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1. Introduction

The importance of human behaviour in antibiotic stewardship

According to the World Health Organisation (WHO) (2022), antimicrobial resistance (AMR) is one of the most serious global health threats facing humanity today. The European Food and Safety Authority (EFSA) define AMR as the ability of microorganisms to withstand antibiotic treatments, thus rendering treatment ineffective and posing a serious risk to public health. The overuse or misuse of antibiotics has been linked to the emergence and spread of resistant microorganisms which can propagate through many routes, for example when AMR occurs in zoonotic bacteria present in animals and food it can also compromise the effective treatment of infectious diseases in humans (EFSA 2021). Thus, the One Health framework, which encompasses animal health, human health, and environmental health, is particularly relevant to combatting AMR. WHO (2017) describes One Health as an approach to planning, implementing, and evaluating programmes, policies, legislation, and research that encourages effective communication and collaboration across multiple sectors towards improved public health outcomes. This report focuses on the best strategies for the management of antibiotics in the agricultural industry as one component of One Health.

Many antimicrobial stewardship initiatives and tools have been developed to promote the most effective use of antimicrobials by preventing their misuse or overuse. One of these strategies is the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) Project, which collects information on how antimicrobial medicines are used in animals across the European Union (EU). This information is essential in identifying risk factors that could lead to the development and spread of AMR in animals. ESVAC annual reports also highlight fundamental changes and trends over time. Of particular importance, sales of veterinary antimicrobials considered critically important in human medicine decreased between 2011 and 2020 by: 33% for third and fourth generation cephalosporins; 77% for polymyxins; 13% for fluoroquinolones; 85% for other quinolones (ESVAC, 2021). In addition, the EFSA coordinates mandatory active monitoring of AMR in zoonotic/indicator bacteria (*Salmonella*, *Campylobacter*, and *Escherichia coli*) from food-producing animals and carcases/meat. Once a year, the European Centre for Disease Prevention and Control (ECDC) and EFSA produce the EU summary report on AMR in zoonotic and indicator bacteria from humans, animals and food. The report based on data from 2018/2019 concludes that outcome indicators show that some encouraging progress has been made in reducing AMR in food-producing animals in several European Member states over the last few years. These coordinated systems highlight significant efforts to produce valuable AMR information at the European level with a public health perspective (Mader et al, 2021).

These initiatives and control strategies are recording significant developments. For example, the prevalence of methicillin-resistant *Staphylococcus aureus* in the UK has been reduced to a cost-effective unavoidable level by implementing management practices that reduce unnecessary antibiotic use (Haywood et al. 2021). Similar trends are also observed in some other European countries due to AMR stewardship programmes such as the strategy for antibiotic therapy and prevention of bacterial resistance in healthcare organisations in France, Germany and Ireland. However, ESVAC (2021) reported that veterinary antimicrobial usage across Europe varied across Member States. Out of the 25 countries that provided data covering 2011 to 2020, 19 observed a decline in the volume of sales of veterinary antimicrobial medicinal products of more than 5%, but 4 countries recorded an increase of more than 5% and two other countries noted a minor increase or

decrease (below 5%) in overall sales. Differences between countries can partly be explained by differences in animal demographics, the selection of antimicrobial agents, dosage regimes, the type of data sources and veterinarians' prescribing habits (ESVAC, 2021). In any case, the substantial decline in antimicrobial sales in some countries indicate that there is also a potential for greater decrease in other countries (ESVAC, 2021). To achieve this, a range of approaches are needed. Previous successes recorded regarding antibiotic resistance management are due to a combination of factors such as national policy and legislative approaches to managing resistance; provision of training and resources to implement stewardship by end-users; creating comprehensive databases of resistance surveillance; and offering economic incentives to boost novel antibiotic discovery research (Haywood et al, 2021).

The DISARM project has focused on creating an active network dedicated to finding and sharing innovative solutions which reduce the need for antibiotics in livestock farming by focusing on disease prevention and prudent use of antibiotics, thereby reducing antibiotic resistance. DISARM uses a multi-actor approach – bringing together researchers, industry, and farmers to share and develop tools and practices that promote animal health. These social elements of collaborative working are a key focus for this report. Understanding and supporting people is essential to bring about and maintain sustainable reductions in AMU in agriculture because people (especially farmers and veterinarians) are ultimately responsible for animal management and the decision to treat with antibiotics or not.

