Good practices for learning and adoption of IPM in hubs and networks

Deliverable D1.1

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Abstract

This first deliverable from the first work package of IPM*WORKS*, aims to provide some inspiration and good practices for learning and adoption of IPM in hubs and networks. These were derived from literature and from interviews on cases of (IPM) (demo) farmer networks across Europe. Each chapter starts with highlights, showing the key findings for a quick insight in the issues in the chapter. The chapters then elaborate on insights on what holistic IPM is and what adoption barriers farmers incur and what IPM approaches to use in IPM demo networks; why networks should be set up to demonstrate and learn about holistic IPM and how to set objectives for individual farmers, as well as for farmer networks and group objectives; how to create a network and who to involve; and how to attract and engage farmers in the networks. Further, this deliverable provides some inspiration on the learning approaches that can be used in IPM demo networks to stimulate farmers' learning and adoption of IPM on their farms. An inspirational table links the 8 IPM principles to specific learning activities mentioned in the interviews. Further, a chapter is dedicated to facilitation and the role of the facilitator (or the hub coach in IPM*WORKS*) and to learning tools. The insights in this document provide a basis for upcoming tasks, guidelines, tools and trainings that will be developed for hub coaches in the coming years. Further, it also elicits some interesting learning questions for IPM*WORKS* regarding how to set up an IPM demo network as a successful learning environment on IPM for farmers.

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1. Introduction

1.1. Objective

IPM*WORKS* will set up an EU wide network of existing regional IPM demo networks extended with newly developed hubs. These newly developed demo farm hubs, are groups of 10-15 demo farmers, under guidance of a hub coach (advisor), who will test IPM practices and decision support tools and share their experiences within the group. These groups of farmers have a common professional interest and show interest to share experiences. They are committed to the group and its goals to share (good and bad!) experiences. They agree upon a common goal for their hub and organise their activities in accordance.

In the IPM*WORKS* network, different types of activities will be organized to stimulate the adoption of IPM practices. Peer-to-peer knowledge exchange and group coaching facilitated by advisors will be set up to reach a wider adoption of advanced IPM practices based on longer-term strategic advice.

The objective of this deliverable is to gather inspiration and good practices of (IPM) (demo) farmer networks and their learning activities, to inspire the IPM*WORKS* hub coaches and other work packages.

This deliverable aimed to inventory barriers and success factors for IPM demo networks that have IPM adoption as an objective. The outcomes of this deliverable are relevant and can provide guidance for upcoming tasks of WP1 (approaches, methods and lessons for the development of IPM demo networks), WP2 (network building) and WP3 (Farm demonstration activities) to set up new IPM demo hubs, (demo)activities and the approaches to monitor and evaluate them. Also first insights in the required skills and needs of IPM demo networks will be generated, which can feed into Task 1.4 (Methods, tools and assistance for advancing social skills of hub facilitators).

1.2. Methodology

1.2.1. Framework

A literature review was performed, focussing on the identification of important aspects of IPM demo networks, such as the type of IPM promoted, embeddedness in the local AKIS, role of advisors and stakeholders, and types of activities organised. To deal with the multitude of potential learning activities and events that can occur within the IPM demo networks, we introduced the concept of *learning environment* as a concept to define and analyse the different learning activities in the IPM demo network and their suitability for stimulating IPM adoption. In literature, the concept of learning environment often seems not strictly defined and can be used to refer to 'conditions of learning', 'classroom climate', or 'school culture' (UNESCO, 2012). UNESCO (2012) defines 'learning environment' as "the complete physical, social and pedagogical context in which learning is intended to occur" (p.12), and can also be applied in non-formal learning spaces (which applies for IPM*WORKS*). According to UNESCO (2012), the components and attributes of a learning environment are conceptualized in relation to their impact on learning processes and outcomes in both cognitive and affective domains.

To build our framework, we started from the three key elements of a learning environment in the definition of UNESCO (2012) and used literature on IPM networks, Farmer Field Schools, farm demonstrations and peer-to-peer learning to further refine the components of the learning environment created in IPM*WORKS*. The

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framework includes four elements to analyse IPM demo networks as a learning environment: the learning objective, the physical learning space, the pedagogical context, and the social context (Figure 1).

