisory services in animal health on organic dairy farms might face additional difficulties compared to the situation in conventional systems and thus that advisory services have to be adaptable to different farm situations. Knowing the heterogeneity of organic dairy production systems across Europe (Krieger et

al., 2016) and the differences in existing activities in animal health management (described in Chapter 4), a multi-country approach was considered of interest to test the feasibility and adaptability of the HHPM program. We can hypothesize that some of the differences identified can be the result of the country specific context.

The results of Chapter 2 show that certain French veterinarians experience difficulty with establishing themselves as herd health advisors on organic dairy farms and even rarely visit these farms. The role of the veterinarian as a herd health advisor is not much protected by a legal framework in France. HHPM-like programs provided by veterinarians or other animal health advisors in France are almost non-existing, compared to situations in certain other countries. Starting more from 'scratch' makes it possibly more difficult to initiate herd health advisory activities. In Sweden, at the national level, organic regulations impose systematic herd health and welfare monitoring and preventive herd health management activities. In addition, in cases of insufficient levels of health and welfare organic farmers are obliged to work together with their veterinarians towards improvement. It was therefore not surprising that regular monitoring activities were more commonly existent on Swedish farms than on French farms (Chapter 4).

Farmers have the responsibility to ensure the care of their animals. The results of Krieger et al. (2016), comparing the prevalence of production diseases on organic dairy farms across Europe, show that there is room for improvement in France. Of all the health indicators calculated, Swedish farms scored better than the French farms, except for the indicator cow mortality. The farmers that were interviewed did not report participation in quality assurance programs, other than in cases of severe herd health problems such as a rise in somatic cell count that would prevent them from delivering milk to the dairy company. Moreover, comparing my experience with basic hygiene standards on farms in France to those encountered in the Netherlands, there seems to be room for improvement farmers' practices. For example, in France I was quite surprised in the beginning not to find boots and coveralls for visitors when entering the farms (personal communication).

The country differences might also explain why French veterinarians found the HHPM program useful but time consuming (Chapter 5). We could hypothesize that one of the reason for this is the fact that, in contrast to the Swedish veterinarians, French veterinarians are less used to charge for their advisory services and to run such programs on a regular basis. Moreover, it takes probably more time to do something you rarely do.

The adaptable nature of the HHPM program proved to be of use in France and Sweden, e.g. in both cases farmers and advisors exchanged new information. The concept of the HHPM program tested might also be very well adapted to conventional dairy farming and other species. As discussed in Chapter 3, the concept will also be adapted to small ruminant farming systems in another research project. In addition, we could also discuss the possibility to use this concept for infectious diseases. Garforth et al. (2013) showed for example that general information on biosecurity measures is likely not taken into account by pig and sheep farmers if it is not adapted to their context. In addition, it can even harm the image of sources of information, such as in the case the UK department for Environment, Food and Rural Affairs (Defra) who provides farmers with advice on practices to implement in order to reduce the risk of disease outbreaks. One of their main recommendations was to adapt communication on disease risk and advice on risk reducing measures to farm specific situations.

The transfer of the HHPM program should be carefully done. The fact that we worked in two countries was a challenge, since it was quite difficult for us in France to gain deep understanding of the Swedish context: who were the actors, how did they interact and how was the participatory approach implemented. Since we were not present during the Swedish workshop, a transfer of the recommendations had to take place during which information was probably lost. Also the transfer of the recommendations made by the French participants and the transfer of the HHPM program and its anticipated function to the Swedish group was difficult. This might explain the need expressed for more training by the Swedish advisors in the use of the HHPM program. The transfer of the HHPM program was probably not the same as in France.

How to measure the quality of advisory services?

In chapter 2, the choice was made not to interview veterinarians and farmers that worked together, although by chance this was the case for one pair. The disadvantage of this choice is that we could not exactly compare the experiences of the two types of participants when facing the same health situations. For example, certain veterinarians referred to extreme cases of poor animal health which included high mortality rates experienced in organic dairy farms but the interviewed farmers did not refer to such serious health problems in their herd (Chapter 2).

The main reasons for this choice were ethical considerations, as it was expected that the topic of the interview would be quite a delicate subject. During all the stages of research, from choosing the theme to reporting the results, ethical issues should be (Brinkmann and Kvale, 2015) and were considered. Regarding the choice of interviewees, we strongly considered the possible consequence, for the pairs of farmers and veterinarians working together, of participating in the study. Due to the close connection of our research group to the actors in the field and our willingness to diffuse our results to the field, it was considered likely that the results would end-up again with the persons involved in the study. In addition, the relatively low number of organic dairy farmers in the clienteles of the veterinarians would possibly have allowed veterinarians to identify which clients talked about them. The other way around would be possible too, farmers recognizing their veterinarians' contributions. As we expected to collect at least some negative experiences, to reduce possible negative impact on the relationship between farmers and veterinarians we chose not to interview them in pairs. Also to create a situation in which interviewees would speak as freely as possible it was considered better to interview them separately. Nearly all participants asked whether their veterinarian or farmers' from their practice would be interviewed too. It is impossible to know if and to what extent it has affected the openness of the interviewees during the interview and their answers. I was sometimes rather surprised by the frankness of the answers, which makes me believe that both groups of interviewees were not holding much information back or not exposing their opinions. However, the fact that the question was asked by the interviewees at least shows that it was of a certain importance to them. Therefore, I do not regret the choice of not linking the two groups.

The HHPM program was shown to have the properties that should promote the dialogue between farmers and their advisors in animal health. However, due to the choice we made not to interfere with the advisory relationship in order to be able to test the programs ability to function in field conditions, we could not measure whether improved dialogue lead to advice considered as pertinent by the farmers. The question remains about whether and how each advisor adapted their advisory

services based on what they learned dialoguing with each of the farmers. It also raises questions such as: who took the lead? Was there a negotiation taking place between farmer and advisor? What were the arguments used and how much time did it take for an advisor to fully understand the needs and constraints of the farmers? We can expect that there was variability in the quality of interactions between the pairs and this will certainly have influenced the HHPM programs' success.