Supporting human behaviour change

Some projects and initiatives have been developed to assist in understanding and supporting human behaviour change. Most AMR coordinated strategies are based around the linear knowledge transfer model (Hayward et al, 2021), where researchers, trainers and technical experts develop solutions to agricultural problems and then pass them down to farmers. There are genuine concerns with this type of linear top-down knowledge transfer model to drive positive behavioural change, recommendations are often perceived as too prescriptive and rigid, and do not take into account the decision-making of farmers – resulting in a lack of ownership, and therefore uptake, of the recommendations. Behaviour change models also tend to focus on influencing the behaviour of individuals, whereas stimulating wider social change (which necessitates actions from organisations, research institutions, policymakers and funders) might be more effective at driving and sustaining positive actions at the farm level (Rose et al, 2018). A number of robust measures, such as exploring formal and informal communication channels with farmers and encouraging participatory and practice-relevant research in which multiple actors are integrated in two-way knowledge exchange activities, could help in fostering social and organizational skills in a broader way (Rose et al, 2018) and result in co-developed strategies which are more likely to be acted upon and maintained.

Participatory approaches can be action-driven and are aimed primarily at driving social change. Farmer Field Schools, for instance, involve collaborative participation at the farm level (Bakker et al, 2021) that provides an opportunity for farmers to be co-researchers and co-designers of innovative technologies, driving positive change, primarily through learning and knowledge-sharing (FAO, 2019). The model has been applied globally, especially in Europe, Asia, Africa and other parts of the world, with reported extreme successes. This approach, in which a trained facilitator works with groups of farmers to develop, enact and review tailored action plans for each farm over a 1-2 year period to allow farmers the opportunity to learn from each other and to benchmark their farming activities to determine the impact of adopting recommendations. The Field Schools approach has

been applied within research contexts e.g. Stable Schools in Denmark (Vaarst et al, 2007), including the reduction of antimicrobial use on UK farms (Farmer Action Groups, Morgans et al 2019). These participatory action-based approaches have been shown to be effective at motivating change – over the course of an 8-12 month period following action plan development, average implementation rate was 54.3%, at least one recommendation from each farm's Action Plan was implemented, and many were still ongoing at the end of the study (Morgans et al 2019). Of particular note, use of highest priority critically important antimicrobials (HPCIA) reduced by 87.5% - a much greater reduction than national trends reported at the time (Morgans et al 2019).

There is also evidence that participatory approaches to the regulation of antibiotics can benefit not only farmers, but also non-farmers. Tonkin-Crine et al (2015) review behavioural science as an effective tool in changing antibiotic prescribing practices. Based on social learning theory, one intervention aimed to increase clinicians' motivation to change their prescribing and their confidence in their ability to change. Similarly, the Arwain Vet Cymru project in Wales invited veterinarians, as a representative for their practice, to take part in online training and workshops to develop an action plan and implement stewardship changes to reduce antibiotic prescribing at a practice level and act as ambassadors for responsible prescribing. The project has proven to be such a success that RCVS Knowledge has launched a similar initiative across the whole of the United Kingdom, Farm Vet Champion program https://knowledge.rcvs.org.uk/forms/register-your-interest-to-become-a-farm-vet-champion/.

Characteristically, these participatory approaches are bottom-up, meaning that the direction of the change initiates from the farm/vet practice levels. The whole process may be communicated in the form of peer-to-peer exchange farm walks/demos, discussion groups, etc. A key element of these approaches is facilitation, and a focus on the ADKAR process (Awareness of the need to change, Desire to make the change, Knowledge of what/how to change, Ability to put the change into practice, and Reinforcement where the success/failure of change is reviewed) which can drive continuous improvement at the farm (or veterinary practice) level. These communication strategies value and promote the beneficial tacit knowledge which is often absent from scientific discussions.