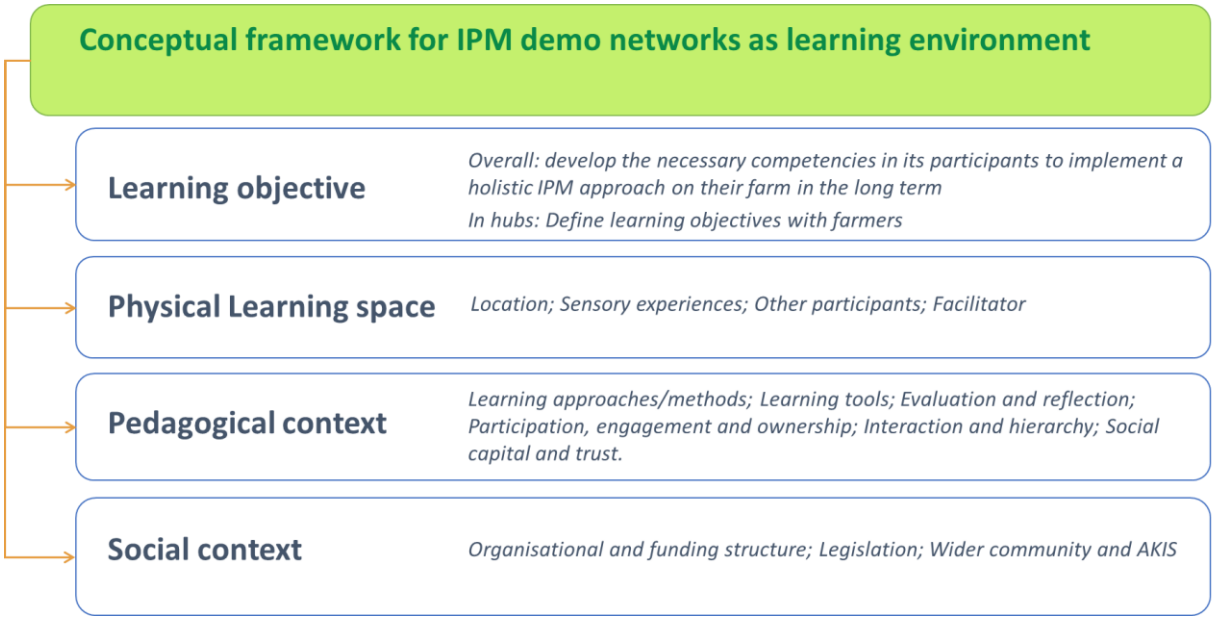

Figure 1. Conceptual framework for IPM demo networks as Learning environment.

The first element is the learning objective. Based on the project objective, the learning objective of the IPM demo networks in IPM*WORKS*, can be defined as 'to develop the necessary competencies in its participants to implement a holistic IPM approach on their farm in the long term'. An important research question resulting from this is how should the learning environment for educating a holistic IPM approach differ from educating single-step IPM measures. Further, also on the local hub level learning objectives will have to be defined. Poulsen and Petersen (2009) stress the importance of discussing the shared goals of the hub with the group of farmers involved, to come to a shared understanding.

The second element is the (physical) learning space, defined by: (1) its location, e.g. Tairraz (2020) mentions successful "locations" for IPM networks being group members' farms and frequent short virtual meetings; (2) the potential for having sensory experiences (Cooreman, 2021), (3) the other participants, who's characteristics can play an important role in the group dynamics and atmosphere created in the learning spaces (Poulsen and Petersen, 2009; Tairraz, 2020), and (iv) the facilitator, who's skills and continuity in the network seem to be an important factor (Tairraz, 2020).

The third element is the pedagogical context, which for IPM*WORKS* can be defined as: (1) the learning approaches or methods and formats used to facilitate knowledge exchange, e.g., farmer discussion group, demonstrations, seminars, leaflets, reports, etc.; (2) learning tools to facilitate the learning process and knowledge exchange amongst farmers, e.g. benchmarking tools, evaluation sheets to enable comparison between farmers, decision support tools (Tairraz, 2020), videos and presentations; (3) evaluation and reflection, allowing to assess the effectiveness of the tested IPM measures in group which supports the farmers' understanding of the outcome and conclusion of the learning activities (Papp Komáromi et al. 2010b); (4) participation and engagement, which can be influenced by the type of motivation of farmers to participate (Triste et al., 2018); (5) interaction and hierarchy between participants, in which experiences of farmers should be regarded equally important as the advisors' and researchers' opinions (Papp Komáromi et al. 2010b); (vi) social capital (Charatsari et al., 2020), ownership and trust (Poulsen and Petersen), which are deemed important for gaining successful outcomes.