6.3 Focusing on initiating advisory activities

Concrete examples of methods, for herd health advisors, to initiate HHPM activities on farms are scarce in the literature. Advisors in animal health management can have numerous roles, such a diagnostic role, advisory role, etc. Currently, veterinarians in organic dairy farms have most often the role of a therapist, who gives most often his or her opinion on how a health problem should be handled in a top-down manner. This was not always appreciated by farmers. Organic dairy farmers' in their taste for farmer experience exchange groups seem also to like a more horizontal approach for exchanging experiences, acknowledging that both farmers and advisors can hold the solution (Chapter 2.2). Furthermore, the facilitated participatory approach to co-construct herd health monitoring indicators resulted in indicators showing that farmers had detailed knowledge of the disease patterns on their farms (Chapter 4).

The tools provide technical support on the main production diseases to both farmers and advisors when needed and a support to stimulate dialogue between farmers and advisors. The adaptability of the HHPM program to farm specific situations was something that was asked for by stakeholders mainly with the objective to stimulate the compliance of users to the tool. However, to adapt it to a farm specific situation, active involvement of the farmer in the health planning process and expression of his/her needs was required. Firstly, in the co-construction of herd health monitoring indicators farmers provided input on (recent) herd health problems, their objectives and focus areas on health and certain constraints for monitoring health (Chapter 4). Second, the format 'objectives to attain' leaves room for discussion about farmers' practices and a gives no recommendations of what are the 'best' practices, aiming thus to stimulate dialogue between the persons involved and prevent top-down advice. According to the results of the users-questionnaires, in both countries farmers and advisors learned during the course of the HHPM program (Chapter 5). The designed HHPM programs' tools serve thus different functions; technical support and promoting dialogue. However, it remains difficult to evaluate with the limited amount of data that we have whether that is due to the HHPM programs concept or the fact that the farmers and advisors met each other on a regular basis, like the situations described in chapter 2 for reasons other than animal health emergencies.

Moreover, the importance of a facilitator in adapting structured advisory tools to farm specific situations was not evaluated. The researcher had not only the role of an observant and learner, but also the role to facilitate the discussion between stakeholders. The use of facilitators has been recommended in the process of defining the terms of herd health advisory contracts for organic dairy herds between farmers and advisors (Vaarst et al., 2001). However, facilitating a participatory approach requires not only of facilitators to be knowledgeable in the context of animal health, but also to have the skills to solve problems and to be adaptable (Jost et al., 2007). In the concept of the Danish Stable schools the fact that the facilitator did not intervene in the process as an 'expert', but

focused only on the facilitating role was considered as an important element explaining its success (Vaarst et al., 2007).

First, as scientists, we were in the luxury position of being in a facilitating role and we realize that field-like conditions this might be difficult for an advisor to combine all the different roles that are asked from her/him in animal health management. Second, during the co-construction of the monitoring tools we did not have the objective to defend our indicators, but had a curiosity towards what was used by farmers and possible changes that would be made. Creating thus an environment in which farmers felt free to propose indicators. It might be difficult for certain advisors to allow farmers to choose other indicators than the ones they use to provide farmers with advice, for e.g. for calculating feeding rations. Taking the time to discuss the choice and use of indicators was something new for everybody involved. The take home message should be that the advisors should not be focused on the chosen indicators but on the dialogue it generates. During this process, advisors can learn farmers' objectives and focus areas related to animal health, obtain detailed knowledge about recurring animal health problems on the farm and understanding how farmers use indicators to monitor disease. The goal of this participatory approach to co-construct a monitoring tool is not necessarily to be able to advice farmers based on their indicators, but to create an opportunity to dialogue and to learn from the dialogue when choosing the indicators about farmers' objectives focus areas in terms of animal health farm constraints and farm specific disease patterns. Most French advisors and farmers and Swedish farmers agreed that choosing indicators improved the advisors knowledge on: farmers' focus areas in terms of health, the way farmers monitor health and the herd health situation (Chapter 5). The participatory approach can be used as a way to initiate HHPM activities.

6.4 Organic solutions to health problems

The results of the qualitative research interviews show that organic dairy farmers have an animal health strategy that is focused on promoting health. One of the reasons that farmers did not perceive veterinarians as pertinent advisors in animal health was due to veterinarians' focus on disease. This difference became evident from the interviews that when veterinarians and organic farmers talked about disease prevention strategies. Organic dairy farmers gave mainly examples of animal health promotion strategies, such as improving the quality of feed and feeding. Veterinarians talked about vaccination for example which is in line with examples given for disease control and prevention programs in widely used textbooks in veterinary medicine such as Radostits et al., (2007).

The difference between animal health promotion and disease prevention seems subtle but is fundamental since it will determine the type of activities needed to reach the respective goals. The focus on disease will lead to activities that aim at identifying risk factors and reducing them for one or more diseases in particular. Health planning in the context of animal health promotion aim at promoting overall health of animals through ensuring the adequacy between the animals and their environment, by using adapted breeds, feed and feeding, housing system and giving animals the liberty to express their natural behaviour. The focus on health requires thus an approach of the animal and the farm system as a whole. The consequence is that animal health promotion strategies require strategic planning, in contrast to disease prevention strategies that are often based on tactical planning decisions. Tactical planning activities are often easier to identify since their effect is

often measurable relatively fast and easier to measure compared to the results of strategic planning and its corresponding daily working routines. This can make it more difficult to maintain the motivation for animal health promotion activities. Hence, the importance for farmers and advisors to find a way to follow-up on the activities and evaluate their effect and make sure that they are in line with farmers' goals (Hovi et al., 2004).

Certain organic dairy farmers that were interviewed would appreciate advice from veterinarians on alternative medicine (Chapter 2.2). Veterinarians responded to that demand in different ways, depending on the interest found in organic farming and their values towards alternative medicine (Chapter 2.1). Today, the regulation on organic dairy farming, for one, holds the situation in an impasse by being vague on what is considered an inappropriate therapy (*Council regulation (EC) No 834/2007*). Veterinarians' biomedical values can discard alternative medicine, such as homeopathy, if they do not meet the scientific standards to prove their efficacy (Hegelund, 2004). Veterinarians would thus consider homeopathy as inappropriate.