Farmers' social relationships and the practices of knowledge sharing should be considered when planning a collaborative stakeholder approach, meaning a shift away from a focus on individual behavioural change to driving social change at group/community levels (Rose et al 2018). Within a farm context, multiple actors influence the practices used, and changes made – individual members of the farm team itself, and trusted advisors e.g. the farm veterinarian(s), nutritionist(s), suppliers, financial planners, etc. These people likely all have differing priorities, ideas and concerns so the role of facilitation to help bring these multiple voices to develop an agreed action plan together could result in attractive, effective, practical solutions that can be applied by relevant persons at the farm level.

The Multi-Actor Farm Health Team Approach

Based on the importance of social, organisational, and behavioural change processes, the DISARM project set out to establish 40 Multi-Actor Farm Health Teams (MAFHTs) across 9 countries in either the poultry, sheep, pig or dairy sector. These teams consisted of the farm staff and advisors (veterinarian, nutritionist, etc.), supported by a DISARM facilitator/coach. The teams met to discuss a farm-specific action plan towards reduced AMU and improved animal health. This included a

baseline biosecurity assessment (https://biocheck.ugent.be/) and data monitoring to assess progress and the effectiveness of the MAFHT.

2. Findings: Application of the Multi Actor Farm Health Team Approach in practice

Methods

DISARM partners from different countries aimed to set up 5 case study farms to use the MAFHT approach in the project period 2018-2022. This period spanned the unforeseen global COVID-19 pandemic which hindered - but did not halt - progress. The Netherlands and Spain focused on pig farms, Belgium and Latvia on poultry farms, the UK, Romania and Denmark on dairy farms and France and Greece on dairy sheep. Part of the process was also to include national and international cross-exchange between the countries per sector represented. Those responsible for organising these DISARM activities were asked the following questions, and their responses inform this report:

1. How did you set up and manage/run the MAFHTs in your country?
2. What worked well regarding the MAFHT approach (including use of data, developing plans, cross visits)?
3. What challenges were experienced regarding the MAFHT approach (including use of data, developing plans, cross visits)?
    a. What was the impact of COVID-19?
    b. What issues were there that were unrelated to COVID-19, if any?
4. How likely is it that the MAFHT approach (or similar) could be embedded in mainstream advisory/regulatory systems in your country?
    a. What opportunities are there for this?
    b. What barriers are there to this?
    c. What is needed in terms of support, e.g. training, structures, funding, etc.?

Results

Setting up MAFHTs in different country-contexts

Pigs

In the Netherlands, DISARM partner ZLTO called for interested pig farmers through their newsletter. A kick-off meeting was held with those farmers to explain the DISARM MAFHT approach. Then the farm veterinarians and feed advisors were informed about the project and a date was set for the first MAFHT meeting on each farm.

In Spain, DISARM partner ANPROGAPOR contacted companies that represent different types of pig production according to the part of our country where they work, company size and type of company and farms.

Poultry

In Belgium, DISARM partner ILVO announced the DISARM MAFHT case study opportunity through social media and professional agricultural and poultry magazines. Some farmers applied to

participate in direct response to these announcements. However, most participants were recruited through a veterinary practice which specializes in poultry and has a uniform database to register antibiotic use on their clients' farms. This feature facilitated the collection and close monitoring and comparing of ABU in the Flemish case studies. Furthermore, to prevent a language barrier in the national knowledge exchange, farms were exclusively selected from Flanders.

DISARM partner LLU had to be mindful of the characteristics of the poultry sector in Latvia when setting up their MAFHTs. Two large farms under one enterprise produce 80% of poultry meat, with small/organic farms producing the other 20% - there were no medium size conventional poultry farms. The two large farms had existing MAFHTs which consisted of the owners of the company, veterinary team, zootechnician team, nutritionists, farm workers, engineers, marketing specialists, personnel department, economists, lawyers, etc. – The DISARM coach observed these teams. Three MAFHTs were formed in collaboration with small farms, two of which were organic – these teams consisted of the farm owner, veterinarian, and occasionally the owner contacted the food and safety inspector. These small farm owners were recruited following communications with a poultry organisation in Latvia.