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The fourth element is the social context, relating to (1) the overarching organisational and funding structure, which can influence the learning activities taking place in the networks; (2) legislation, which can be conducive or counteracting for the learning objectives of IPM demo networks (Tairraz, 2020); and (3) dynamics in the farmer community and the broader AKIS, who's attitudes and support for IPM can have impact on the farmers' adoption of IPM strategies (Wijnands et al. 2014).

This framework was used as a basis to build the interview guidelines for collecting data from the selected cases.

1.2.2. Case selection

The IPM*WORKS* project partners were asked to list initiatives related to IPM in their countries. Cases that showed the most resemblance with the demo network that will be set up in IPM*WORKS* and were willing to collaborate, were selected for an interview and contacted by one of the WP contributors. With the selection, a representation of cases of North, South, East and West of Europe was taken into account, and also a representation of networks dealing with IPM, demonstration or both was guarded. In total 21 cases were interviewed.

1.2.3. Interviews

The conceptual framework was translated into interview questions (Annex 1), together with other questions of interest. These questions were complemented with a guideline on the general aim of the interview and tips & tricks for semi-structured interviews. The WP1 contributors conducted these interviews and reported the answers in a predefined reporting template (Annex 1).

1.2.4. Data processing

The answers of the different interviewees were collected per question. These were further summarised into more general findings. Many quotes were kept for illustration and to provide nuance and context to the findings.

1.2.5. Validation workshop

A draft of the deliverbable was send to the WP1 contributors who conducted the interviews, the sector leaders of IPM*WORKS*, the leaders of related tasks (2.1, 2.4, 3.1) and the project coordinator. These persons were also invited to a workshop to focus on the following questions:

- Are the key messages relevant for the hub coaches (HCs)? Do you recognize them in practice?
- Which information is still missing?
- How can we integrate these insights in guidelines and tools developed for HCs in other tasks?
- How can we turn this deliverable in a useful tool for HCs?

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1.3. Reader's guide in the results

The results from the literature study and the case interviews are clustered in chapters 3 – 10.

What holistic IPM is and what barriers farmers incur towards its adoption is described in chapter 3. This chapter also provides an overview of the IPM approaches mentioned in the cases.

Why networks should be set up to demonstrate and learn about holistic IPM and how to set objectives for individual farmers, as well as for farmer networks and group objectives is explained in chapter 4.

Who to involve in a network, how to create a network, how to attract farmers and engage them in the networks is explained in chapters 5 and 6 respectively.

How learning approaches can be implemented in IPM demo networks, the learning activites and the tools that are used used to stimulate farmers' learning and adoption of IPM is elucidated in chapter 7.

How IPM networks can be facilitated, the role of the facilitator (or the hub coach in IPM*WORKS*), how learning tools can be used is elaborated in chapter 8.

Internal and external communication strategies and dissemination are discussed in chapter 9.

Finally, chapter 10 highlights some key messages from the interviewees towards the IPM hub coaches. This chapter also looks beyond this deliverable to elicits some gaps in knowledge and understanding on the creation of a succesful environment for farmers to learn on IPM.

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2. Case IDs

Figure 2. Overview of the cases interviewed per country

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Table 1. Overview of the cases interviewed, with the country of the interviewee, the objective of the network and, if applicable, some additional information.