Hegelund (2004) touched upon the fact that the holistic approach of homeopathy, considering the animal and its environment when trying to understand the cause of the disease, shows similarities with the global approach of herd health of conventional veterinarians. Maybe this could be area where were veterinarians can get back into the picture so to speak. We concluded that alternative medicine should not be the only focus of the dialogue between organic farmers and their veterinarians. The holistic approach could be an opening to open the discussion on farm practices and animal health. Veterinarians can make the link between the animal, its environment, management practices and health outcome. Moreover, such a holistic approach of health problems corresponds to what is considered to be needed in disease prevention and is part of health management by the veterinary community (LeBlanc et al., 2006). However, veterinarians are not the only advisors in domains like nutrition and housing (LeBlanc et al., 2006; Ruston et al., 2016). It might be one of the explaining elements of the observed difficulty that veterinarians have to maintain an advisory role on organic dairy farms, if they do not manage to put forward how they can link herd health to farm practices.

This research project was the first project in the context organic farming of our research group in Nantes, as well as it was my first experience working closely together with its stakeholders. Moreover, like the interviewed veterinarians, we all carry our background in veterinary medicine which is mainly focused on disease and conventional farming system. We can question whether the HHPM program designed is really an organic solution to improve herd health and in line with organic dairy farmers' strategies in this. The objectives of the IMPRO project to provide for example protocols for the surveillance of the major clinical and sub-clinical production diseases were imposed by the call (http://www.impro-dairy.eu/index.php/en/2012-10-04-16-42-51/workpackages/2012-10-04-16-46-41 accessed on 21.06.2016). The choice of a HHPM program-like concept was our choice.

Although the designed HHPM program was based on the characteristics of a herd health management and production program (Brand et al., 2001), not one farmer added an indicator on milk production and only one farmer added the 'indicator calf growth'. Farmers did not find it important, they did not see the need or they did not think of it. According to Hovi et al. (2004) in organic farming systems, production objectives can be overruled to be able to ensure animals' needs and well-being which are the priority.

The qualitative research interviews were performed only in the final year of the thesis, after the design and implementation of the HHPM program. The HHPM program might have had a different design if the interview studies had been finished before the HHPM program' design stage.

6.5 Research perspectives

Evaluating the quality of animal health advisory services

The quality of animal health advisory services is an important factor determining its effectiveness, but very difficult to assess. In both the Chapter 2 and 5 we could not evaluate the quality of advisory services provided, in the one-to-one setting of the farmer-veterinarian collaboration. The variability of the success of the HHPM program could not be explained. Neither were success stories of individual veterinarians that managed to have an advisory relationship in developing advisory services in organic dairy farms studied in detail. In the discussion of Chapter 5 several propositions have been made to improve the evaluation of complex interventions of which the implementation of a HHPM program can be considered as an example. A solution to the problem of how to evaluate the collaboration between farmers and veterinarians and the possible advisory situation is to choose a study design as was opted for by Inger Anneberg in her thesis work on animal welfare inspections on farms. She was present on the farm when farmers received an official inspector who evaluated animal welfare on their farm. After the visit, she performed separate interviews with farmers and inspectors (Anneberg, 2013). This proposition might seem in contrast to what was discussed above, about the delicate nature of the topic and the possible negative impact on the relationship between people. However, the focus would be on the effectiveness of the HHPM program and how it can improve the relationship between farmers and advisors and not on the existing relationship. The focus would be away from conflicting situations. Furthermore, people agreeing to participate in such a study could be considered to be motivated to improve their collaboration. In this case, studying the effectiveness of the HHPM program is not expected to have negative consequences on their working relationship.

The impact of a protected status of veterinarians as advisors on herd health and health management

We hypothesize that Swedish advisors saw more the value of the HHPM program as, in contrast to French advisor, they are used to sell their advisory services. In line, with the expectations regarding public health issues such as antimicrobial resistance, veterinarians will have to reduce the use of antimicrobials on farms and focus more and more on developing their advisory services in disease prevention. Therefore, it would be of interest to study the long term impact of national regulation, like in Sweden, which 'protects' the role of the veterinarian in organic dairy farms on herd health and the collaboration between farmer and veterinarians.

Learning in farmers' experience exchange groups in animal health management

The HHPM program designed in this research provides advisors with a support to initiate such advisory activities in animal health. However, this type of collaboration cannot be expected to suit all farmers and advisors. Jansen et al. (2010) showed that not all the farmers can be reached by using the same kind of communication pathways. Moreover, dairy farmers that were addressed by their

veterinarians as 'hard-to-reach' were sometimes well informed about udder health since they used different information sources, such as farmer study groups or the internet (Jansen et al., 2010). Different types of advisory services will need to be available to serve everybody involved. Due to the apparent importance of farmer exchange groups to organic dairy farmers it would be interesting to understand how the exchange of knowledge takes place, whether they exchange on the same type of knowledge as they would with their veterinarian. It also raises a question about the efficiency of the transfer of knowledge: does it occur at a different speed when learning from peers compared to learning from an expert and what is its effectiveness? Studies on these groups in animal health management exists, but are mostly descriptive of the groups composition, history and the exchange of knowledge (Ruault et al., 2016). It would be interesting to compare them with one-to-one advisory situations between farmers and advisors.

6.6 Perspectives for the field

Training animal health advisors to use 'new' advisory services

The participatory construction of the HHPM program is a promising approach for herd health advisory services as they stimulate dialogue between farmers and advisors and they have the potential to render the advice adapted to farm specific situations.