Dairy Cattle

In the UK, DISARM partner IfA employees used their existing farmer networks to identify and recruit dairy farms for the MAFHT case studies. Using the previously established relationships with farmers, recruitment began in autumn 2019 with phonecalls/emails to a selection of farms who were known to have an interest in antibiotic stewardship and herd health to inform them about the DISARM project and invite them to take part as a case study farm. However, issues arose when getting two of the five farms to confirm a date for their first MAFHT meeting and various obstacles were identified in the way of their continued participation in this first stage of the project, despite their initial enthusiasm. Furthermore, by 23rd March 2020, COVID-19 had taken hold and lockdown restrictions were in place causing all face-to-face meetings and visits to be cancelled until further notice.

In Romania, DISARM partner USAMV recruited 4 dairy farms from their existing farmer networks and 1 following promotion of the DISARM MAFHT approach at a trad event. The MAFHTs were set up with the farm owner/manager and included the farm veterinary manager, a zootechnical engineer and one or two other specialists with complementary skills to those of the famer and farm veterinarian. This meant that team members were able to contribute to discussions about the health problems identified on farms e.g., udder pathology, hoof pathology, calf pathology and nutritional disorders.

In Denmark, farmers with >100 cows or a youngstock population of >200 animals must sign a herd health contract (HHC). There are different types of HHC which dictate the number of mandatory veterinary visits, participation in a farmer field school, or interdisciplinary herd health visits. In general, farms with many veterinary visits have more options to treat and handle medical products. Organic farmers most often choose a HHC that requires participation in a farmer field school or a HHC that includes at least two annual interdisciplinary herd visits where the herd veterinarian and at least one other advisor (usually an independent feed advisor) work together with the farmer to set up and follow up on herd health plans – this HHC is the same as the DISARM MAFHT approach. DISARM partner SEGES/L&F included two organic farms that were already used to the principles of the MAFHT. In addition, some of the farms have established advisory boards where

influential/knowledgeable people gather to come up with new solutions and discuss different issues concerning the farm.

Sheep

In France, DISARM partner IDELE opted to select farms participating in the MAFHTs in a limited geographical area to limit travel costs and transport times. Thus, the five case study farms belonged to the Roquefort cheese production area which has three main technical support bodies. These three local technical organisations assisted with farmer recruitment and collection of the basic data. Then, a personal connection was made with the MAFHT by the DISARM coach, which allowed for easy interaction between group members.

In Greece, DISARM partner AUA employees selected five farms from their existing farmer networks to represent different livestock production systems. It was important for the farmers to know/trust the DISARM coach to foster cooperation in the project as it was extremely unlikely that farmers would respond to adverts etc. Once farmers were recruited, they approached their veterinarians and other advisors to invite them to get involved in the MAFHT as part of their professional cooperation.

What worked well in the MAFHTs?

In the Netherlands, the MAFHT approach was considered helpful to formalise teamwork regarding animal health, add structure to the processes at the farms, and evaluate actions. The element of peer-to-peer exchange between case study farms was also considered beneficial.

In Spain, it was important to convince them to share information about aspects which affect the need and the use of antibiotics in farms such as: biosecurity, disease control programs, etc. The farms collaborated well with the DISARM coach in audits and communicating the problems they believed were responsible for the use of antibiotics in their pigs.

In Belgium the farmers were very open to have their farms being visited and were happy to adopt the changes presented through discussions with the coach. The farmers participating in the project were very proactive and had a good relationship with the vet and other advisors.

In Latvia, small scale poultry farm owners were interested primarily because of the cross-exchange experience with Belgian farmers. However, the DISARM coach's contribution to discussions around biosecurity and other issues that could have a lasting and significant effect on their farming results were also found to be very beneficial to them.

In the UK, it was found that dairy cattle farmers were generally positive about the approach and what it set out to achieve. The principle of getting all actors together who have a stake in the farm's success and optimising herd health was seen as a worthwhile cause. The farmers were keen to see their antibiotic use and herd performance analysed further and wanted to be benchmarked with themselves over time, as well as with a peer group. The concept of meeting other farmers and viewing other farms as a way of learning was also appealing to the group, however, the time commitment including travelling to other farms was a concern.

In Romania, farmers provided all the information necessary for the running of the MAFHT case studies and all dairy farm owners or managers answered the Biocheck.Ugent questions that were used to identify farm health problems and develop the farm health plans.