Name	Country	Case objective	Additional info
FABulous Farmers	Belgium	Implementing functional agrobiodiversity measures (FAB measures) on different farm types in the pilot areas.	https://www.fabulousfarmers.eu/nl This project is active in BE, NL, LUX, FR, UK
Viherriski / IPM-APU / Ansari	Finland	Change laboratory on pest management.	
Reseau d'avertissements phytosanitaires (RAP)	France	Organising demo events	
Écophyto groups 30000	France	Favor the maintenance of biodiversity and auxiliaries by setting up agro-ecological infrastructures around farms and promoting the use of alternative methods in cultivation such as growth stimulators, alternative substitute products, or service plants and trapping (25% reduction in Treatment Frequency Index at farm level).	https://agriculture.gouv.fr/ecophyto-objectif-30-000-exploitations-agricoles
Groupement d'intérêt économique et environnemental (GIEE)	France	Putting in place multi-annual projects to change or consolidate their practices with economic, environmental and social objectives linked to agroecology	https://collectifs-agroecologie.fr/
DEPHY	France	The DEPHY network aims to test, develop and deploy agricultural techniques and systems that are economical in the use of plant protection products and economically, environmentally and socially efficient, based on a national network covering all French plant sectors.	https://ecophytopic.fr/dephy/carte-interactive-dephy

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Name	Country	Case objective	Additional info
AgriLink	France	Living labs linking farmers, advisors and researchers to boost innovation	https://www.agrilink2020.eu/ Also active in Poland, Greece, Belgium, Czech Republic, Romania, Spain, Latvia, United Kingdom, Netherlands, Norway, Portugal and Italy.
IPM demo farms (DIPS)	Germany	To establish, support and analyse a network of demonstration farms that implement and demonstrate integrated pest management in the best possible way	https://www.nap-pflanzenschutz.de/en/integrated-plant-protection/demonstration-farms/
SmartAgriHubs	Greece	Effective adoption of digital solutions in the agri-food sector. They assist in the service provision of Digital Innovation Hubs (DIH's) towards SMEs in their digital transition.	https://www.smartagrihubs.eu/
AgROBOfood	Greece	Aiming to build a European ecosystem for the effective adoption of robotic technologies in the agri food sector, which in turn will become more efficient and competitive.	https://agrobofood.eu/project/ Also active in all regions across Europe
Teagasc BETTER farms	Ireland	Economic, social and environmental sustainability through the use of precision technology, e.g., low drift nozzles, yield mapping and variable rate application.	https://www.teagasc.ie/crops/crops/advisory/better-farms/
KPODR	Poland	Public consultancy institution dealing with environmental, farming and rural consultancy deploying 130 field advisors who have daily contact to farmers, entrepreneurships, and other inhabitants of rural areas in order to increase farm incomes and improve living conditions in the countryside and municipalities.	http://en.kpodr.pl/

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Name	Country	Case objective	Additional info
Smart AKIS	Serbia	*Thematic Network on Smart Farming* introduces smart farming technologies to average farmers and to do brokering between partners.	https://www.smart-akis.com/index.php/nl/home-du/
Commitee field technicians COEXPHAL - Estación Experimental Cajamar	Spain	To have the most economically and environmentally sustainable and productive farmers as possible	https://www.coexphal.es/ https://www.fundacioncajamar.es/es/comun/
NEFERTITI	Spain	To coordinate a network of stakeholders to promote peer-to-peer learning via demo activities in commercial farms of different crops	https://nefertiti-h2020.eu/ Also active in France, Germany, Ireland, UK, Finland, Poland, Belgium, Bulgaria, The Netherlands, Croatia, Portugal, Hungary
INNOSETA	Spain	Thematic network on best practices for crop protection and spraying equipment	https://www.innoseta.eu/ Also active in Italy, Switzerland, Greece, France, Poland, Belgium, the Netherlands
PestiRed	Switserland	Reduce the use of synthetic chemical pesticides (PPh) by 75% through various measures within a defined crop rotation, with a maximum yield reduction of 10%.	www.pestired.ch
Veldleeuwerik	The Netherlands	To help arable farming become more sustainable along the lines of a certification scheme	
PPS Groen	The Netherlands	1) to develop (green) cropping systems that reduce dependency on agrochemicals, 2) to integrate existing building blocks in such systems, 3) to develop IPM building blocks that address pressing issues, and 4) to test and evaluate performance of such cropping system.	https://www.wur.nl/nl/project/PPS-GROEN-Publiek-Privaat-Samenwerkingsproject-Gewasbescherming-Robuust-Optimaal-Economisch-Natuurlijk-.htm