However, the success of the participatory approach will also depend on the competences of the facilitator (Whay and Main, 2010). Training animal health advisors as facilitators of change is thus recommended. Animal health advisors will also need to be taught about the advantages and disadvantages of adaptable advisory tools. Lessons learned from this thesis need to be transferred to the field and the tested tools provided to advisors. Training sessions could be imagined, that include testimonials from prior users. As the research group is part of the veterinary school of Nantes integration of the knowledge obtained could be taught and further tested with students in veterinary medicine. Moreover, as has been discussed earlier the transferability of the HHPM program should be improved. To assure the transfer of the program to the field, the design and testing of a user's guide is planned.

A role for farmer and veterinary education

Organic dairy farmers and veterinarians often did not share the same view about the value of organic agriculture. In addition, their approach to health was different as were therefore some of their animal health management practices. The differences can be explained to a certain extent by the different socio-cultural background of these two groups.

An important barrier for veterinarians to develop adapted advisory services for organic dairy farmers remains the lack of (economic) interest veterinarians find today in organic dairy farming. Indeed the organic dairy sector is growing; and the economic importance of the sector to veterinarians should follow. Moreover, the recent crisis in agriculture and already older criticisms of the conventional agricultural food producing systems ask to look for alternative agricultural systems. In addition, veterinarians have been criticised for their role as providers of antibiotics. If veterinarians would look at organic farming from a broader perspective than their focus on animal health they might find a

value in organic dairy farming as an example of a sustainable agricultural food system. This would require that they are better informed on the organic principles and regulations other than those regarding animal health.

Veterinarians definition of disease prevention follows the definitions given by classic veterinary textbook (Radostits et al., 2007) and what is taught in veterinary schools (Figure 6.1, e.g. the medical prevention via vaccination). It requires thus that veterinarians talk to, but maybe more important carefully listen to farmers to become aware of such important differences. Their definition of disease prevention determines the kind of practices that will put or recommend putting into place. It is when we become aware of such differences that we learn to recognize them. As an example, I have walked many times in the corridor with the door of Figure 6.1, but it was not until doing the interviews that I became aware of what was written. Communicating the lessons learned from the two interviews studies to veterinarians and veterinary students is important to activate this awareness. These differences should be communicated and explained to both farmers and advisors to promote mutual understanding of each other's viewpoints which could possibly effect the expectations that both groups from one another. This could be taught for example in schools or programs for continuing education for veterinarians and other animal health advisors.

Figure 6.1: Picture taken, in the department of companion animals, of a door sign of one of the clinical practice rooms for students in veterinary medicine on the veterinary faculty of Nantes, taken in August 2015.

Moreover, it seems important to promote the importance of herd management and nutrition in the curricula of schools in veterinary medicine, especially for students planning to become farm animal practitioners. Also, the timing of these disciplines should be considered within the training course. Students become possibly more aware of the connections between herd management and nutrition and animal health outcome at a later stage in their training, after understanding the pathogenesis of disease and being confronted with cases.

Herd health management in the education programs for future farmers, in France, has a relatively small place within the curriculum. The module, in which animal health is situated, as one of 6 objectives of the module, represents only about 8% of the number of hours in the program (*Référentiel de diplôme: Baccalauréat professionnel "Conduite et gestion de l'exploitation agricole,"* 2010). At the end of the program the knowledge of farmers on health management is limited

(personal communication with a private veterinary practitioner that also is involved in farmer education on animal health). Future farmers might benefit from more education on health management. The role of continuing education in should not be neglected and farmers' participation in this should be encouraged. Based on the interviews with veterinarians their implication in farmer education was low at the time of the interviews, but several veterinarians expressed their interest and willingness to participate in these activities. Implication of veterinarians in health management education could be another pathway to stimulate the uptake of herd health management practices by farmers.

Conclusion

This thesis aimed to provide knowledge that will contribute to meeting the challenge of translating the existing body of scientific knowledge on the prevention of production disease into the implementation of efficient animal health management practices at farm level. This is expected to ultimately lead to improvement of herd health on organic dairy farms. Considering the fact that health advisors, mostly veterinarians, were known to propose advisory services considered by farmers to be not always adapted to their farm-specific situation, the general research question of this thesis was **'how to improve the pertinence of herd health advisory services in order to improve animal health on organic dairy farms?'**

For that purpose qualitative research interviews were conducted. Fourteen organic dairy farmers and veterinarians from the same geographic region were interviewed on the role of veterinarians in animal health management on organic dairy farms. The farmers and veterinarians agreed that most often the veterinarian had contact with organic dairy farmers in cases of individual sick animals or acute herd health problems. Although some veterinarians have experienced situations and approaches to health and well-being of animals in organic dairy farms that do not meet their standards, they were often not able to create an advisory role on these farms to support farmers in improving animal health and welfare. Veterinarians perceived that the principles of organic production, regulations and farmer health approaches sometimes challenge their values on animal health and welfare and "good veterinary practice". Indeed, organic dairy producers had an animal health management strategy focusing on the promotion of animal health, in contrast to what they perceived as veterinarians' strategy focusing mostly on disease. These differences in strategies lead to differences in animal health management practices and could hold farmers back from considering veterinarians in an advisory role preventing health problems. Possible opportunities to improve their role in these farms were identified and which were more or less agreed upon between farmers and veterinarians: for example by offering more proactive advice, making adaptations to consulting services for the organic sector and/ or by separating the curative role of veterinarians in their advisory role in disease prevention. Improved dialogue between veterinarians and organic dairy farmers is essential to promote mutual understanding of farmers' objectives and the identification of adaptations of veterinary advisory services. To improve mutual understanding on disease prevention and animal health promotion, we recommend education for both farmers and veterinarians, respectively on animal health and the organic principles, regulation and values. Communicating the findings of this study amongst organic (dairy) farmers and veterinarians should be the first step herein, but should be done with care considering the sensible nature of the topic.

The HHPM program designed promotes the renewal and initiation of the dialogue between farmers and advisors. The participatory approach used to allow farmers to adapt the indicators proposed by scientists for herd health monitoring confirmed the need for adaptable tools for animal health advisory services. Farmers' adaptations resulted in unique and farm-specific combinations of indicators for herd health monitoring, in both France and Sweden. The need for adaptable tools was even more supported by the Swedish results, considering the existing advisory context and Swedish farmers' familiarity with the use of standardized indicators compared to the situation on French farms. Moreover, all but three farmers intended to monitor five health topics simultaneously using

the constructed indicators. Furthermore, discussing the choice of indicators proved to be a source of information for advisors on farmers' objectives and the animal health situation.