In Denmark, the farmers were already experienced users of the MAFHT principles, so it was useful to study their way of working. Introduction of the Biocheck.Ugent tool in the MAFHT work provided inspiration and information to the farmers and advisors.

In France, the teams functioned well and easily understood the health issues of the farm and the overall aims of DISARM project. The plan was built with reasonable objectives. The meetings were exciting, and everyone left satisfied, especially the veterinarians.

In Greece, the MAFHT approach worked well – the participating dairy sheep farmers were very pleased with the meetings, data and were keen to implement suggestions as the farm health plans developed. Farmers played an active role in deciding how, when and where to meet all together for the national cross-exchanges and the DISARM coach was flexible regarding arranging the meetings. In general, farmers were more interested in reducing (animal) losses and treatment costs of antibiotics. They were also interested to be involved in a European project for their own benefit (prestige etc.)

What challenges were experienced with regards to the MAFHTs?

In every country, COVID-19 and the associated restrictions caused problems in running the MAFHT case studies and cross visits. Meetings had to be postponed and rescheduled. Long periods without a farm visit made it difficult to maintain farmer engagement. Although other methods of contact were used e.g., phonecalls, WhatsApp group chats, they were not as efficient or effective as in-person interactions. Different individual preferences for communication platforms (email, WhatsApp, phonecall) could hinder effective and timely communications.

Aside from COVID-19, other issues were identified, primarily a lack of time. Managing MAFHTs is time consuming, and if only one coach is involved, there may be time conflicts with other projects or studies. In addition, the availability of farmers also fluctuates over time depending on the peaks in workload during the production season so finding an appropriate time for meetings could be challenging. Furthermore, not all farmers have an effective, easy-to-use system for documenting health events to allow for benchmarking of progress.

Another key issue that was highlighted was that the participation of veterinarians and other advisors in the MAFHT meetings was not funded by the DISARM project. This often caused some reluctance since the veterinarian/advisors' time was not being paid for, or farmers were expected to cover the cost.

Furthermore, lack of continuity in the staff participating in the MAFHT – be that at the farm, advisor, or coach level – could interrupt the implementation of the plans and cause difficulties, especially since the process relies upon establishing trusted relationships.

Potential for the MAFHT approach as part of mainstream/national initiatives

Netherlands

In the Netherlands, the MAFHT approach has been a part of regulatory systems since 1 January 2021. As part of the Dutch IKB assurance system for production chain control (IKB = total surveillance of animal production), antibiotic use is monitored and assessed based on the previous calendar year(s). Farms identified as high users of antibiotics are classified as red farms, and the following steps are in place to support farmers in getting their use of antibiotics into the green zone:

- 1 year red: the farmer and veterinarian make a farm health plan.

- 2 years red: the farmer puts together an advisory team consisting of at least a veterinarian and an external farm advisor, preferably the feed advisor. This team meets and reports three times in one year.
- 3 years red: the pig farmer puts together an expert team consisting of an independent process supervisor as well as the members of the advisory team. This team meets and reports three times in one year
- 4 years red: a tailor-made solution will be provided for the company, with possible suspension from IKB assurance.

Currently, there is a lack of coaches to support this approach, but there are opportunities for more advisors to become a coach through the provision of training which highlights the differences between advising and coaching.

Spain

In Spain, some farm health responsibilities are delegated to regional governments – laws are not the same in all regions, so sometimes it is difficult to implement the same regulations across all farms. Some aspects of the MAFHT approach could be introduced, particularly relating to biosecurity measures and auditing. However, the starting point for implementing a MAFHT varies depending on the farm and sector.

To support mainstream rollout of the MAFHT approach, funding is important to ensure an efficient work system that can reach all farms, facilitated by independent structures (non-profitable organisations) to assess and support farmers in the application of a MAFHT. Furthermore, it is important to fund training for veterinarians, advisors and farm workers in how to establish a health plan as part of the MAFHT approach – this also requires independent organisations which could coordinate these plans and act as intermediaries between producers and the government.

Belgium

Regulatory authorities in Belgium are pushing for the implementation of coaching for farms with high consumption of antimicrobials, so the approach will soon become widespread. However, the biggest barriers are time and money – farmers may feel they are wasting precious time and be disinclined to pay additional fees for the employment of other advisors/coaches.