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Name	Country	Case objective	Additional info
LEAF	UK	To work with farmers, the food industry, scientists and consumers, to inspire and enable sustainable farming that is prosperous, enriches the environment and engages local communities.	https://leafuk.org/
AHDB	UK	To improve the performance on a real farm by setting goals, recording progress, benchmarking, sharing information and ideas, adopting new systems and techniques, having a market led approach, ensuring knowledge transfer to the wider community, enhancing the natural environment and developing people.	https://ahdb.org.uk/farm-excellence

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3. IPM approaches

Highlights

1. Although IPM by definition is an integration of a set of principles and practices to manage pests, diseases and weeds and all principles are addressed by the cases, IPM keeps being interpreted by farmers as a 'toolbox' from which they can pick single 'tools'.
2. IPM*WORKS* aims for the implementation of a holistic IPM. This may imply the redesign of cropping systems.
3. Multiple barriers for the adoption of a holistic IPM were identified and from those recommendations for the project arise.
4. Research and demonstration need to focus on what holistic IPM actually is, and show the links between the IPM principles, while taking the economic aspects into account.
5. Stakeholders can influence the attitude and behaviour of farmers, so it may be important to include them in the networks.
6. Incentives to enhance adoption need to be adjusted to the socio-psychological and the economic aspects of IPM adoption.
7. Incentives to enhance adoption need to be adjusted to the economic and the socio-psychological aspects of IPM adoption.

3.1. Definition of IPM

3.1.1. Current definitions of IPM

IPM (Integrated Pest Management) was introduced by Stern (1959), as a combination of chemical and biological control methods, taking economic damage tresholds to the crop into account. Nowadays, IPM is defined as the management of pests, pathogens and weeds based on agro-ecology and a system approach that aims at contributing to sustainable, resilient, profitable and robust farming systems (Wijnands et al., 2018). IPM is based on a diversity of management measures that can be summarized in 8 principles: (1) Prevention and suppression of pests, diseases and weeds; (2) Monitoring of both pests, diseases and weeds and beneficial organisms; (3) Decision based on monitoring and thresholds, potentially using decision support or warning systems; (4) Non-chemical control methods, i.e. physical or biological methods; (5) Pesticide selection as to minimise impact on human health, the environment, and biological regulation of pests; (6) Reduced pesticide use by e.g. reducing doses, application frequency, or partial application; (7) Anti-resistance strategies; (8) Evaluation of the applied crop protection measures (Barzman et al., 2015; EC, n.d.). These measures should be combined at the farm level to enable reduced reliance on chemical plant protection products (PPPs), and therefore a decrease in the exposure of the environment and people to PPPs. However, the majority of European farmers still have not adopted such a holistic approach on IPM so far. They either still rely heavily on chemical PPPs or seem to have adopted single measures without actually integrating them.

3.1.2. IPM in IPM*WORKS*

Rather than focusing on the relatively highly adopted single measure IPM , this project focusses on *holistic IPM*, which is based on a combination of alternative approaches and techniques all contributing to pest, disease and weed management. Often the efficacy/efficiency of each single alternative method is lower than for chemical PPPs (when pest biotypes are not resistant). Hence a decrease in reliance on PPPs requires combining several methods within IPM strategies designed at the cropping or even the farming system level. The aim of IPM*WORKS* is to demonstrate that holistic IPM is an economically viable and an equally, or more, successful alternative for the use of chemical PPPs.

3.2. Barriers for holistic IPM approaches in literature

3.2.1. Context

Legislation

Legislation can be conducive or counteracting for the learning objectives of the IPM demo networks. Directive 2009/128/EC on the Sustainable Use of Pesticides (SUD), is conducive, as it promotes IPM as a strategy to reduce PPP use. Following this Directive, EU Member States drafted national action plans (NAPs), in which they show how they will comply with the SUD. Each member state may thus have a different approach in how it will stimulate the reduction of PPP use and how it interprets IPM. Anyhow, compliance with IPM principles is mandatory for all professional PPP users in the EU since January 2014. However, specific legislation may be counteracting IPM, for example compulsory treatments against invasive pests can be adverse for beneficial insects (Tairraz, 2020). Moreover, also other legislation might negatively impact IPM

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adoption. For example the legislation on nitrate vulnerable zones was found counterproductive to best practices in weed management in France (Tairraz, 2020).