The intervention study allowed evaluating the impact of the HHPM program. Complete compliance to the program was fulfilled by 21 of the farmer-veterinarian pairs out of 40. In these cases the program functioned as intended: it stimulated change in farmers' herd health management practices and the dialogue between farmers and advisors on several topics. Although the majority of these users perceived that the program contributed to herd health improvements, the implementation of the program did not lead to significant herd health improvements in the participating farms and no difference were found compared to control farms. However, this does not necessarily mean that the HHPM program was ineffective, since the methodological approach used was not optimal for the purpose of assessing the impact on herd health. The program created an environment promoting the exchange of information between farmers and advisor, a prerequisite for pertinent advice in a farm specific situation, in theory. However, we could not evaluate if and how advisors used this information. Nor could we evaluate the quality of the information given. Although compliance levels were low, the feedback from the participants that used (partially) the program allow us to consider that dialogue promoting and tools adaptable to farm specific situations are the way forward for the development of support tools for advisory services in animal health. We recommend that future research should aim at improving methods for the evaluation of the effect of advisory programs. Also, we recommend studying further other types of advisory services, in particular farmer experience exchange groups as they seemingly are much appreciated by organic dairy farmers.

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Appendix I: List of publications

Refereed scientific papers

Accepted:

Duval, J.E., Fourichon, C., Madouasse, A., Sjöström, K., Emanuelson, U., Bareille, N., 2016. A participatory approach to design monitoring indicators of production diseases in organic dairy farms. *Preventive Veterinary Medicine*. 128, 12–22. DOI:10.1016/j.prevetmed.2016.04.001

Submitted:

Duval, J., Bareille, N., Fourichon, C., Madouasse, A., Vaarst, M., 2016. Perceptions of French private veterinary practitioners on their role in organic dairy farms and opportunities to improve their advisory services for organic dairy farmers. *Preventive Veterinary Medicine,* Under review.

In preparation:

Duval, J.E., Bareille, N., Fourichon, C., Madouasse, A., Vaarst, M., 2016. French organic dairy farmers' perceptions of private veterinary practitioners' role in their farms.

Duval, J.E., Bareille, N., Madouasse A ., de Joybert M., Sjöström, K., Emanuelson U., Fourichon C., 2016. Evaluation of the use and effectiveness of a herd health management tool on advisory services and herd health.

Conference papers and presentations in scientific conferences

Duval J.E., Bareille N., Fourichon C., Madouasse A., Vaarst M., 2016. Perceptions of French private veterinary practitioners on their role in organic dairy farms. *Annual meeting of the European Federation of Animal Science*, Belfast (oral presentation).

Duval J.E., Bareille N., Madouasse A., Fourichon C., 2015. Health surveillance in organic dairy farms: comparing indicators of farmers to those of scientists. *Annual meeting of the European Federation of Animal Science*, Warschau (oral presentation).

Duval J.E., Bareille N., Madouasse A., Fourichon C., 2015. Data in livestock farming systems: does the science supply meet farmers' needs? The design of a dairy herd health monitoring tool as an example. *Annual meeting of the European Federation of Animal Science*, Warschau (oral presentation and participation in a workshop).

Duval J.E., Bareille N., Madouasse A., Fourichon C., 2015. Participatory approaches are beneficial for making the conceptions of farmers and scientists converge - The design of a monitoring tool for dairy herd health as an example. *Annual meeting of the Society for Veterinary Epidemiology and Preventive Medicine,* Ghent (poster presentation).

Duval J.E., Bareille N., Fourichon C., 2014. Can a participatory approach adapting a structured framework for disease monitoring and prevention to farm-specific situations improve animal health? An intervention study in organic dairy herds. *Annual meeting of the Society for Veterinary Epidemiology and Preventive Medicine,* Dublin (poster presentation)

Other activities of dissemination of research results

Bareille N., Duval, J.E., de Joybert M, 2016. IMPRO Deliverable 3.1: Results of a pro-active approach (deliverable research project).

Bareille N., Duval, J.E., de Joybert M, 2016. IMPRO Deliverable 3.2: Final monitoring and preventive protocols (deliverable research project. Available online: http://www.impro-dairy.eu/images/deliverables/IMPRO_D3.2_Monitoring_and_preventive_protocols.pdf).

Appendix II: Résumé de la thèse en français (abstract of the thesis in French)

Le conseil sanitaire en élevage bovin laitier agrobiologique

Contexte et enjeux

Depuis une dizaine d'années l'agriculture agrobiologique a connu une croissance continue en Europe et en France. Cela s'explique par une demande importante des consommateurs pour des produits issus de l'agriculture agrobiologique, soutenue par des politiques européenne et nationale, et un cadre légal clairement défini.

Le défi majeur pour l'agriculture agrobiologique est de maintenir la confiance des consommateurs envers ces produits afin d'assurer la croissance du secteur. Cependant, la notion de confiance des consommateurs pour les produits agrobiologiques est complexe. Les facteurs qui poussent les consommateurs à choisir des aliments agrobiologiques varient selon les pays et peuvent être influencés par le contexte socioculturel. Selon la littérature, la sécurité et la qualité des produits sont les principaux éléments préoccupant les consommateurs. Les consommateurs choisissent des produits issus de l'agriculture agrobiologique aussi pour des raisons de santé et de bien-être. Des considérations éthiques sont également identifiées comme motif de choix des produits agrobiologiques, par exemple le bien-être animal.

La Fédération internationale des mouvements de l'agriculture agrobiologique (IFOAM) est l'organisation mondiale qui a pour mission de fédérer et d'assister le mouvement bio dans toute sa diversité. Selon l'IFOAM, l'agriculture biologique repose sur quatre principes indissociables : l'écologie, l'équité, les soins et la santé. Selon ce dernier principe, l'agriculture agrobiologique a pour mission de soutenir et améliorer la santé des sols, des plantes, des animaux, de l'homme, et de la planète comme une et indivisible.