To facilitate low-cost access to a wide pool of coaches that can be easily consulted by farmers, embedding the MAFHT approach can be aided by the service being partially subsidised by local governments. In addition, high quality training for coaches is needed.

Latvia

In Latvia, within some sectors – and especially in larger farms – the MAFHT approach is already being used. In the dairy and pig sectors, there are already teams consisting of owners, veterinarians, zootechnicians, workers, nutritionists etc., working together to achieve better results. In larger farms, it is easier to organise a MAFHT because it aligns well with animal health, productivity, and connects to the financial performance of the business and the team consists of people that are working full-time onsite. However, for small farms, it will likely be uneconomical (poor time- and cost-effectiveness) to organise regular meetings with the veterinarian, nutritionists, and other advisors, but a MAFHT meeting once or twice per year on small farms could be very beneficial. There is space to further develop and transfer this approach to other sectors and smaller farms.

The MAFHT approach is not part of any regulatory framework, and there is no specific funding for it, but if requirements/funding were in place, it would be likely to increase the motivation of farmers to set up a MAFHT. Furthermore, with regards to the poultry sector in Latvia, there is no regular demand for poultry-specialised veterinarians so there are not many veterinarians who could give consultations about broilers on small scale farms. In other sectors, the main obstacles to overcome would be the understanding of the benefits that the MAFHT approach provides and the motivation to use it.

The MAFHT approach could be a useful requirement e.g. when restructuring farms, transitioning farm ownership/management (succession), or supporting new entrants to farming. Providing financial support for establishing a MAFHT is essential.

UK

In the UK, there is plenty of opportunity to embed the MAFHT approach into the veterinary advisory toolkit. IfA are promoting the approach to veterinary advisors and offering a free taster training session as part of DISARM which has been taken up by several veterinary practices who want to improve their herd and flock health planning processes and would like to use a more collaborative team approach.

There are many vet practices in the UK who are already doing collaborative team approaches to herd and flock health planning, but this is not the norm and is practiced differently between practices. There is no formal coaching or facilitation training for vets in the UK and arguably, vets are not equipped to coach or facilitate groups through a process of change due to the pedagogical top-down nature of their advisory training. In IfA's experience, there is a risk that veterinarians/advisors perceive themselves as coaches simply because they are experienced and well trusted advisors but coaching and facilitation is a very different communication style and skillset to general advising. Lack of training in it could reduce the impact of the approach as it could be delivered poorly. Therefore, more training in coaching and facilitation approaches is needed.

Furthermore, there is limited funding available for collaborative bottom-up approaches like this in the UK Agricultural Knowledge Innovation System (AKIS), although there are signs of this changing with the arrival of new Agricultural Policy. As we have found, unless a MAFHT is already established and meeting, funds need to be available to see the group establish and pay for advisors' time.

Romania

In Romania, the financial benefit associate with implementing the MAFHT approach is difficult to quantify, representing a key barrier, however there is potential to extend the approach to other sectors e.g., pig farms. Furthermore, implementation of actions outlined in the farm health plan could be supported through funding e.g., for improved housing conditions which require large investments.

Denmark

As previously described, the MAFHT approach is already applied in Denmark, though it is still developing, particularly with the involvement of advisory boards. Showing the economic benefit of including more advisors that work in cooperation with each other is important to further disseminate the MAFHT model. Availability of facilitators to drive the joint meetings forward, and continuing education for vets and other advisors in using the MAFHT approach would be valuable. In

future projects it would be best to have funding to pay advisors and veterinarians to participate in more joint meetings without the fee falling on the farmer.

France

In France, exchanges with livestock technical support organisations (cooperatives) have shown that they can take ownership of the aims and principles of MAFHTs, and that this can coincide with their own development objectives. This may help to reinforce contracts among technical organisations and veterinarians/farmers in the future. Under these conditions, communication is key to the continuation of the approach. However, even if a business model based on the contract between farmers and advising organisations or cooperatives, the willingness to pay for advice and coaching may be a barrier.