Dynamics in the AKIS/ecosystem

Farmers will be more motivated to implement and adopt holistic IPM, if they can **see the effects of the strategies and approaches suggested**. This means training/demonstration need to go on as long as the strategy would take in practice, i.e. at least season-long (Papp Komáromi et al., 2010a). As for some pests or diseases a long crop rotation is one of the most effective preventive measures (e.g. against rootworms in maize) (Meissle et al., 2011; Kemper et al., 2021), **long-term demonstration** may be needed.

Wijnands et al. (2014) postulate that **stakeholders can influence the attitude and behaviour of farmers**, either directly because they are visitors on the farm such as advisors and commercial employees from suppliers and/or collecting industries, or indirectly because they deal and communicate with the agricultural sector and put the wider market and societal context into perspective.

Some examples of the influence of stakeholders on IPM adoption:

- Resistant cultivars are sometimes not planted because of demands from consumers or processors (who for example may not be equipped to sort mixtures of crops when crop diversification is applied) (Tairraz 2020).
- It is in the interest of cooperatives and traders that each farmer maximizes yield (to maximize trading volumes and profits). Therefore, they provide advice tending to maximize yields (productive cultivars, early sowings, high fertilization), which increases pest pressure and requires high amounts of pesticides. However, this does not necessarily meet the interests of farmers, who can make the same profits with moderate yields and moderate input costs (Lechenet et al., 2017).
- the surrounding landscape might impact the spread of diseases (Tairraz 2020), which might advocate for a collaboration with organizations working on landscape level. Such open multi-actor networks thus also aim to stimulate a good cooperation between stakeholders and stimulate the adoption and long-term durability of efficient strategies.
- Including stakeholders from the upstream food chain in the networks could be a major lever to break down barriers to the use of products from IPM farming (Tairraz, 2020)
- by increasing the awareness on PPP use and IPM among different actors types, better mutual understanding of different perspectives can be obtained, and a reduced occurrence of unexpected resistance can be expected.
- A good understanding with the neighbours can be beneficial for the implementation of IPM strategies. For example, Tairraz (2020) noted that abandoned neighbouring vineyards were a source of black rot contamination and that neighbouring fruit growers did not collaborate in mating disruption practices, which limited the success of the IPM strategy.
- Further, also citizens are able to hinder the implementation of specific measure. For example, Tairraz (2020) reports on a methanisation project, that allowed the diversification of (cover)crops, that was blocked by local residents.

The influence of stakeholders should be taken into account when the network is composed (see chapter 5).

Dynamics in the farmer community

There might be a difference in awareness or attitude of farmers towards IPM, depending on the **sector**. In fruit and greenhouse horticulture sector, for example, the IPM concept was already introduced decades ago (Boller et al., 2006), which results in a higher awareness of growers regarding the benefits of IPM compared to other sectors (Wustenberghs et al., 2016).

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3.2.2. Socio-psychological aspects of farmers' IPM adoption

Despotović et al (2019) analyzed farmers' intentions to adopt IPM practices in Serbia, using the Theory of Planned Behavior. They found that **attitudes, subjective norms, and perceived behavioral control**, together with farm size, explain 49% of farmers' intentions to adopt integrated pest management practices. Whereas farmers' environmental knowledge, education level and the use of extension services did not play a significant role. In a similar study in Greece Damalas (2021) found found that attitudes, subjective norms, and perceived behavioral control were significant predictors of intention, capturing 54.7% of the variation in farmers' intention to reduce PPP use. Moreover, 58.2% of the farmers had high levels of perceived **risk of loss** by the reduction of PPP use, which explained 37.3% of farmers' intention. Poor control of PPP reduction (high-perceived barriers) and high perceived risk of loss drive farmers' intention to reduce the use of PPPs. Both authors conclude that incentives to enhance adoption need to be adjusted to the socio-psychological and the economic aspects of IPM adoption.

3.2.3. Holistic approaches

Papp Komaromi et al. (2010a) state that farmers should consider IPM as an holistic approach rather than as a 'toolbox'. In his evaluation of the Écophyto-DEPHY networks, Tairraz (2020) detected many barriers that suggest that many farmers (and perhaps even advisors?) in the network have still only 'taken a few tools from the toolbox', instead of adopting a holistic IPM. He questions whether the Écophyto plan (the French NAP), by focusing on the reduction of plant protection products, would not encourage efficiency and substitution strategies at the expense of a **redesign of cropping systems**, which are better able to respond to the agro-ecological transition (Hill and MacRae, 1995).