Selon le cahier des charges défini par la Commission européenne, « L'élevage agrobiologique devrait respecter des normes élevées en matière de bien-être animal et répondre aux besoins comportementaux propres à chaque espèce animale, et la gestion de la santé animale devrait être axée sur la prévention des maladies» (CE n° 834/2007). La santé animale est un élément clé du bien-être animal. Cependant, en cas de blessure ou de maladie, il est considéré que le bien-être animal n'est pas assuré.

Au cours des dernières décennies, l'incidence des maladies de production en élevage laitier s'est accrue, conséquence de l'intensification des systèmes de production laitière. Elles représentent un risque majeur pour la santé des vaches laitières et leur bien-être. Malgré le principe de « santé » de l'agriculture agrobiologique, le niveau de santé dans les fermes laitières agrobiologiques n'est pas toujours meilleur que dans les fermes conventionnelles. De plus, la prévalence des maladies de production dans les fermes laitières agrobiologiques varie selon les régions et les pays européens. L'état de santé de certains troupeaux laitiers agrobiologiques pourrait donc encore être amélioré.

Les maladies de production sont multifactorielles et résultent d'un déséquilibre entre l'hôte, le pathogène et l'environnement. Pour pouvoir maîtriser et prévenir ces maladies, il est nécessaire de prendre en compte ce triptyque dans son ensemble. De plus, l'attitude et le comportement des éleveurs en matière de gestion de la santé du troupeau ont une influence importante sur l'efficacité de la maîtrise des maladies de production.

Les efforts pour prévenir les problèmes de santé dans les exploitations laitières devraient se concentrer sur la mise en œuvre des pratiques d'élevage préventives au niveau des exploitations. Au cours des dernières décennies, la recherche sur la prévention des maladies a permis une meilleure compréhension de leur épidémiologie et de leur physiopathologie. Toutefois, dans le meilleur des cas, l'incidence des maladies dans les troupeaux laitiers est restée stable. Donc, le défi semble être d'améliorer l'utilisation de ces résultats scientifiques sur le terrain.

L'évolution des pratiques nécessite une vision systémique de l'élevage, impliquant de former et motiver les parties prenantes aux pratiques de gestion appropriées. Pour répondre à ce besoin des activités de conseil ont été développés. Le plus connue est le suivi sanitaire de troupeau (Herd Health and Production Management programs, en Anglais). Par contre, pour qu'un conseil sanitaire soit considéré comme pertinent par l'éleveur, il doit être en accord avec sa perception du problème et l'effet bénéfique de cette pratique sur la santé de son troupeau, ses objectifs, son système d'exploitation et ses contraintes. Assurer un dialogue entre l'éleveur et le(s) conseiller(s) semble être important, si les conseillers veulent être en mesure d'en apprendre davantage sur les éléments influençant la perception de la pertinence du conseil, afin d'adapter leurs conseils aux éleveurs. Aujourd'hui, le conseil sanitaire ne fournit pas toujours un impact positif satisfaisant sur la santé et le bien-être des animaux et cela reste un domaine peu étudié.

De plus, les vétérinaires apparaissent comme des conseillers qualifiés en matière de santé animale, cependant, selon la littérature, les éleveurs agrobiologiques ne les considèrent pas toujours comme aptes à leur fournir des conseils pertinents. Cela peut conduire à la non-adoption des conseils et est donc une occasion manquée d'améliorer la santé du troupeau. L'explication de cette situation est peu étudiée, notamment le point de vue et la perception des vétérinaires.

L'objectif général de cette thèse est de produire des connaissances pour améliorer notre compréhension de la façon dont la pertinence des activités de conseil en matière de santé animale pour l'élevage bovin laitier agrobiologique peut être améliorée. Ces connaissances contribueront, *in fine,* à l'amélioration de la santé des vaches laitières en élevage agrobiologique. Trois sous-objectifs ont été formulés, à savoir:

- *Objectif 1 :* Améliorer notre compréhension du rôle des vétérinaires dans les stratégies de gestion de la santé animale des éleveurs bovins laitiers agrobiologique.
- *Objectif 2 :* Concevoir un outil pour le suivi sanitaire de troupeau qui favorise le dialogue entre les éleveurs et les conseillers.
- *Objectif 3 :* Évaluer l'utilisation et l'efficacité de l'outil sur les activités de conseil sanitaire et sur la santé du troupeau.

Le rôle du vétérinaire en élevage bovin laitier agrobiologique

Deux études ont été réalisées pour acquérir une meilleure compréhension du rôle des vétérinaires dans les stratégies de gestion de la santé en élevage bovin laitier agrobiologique. Quatorze producteurs laitiers agrobiologiques et 14 vétérinaires ont été interrogés via des entretiens de recherche qualitatifs et semi-directifs. Une approche modifiée de « Grounded Theory » a été utilisée pour la collecte et l'analyse de ces entretiens.

Dans la plupart des cas, les vétérinaires considèrent que les contacts les plus réguliers qu'ils ont avec les éleveurs laitiers agrobiologiques sont soit pour soigner un animal malade, soit pour prendre en charge des problèmes aigus de santé du troupeau. Certains vétérinaires ont rencontré dans certains élevages agrobiologiques des niveaux de santé et de bien-être animal qui ne répondent pas à leurs attentes. De plus, ils ne se sont pas toujours sentis en mesure de jouer un rôle de conseiller dans ces situations. Les principes de production agrobiologique, le cahier des charges et la gestion de la santé animale par les éleveurs remettent parfois en cause les valeurs des vétérinaires sur la santé et le bien-être animal et leur perception des «bonnes pratiques vétérinaires». En outre, certains vétérinaires ont estimé qu'il n'y avait pas d'intérêt économique direct pour eux dans l'agriculture agrobiologique, ce qui pouvait diminuer leur volonté d'investir dans ce secteur. Des opportunités possibles d'amélioration de leur rôle dans ces élevages ont été identifiées, en proposant par exemple de façon plus proactive des conseils par l'intermédiaire des organisations de conseil existantes (telles que les groupements d'agriculteurs ou les Chambres d'Agriculture), en adaptant leur services de conseil vétérinaire conventionnel pour le secteur agrobiologique et / ou en dissociant le rôle curatif des vétérinaires de leur rôle de conseil dans la prévention des maladies.