Continuing education and dissemination of the MAFHT approach should be made available (through testimonials, videos, etc.) that coaching and/or MAFHTs can help to improve animal (herd/flock) health and reduce the use of antibiotics. Funding for training and education is also needed.

Greece

In Greece, there is no mainstream use of the MAFHT approach and it is unclear which organisation or state body would be best suited to promote such an approach. The Ministry of Agriculture does not provide practical advice to farmers, and the private sector gives advice in an effort to sell products. Farmers have a book for recording all the medicines used on their farm so it is possible that the approach could be incorporated as a consequence of high antibiotic use, similar to the Dutch model.

3. Discussion

The insights provided from DISARM colleagues responsible for the MAFHT case studies show that there are notable differences between countries and farm sectors with regards to the application of the MAFHT approach. Whereas some countries (Netherlands, Denmark) have already incorporated these bottom-up approaches involving coaching to support sustained changes in animal health and antibiotic use on farms, most did not include these types of approaches in formal regulatory requirements or advisory services. Although DISARM respondents believed there was potential scope to incorporate the MAFHT approach in multiple livestock sectors within their countries, the responsible organisations and appropriate mechanisms would need further consideration.

In general, the principle of gathering all relevant actors together to discuss and plan for animal health and the success of the farm business was well received and the formalised structure, evaluation and peer-to-peer exchange allowed for the development of plans with realistic actions. However, there were common challenges – the time required to prepare and coach/facilitate a team, and for farm staff and advisors to gather for a meeting. In many cases, poor records (often linked to a lack of time, and/or easy-to-use data recording/entry/analysis systems) could make benchmarking (for the farm over time, or with peers) and assessing the results of any changes difficult due to insufficient data.

In addition to the challenge of time, the MAFHT approach requires good collaboration between actors, so it is important to establish trusted relationships. Staff turnover at the farm, advisor, and/or coach level therefore requires careful management. A clear agreement between the farm,

veterinary practice and advisory organisation(s) is needed so that the process continues regardless of personnel. If the coach facilitating the process changes, a handover period involving an introduction of the new coach to the team by the outgoing staff member, as well as information on progress to-date could help smooth the transition from one coach to another.

Funding was another area of concern which was highlighted across sectors and countries with three main areas being mentioned:

- Training of coaches and promotion of the MAFHT and coaching approach;
    - It is important that coaches are well trained so that the approach is conducted properly to ensure greatest possible benefits are gained from the process, and to prevent damage to the reputation of facilitation/coaching approaches.
    - The cost-benefit of coaching and MAFHT approaches should be quantified.
    - Data and testimonials should be used to produce materials for dissemination to promote these approaches more in the mainstream.
- Paying to support the establishment (and continuation) of MAFHTs, including paying for the time of coaches, veterinarians and other advisors;
    - Supporting the establishment of MAFHTs might allow team members to experience the benefits of the approach and help motivate them to transition to fund the continuation of the process themselves.
    - Who should be responsible for the cost of MAFHTs, and whether they should be subsidised, will depend somewhat upon why the approach is being used. If part of a regulatory framework, it is likely that subsidies will play a role, if motivated by the farmer, veterinarian or other advisor, they would need to establish a business model.
- Supporting farm investments to act upon their health plan;
    - The plans established by the MAFHTs must be acted upon to have positive benefits, however it is likely that some actions will require costly investments to farm infrastructure etc. Financial support for these items could help drive farm improvements and further development of the farm health plan.

4. Conclusions

Key areas for further research, funding and regulation include:

- Country-specific analysis of how the MAFHT approach and coaching could be better integrated into regulatory requirements and/or advisory services for livestock farming.
- Conducting cost-benefit analyses to establish strengths, weaknesses, opportunities, and threats, as well as tangible financial and animal health performance data resulting from participation in a MAFHT approach.

- Further investment in, and development of, user-friendly data recording/monitoring systems for use at the farm-level to offer useful insights for farm businesses, benchmarking and health planning whilst also meeting regulatory requirements.
- The development and provision of facilitation/coaching training to ensure sufficient workforce to support an increased demand for MAFHT approaches.
- In addition, business models for how to make MAFHT approaches viable if driven by regulatory authorities, advisory services, or farm businesses are needed to establish the sustainability of the approach.

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