3.3. IPM approaches in the interviews

3.3.1. Learning and adopting IPM approaches

The cases were asked about the IPM methods, measures and techniques that are addressed in their farmer networks. All 8 IPM principles (Barzman *et al.*, 2015) were addressed in the cases: preventive cropping system, monitoring, long term decision making strategies, combination of non-chemical methods; such as biological agents and products, using specific PPPs, reducing doses and applications, addressing PPP resistance through different modes of action, and recording the effectiveness of measures taken. However, the principles most mentioned are preventive cropping systems, functional biodiversity and ecological infrastructures. How to use PPP's and their link with resistance seems to be less integrated in the pest management approaches of the cases studied.

Multiple cases mention the importance to **work towards a holistic and integrated view on pest management**, linked to whole crop cycles, cropping systems or farm management. However, no explicit examples were found that link all the IPM principles to examples of crop cycles, cropping systems or farm managements. Also no cases mention techniques or templates on how to show, visualise or schematise the links between the IPM practices, cropping systems and concrete farm management techniques. Except for LEAF and Veldleeuwerik, who mention a survey and indicators to monitor advancements in IPM and farm management and cases like DEPHY and AgriLink who mention on-farm testimonies of farmers who give a tour on the whole farm and explain their decisions.
In the validation workshop there was also a discussion on whether to explicitly define IPM as holistic and what this could mean. There it was stated that the IPM principles are not sufficiently developed to show how they should be integrated and address systemic aspects of farming.

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Further, most cases mention the importance to **start from the farmer's needs, concrete problems and the barriers they perceive** to the application of a IPM approach. A number of barriers were highlighted by interviewees in terms of adoption of IPM practices. These included:

Barriers regarding context:

- Market requirements: The implementation of IPM can be hindered due to market requirements (e.g. harvest date or availability of choice of variety and choice of PPPs).
- Broader economic pressures: A major hindering factor is the ease of using PPPs and their relatively low cost, and the economic power of the chemical pest control industry, and indeed the economic and advisor power more generally of the whole chain that buys the agricultural products. Many solutions in IPM (like biological control) or agroecological solutions cannot be patented, so the commercial margins are small or inexistent, so there is little budget for investigation, marketing, etc. Retailers may also demand certain specific varieties which are less suitable for IPM or they will not accept certain microorganism and PPP's residues, which depending on the crops can be both a driver for more and less use of PPPs.

Barriers regarding research/demonstration:

- Long timescale for effective actions: preventive measures often require a long time scale, it often takes longer than a project duration before the effects are evident.
- Lack of evidence/advice on IPM: There is a lack of awareness of current legislation and of all the tools, materials, techniques, and technologies available to farmers. In addition, there is still a lack of hard evidence that IPM works.

Barriers at farmer level:

- Lack of capacity (expertise, time, money, etc) of farmers: The workload associated with IPM (e.g. mechanical weed control, intensive monitoring, etc) can be a significant obstacle for farmers, as can be the investment in additional machinery, or high costs derived from certain techniques, strategies or production losses.
- Farmer perceptions, values and risk aversion: A farmer's point of view on IPM can be strongly influenced by his/her personal opinion (knowledge and beliefs towards IPM), his/her approach towards crop management and crop certifications, and the perception/pressure of peers. In addition, IPM involves risks (financial, yield, agronomic risks) that can make farmers hesitant. Important to this point is the trust in advisers.
- The barriers are generally psychological ones: fear of change and a lot of stress linked to taking risks.

First, these barriers confirm it may be important for IPM*WORKS* to involve stakeholders, like retailers and policy makers, to be able to address the barriers in recommendations and proposed solutions.