Selon les éleveurs, les vétérinaires ont le plus souvent uniquement un rôle de thérapeute dans leur élevage. Les producteurs laitiers agrobiologiques mettent l'accent sur la promotion de la santé animale, contrairement à ce qu'ils perçoivent de la stratégie des vétérinaires qui se concentre le plus souvent sur la maîtrise de la maladie. Entre éleveurs et vétérinaires, il existe des différences de stratégies de promotion de la santé animale à long terme, de résolutions de chacun face aux problèmes de santé, et d'un manque de dialogue et de partage d'expériences. Ainsi, l'amélioration du dialogue est essentielle pour améliorer la compréhension des objectifs des éleveurs par les vétérinaires, afin d'adapter leurs conseils sanitaires. Cependant, cela nécessite un investissement de temps par les vétérinaires dans l'élevage agrobiologique et une attitude proactive montrant un intérêt pour la situation sanitaire de ces élevages et leurs pratiques de gestion de la santé animale. Les éleveurs doivent également faire l'effort de maintenir le dialogue avec les vétérinaires.

Outil de conseil en santé animale

Un outil support de conseil sanitaire en élevage bovin laitier a été conçu en mobilisant une approche de recherche participative, rassemblant les acteurs principaux en santé animale en élevage laitier agrobiologique (éleveurs, conseillers agricoles, vétérinaires, chercheurs). Cet outil repose sur le concept et principes des suivis sanitaires de troupeaux en termes de « santé et performances », mais a été adapté par les acteurs du terrain durant des workshops participatifs. Des changements ont été apportés pour rendre l'outil plus adaptable aux conditions d'élevage spécifiques et pour promouvoir le dialogue entre éleveur et conseiller en santé animale (Figure A).

Une approche participative a été utilisée pour créer un environnement dans lequel les éleveurs pourraient adapter les indicateurs proposés par les scientifiques pour surveiller les cinq principales maladies de production dans leur troupeau bovin laitier. Les adaptations des indicateurs ont été caractérisées et les explications des éleveurs pour les modifications apportées ont été décrites.

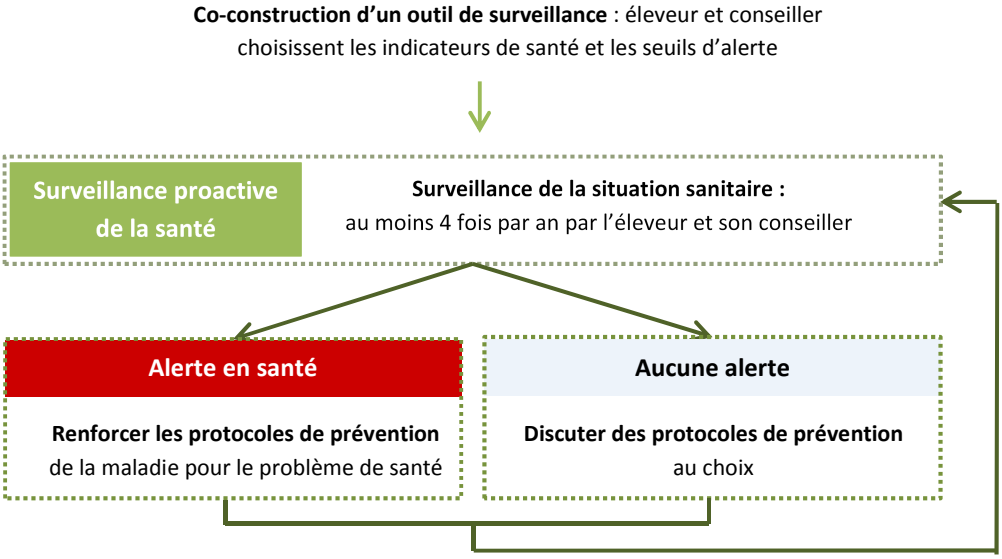

Figure A : Concept général de l'outil pour le conseil sanitaire

L'étude a été menée en France et en Suède, qui diffèrent en termes de règlements relative à l'agriculture agrobiologique et d'activités de suivis de troupeau préexistantes. Dans les deux pays, 20 producteurs laitiers certifiés en agrobiologie et leurs conseillers en gestion de la santé des animaux ont participé à l'étude. Tous les éleveurs ont adapté le plan de surveillance initial proposé par les scientifiques à la situation sanitaire de leur élevage. Cela a abouti à quarante combinaisons uniques et spécifiques à chaque troupeau, d'indicateurs pour la surveillance de la santé du troupeau (santé mammaire, boiteries, santé des veaux, maladies métaboliques, performances de reproduction). Tous sauf trois éleveurs ont créé un outil de surveillance des cinq maladies de production en utilisant simultanément les indicateurs construits. L'analyse qualitative des explications données par les agriculteurs sur leurs choix a permis d'avoir une meilleure compréhension de leurs raisons à sélectionner et à adapter les indicateurs. Ces informations sont précieuses pour les scientifiques impliqués dans la conception des outils pour le conseil sanitaire. Les conseillers dans le domaine peuvent également bénéficier de cette approche de co-construction car elle transforme les outils de surveillance génériques fournis par les scientifiques en outils spécifiques à la ferme.

Une étude d'intervention a été réalisée afin d'évaluer l'impact d'un suivi de troupeau utilisant l'outil de conseil conçu pendant cette thèse. L'outil a été mis en œuvre au niveau de la ferme à l'aide d'une approche participative, par 20 producteurs laitiers agrobiologiques et leurs conseillers en santé animale en France et 20 en Suède. L'évaluation de l'impact des programmes de conseil est difficile en raison des multiples éléments qui interagissent et qui influent sur ses résultats. Par conséquent, la seule mesure de l'évolution de la fréquence de maladies de production ne suffit pas. L'ensemble du processus, de sa mise en œuvre à son utilisation, doit être évalué. L'impact de l'outil a été évalué sur : i) la base du respect du protocole exécuté, ii) son efficacité en termes d'amélioration de la santé du troupeau perçu par les utilisateurs, iii) sa capacité à remplir son utilisation prévue concernant les activités de surveillance et de prévention, iv) sa capacité à influer les pratiques de gestion de la santé

du troupeau et v) à stimuler le dialogue entre les éleveurs et les conseillers. Vingt et un des quarante élevages ont strictement respecté l'utilisation de l'outil de suivi du troupeau. Les résultats du questionnaire rempli par les utilisateurs ont montré que les protocoles fonctionnent comme prévu, que l'outil stimule le changement dans les pratiques de gestion de la santé du troupeau des éleveurs ainsi que le dialogue entre les éleveurs et les conseillers sur plusieurs sujets. Même si la majorité des utilisateurs a perçu que le suivi de troupeau a contribué à améliorer la santé des troupeaux, sa mise en œuvre n'a pas conduit à une amélioration mesurable des indicateurs de santé des troupeaux dans les fermes participantes, aucune différence significative n'ayant été trouvée par rapport aux fermes témoins ou par rapport à la situation antérieure.

Conclusion et perspectives

Un manque de dialogue entre les éleveurs agrobiologiques et les vétérinaires peut amener à des situations de non compréhension des pratiques de l'autre en santé animale, qui sont parfois liées au contexte de l'agriculture agrobiologique. Sur le long terme ceci peut conduire à une relation de travail où le vétérinaire n'est pas perçu comme un conseiller pertinent en santé animale. La diffusion de ces résultats de recherche et la formation des vétérinaires sur les spécificités de l'élevage agrobiologique est recommandée pour aplanir ces incompréhensions et améliorer la relation de travail entre ces acteurs.

Les outils de conseil sanitaire de troupeau doivent être adaptables aux conditions spécifiques à chaque élevage. Le suivi de troupeau conçu dans cette thèse a permis de créer un environnement favorisant l'échange d'informations entre les éleveurs et les conseillers, par contre nous ne pouvions ni évaluer si les conseillers avaient utilisé cette information, ni comment ils l'avaient utilisé. La qualité de l'information donnée ne pouvait être évaluée. Nous recommandons donc que les futures recherches visent à améliorer les méthodes d'évaluation de l'effet des programmes de conseil, en identifiant les indicateurs précoces pour des conseils efficaces, ainsi que le développement de méthodes pour évaluer la qualité des situations de conseil sans que le scientifique n'interfère avec le duo éleveur-conseiller.

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Oniris
ÉCOLE NATIONALE VÉTÉRINAIRE, AGROALIMENTAIRE ET DE L'ALIMENTATION
SANTÉ ET ALIMENTATION AU CŒUR DE LA VIE

Thèse de Doctorat

Julie DUVAL

Le conseil sanitaire en élevage bovin laitier agrobiologique

Herd health advisory services in organic dairy cattle farms

Résumé

Améliorer la santé des vaches laitières en élevage agrobiologiques (AB) est bien souvent nécessaire, pour ces élevages ne répondant pas toujours aux principes de l'AB et aux attentes des consommateurs d'avoir un niveau de santé et bien-être animal élevé. Cette thèse explore des voies d'amélioration du conseil sanitaire en vue d'améliorer la santé animale dans ces élevages. Les résultats de nos travaux montrent que les vétérinaires ont le plus souvent un rôle de thérapeute dans les élevages laitiers AB. L'obtention d'un rôle de conseiller a été entravée par des spécificités liées à l'AB, telles que les différences entre éleveurs et vétérinaires dans les objectifs de gestion de la santé des animaux et les pratiques sanitaires.
Une étude d'intervention a été effectuée pour tester un dispositif de conseil dans des élevages AB en France et en Suède, basé sur l'utilisation d'outils de surveillance et prévention de maladies de production. Le dispositif a été réalisé en utilisant une approche participative, impliquant l'éleveur et le conseiller ; la flexibilité de l'outil a permis de produire un protocole de surveillance adaptée à chaque élevage. Bien qu'aucun effet sur la santé du troupeau n'a été prouvé, le dispositif a été perçu pour contribuer à la santé du troupeau par ses utilisateurs. Il a rempli la plupart de ses fonctions prévues de surveillance et de prévention des maladies et a stimulé le dialogue entre éleveurs et conseillers. Des outils qui stimulent le dialogue et qui sont adaptables à chaque élevage sont une voie à suivre pour le développement du conseil en santé animale.

Mots clés : agriculture agrobiologique, vaches laitières, gestion de la santé animale, décisions d'éleveur, conseillers, services de conseil

Abstract

Improving herd health on organic dairy farms is often needed, since organic dairy farms do not consistently meet the organic principles and consumers' expectations of high animal health and welfare. This thesis explores ways to improve the pertinence of herd health advisory services in order to improve animal health on organic dairy farms.
The results of our studies show that veterinarians most often have a role of therapist on organic dairy farms. Obtaining a more advisory role was hampered due to specificities of the organic sector, such as differences between farmers and veterinarians in animal health management objectives and practices.
An intervention study was performed testing a Herd Health and Production Management (HHPM) program on organic dairy farms in France and Sweden, based on herd health monitoring and disease prevention activities. The program was built using a participatory approach, making farmer and advisor work together; the adaptability of the program allowed to design farm specific herd health monitoring tools. Although no effect on herd health measured, the program was perceived to contribute to herd health by its users. The program fulfilled most of its intended functions in herd health monitoring and disease prevention and stimulated dialogue between farmers and their advisors. We consider that dialogue promoting and tools adaptable to farm specific situations are a possible way forward for the development of advisory services in animal health.

Key Words: Organic farming, dairy cows, animal health planning, farmer decision-making, advisors, extension services

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