Second, the cases suggest that it is very dependent on the experience of the advisor/facilitator, whether these needs, problems and barriers can be redefined in topics that link to the IPM principles and farm management, to get a more global reflexion on one's own situation. This means that there are currently in IPM*WORKS* no guidelines or examples available to help the hub coaches to translate and picture the farmers needs in a holistic and integrated vision on pest management (IPM), which makes it hard to address the farmers needs with holistic approaches, rather than single step solutions. Also on how to address more personal barriers there is a lack on guidance how to address these in the hubs and activities. In a further stage this implicates that it is hard to imagine learning activities that work towards these more holistic approaches, except for the above mentioned surveys and farm tours.
In the validation workshop it was noted that it is not clear yet which needs and barriers could be addressed with learning and which ones are bottlenecks that for example policy should address.

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Also specificly on the socio-psychological barriers like perceptions, values and risk aversion the cases mention that advisors and facilitators should be aware of and anticipate on these, but how they should do this is less clear. It could be interesting to **provide motivational strategies or other ways to address these emotions in a constructive way in the hubs**.

3.3.2. Good practices for a holistic IPM approach

In the case of PestiRed, a set of general questions is being posed, to indicate which topics should be addressed to get a holistic view on IPM. Their approach on the measures makes it possible to bring in main IPM principles, but still leave room for adaption to the farmers needs and context.

> **PestiRed:** *"One of the main objectives of PestiRed is to create new practical knowledge that can be used in the future. By the end of the project, the following questions (learning questions) should be answered:*
>
> - *What alternative, economically justifiable plant protection measures are available for introduction into practice on farms? What effective reduction in the use of chemical PPPs can be achieved on farms with the measures and combinations examined?*
> - *Where do preventive strategies and alternative plant protection measures reach their limits so that chemical PPPs have to be used?*
> - *What are the effects of reducing chemical PPPs on the presence of pest antagonists in crops?*
> - *What is the extent of yield and quality losses and, on this basis, the cost-effectiveness of alternative measures? What is the acceptance by farmers?*
> - *Can the measures be recommended for farms throughout Switzerland? Can/should they be promoted by agricultural policy? Where are the limits?*
> - *What are the advisory requirements? What are the corresponding costs?*
>
> *The focus is on prevention measures. They have identified 24 potential measures that farmers can adopt. […] Not all farmers need to adopt all measures: there are **five basic measures and then farmers can choose to add more**. The design of the project relies on an innovation field and a standard field of around one hectare each. The farmers commit to using the same rotation on each field for a duration of 6 years, and to apply the new measures on the innovation field, and keep their business as usual on the standard field."*

The project thus offers a 'toolbox' from which not all tools need to be used, but they do need to be used in an integrated way.

In the NEFERTITI case, the problem and context was more specified and 'holistic' means a very specific combination of measures. So wheras PestiRed works more with general principles and a broad range of measures, NEFERTITI already defines a very specific integration of pest measures.

> **NEFERTITI:** *"Holistic approaches can be more difficult to appreciate at first because of their complexity; sometimes, there are specific mechanisms that are still unclear from a purely scientific point of view, yet we know - from empirical evidences tested in commercial greenhouses -that they work under commercial conditions. **Farmers who have already adopted and tested these holistic approaches, hold the best arguments to convince others to use them**. For example, we have extensively worked on the biological control of Tuta absoluta, via the detection and enhancement of a native wasp parasitoid (Necremnus tutae) which enters tomato greenhouses spontaneously. Detecting the presence of the wasp, and understanding its biology is a fundamental key towards controlling the pest, but not enough. Certain changes in the cultural management of the crop have to be made in order to boost*

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the parasitoid activity and successfully control the pest (e.g. reducing/stopping insecticide spraying, planting flowering plants in the greenhouse, using pheromone traps to reduce T. absoluta reproduction). … The biological control of Tuta absoluta was conducted via demonstration events in which ***we shared a combination of tools integrated in a protocol****. Some of these tools were: using sex pheromones for mating disruption of the pest, releasing predators (Nesidiocoris tenuis) and egg parasitoids (Trichogramma achaeae), using sticky black traps and light traps to reduce adult population, and especially learning to attract and recognise the wasp parasitoid Necremnus tutae, by planting auxiliary flora (e.g. Lobularia maritima) and avoiding any unnecessary and/or toxic treatment."* https://www.youtube.com/watch?v=3REA4d0D9Hw

The experiences of these two networks illustrate that a holistic approach to IPM at least requires to integrate multiple tools from the IPM 'toolbox', whereas an integrated protocol, combining several tools, moves into the direction of redesigning the cropping system.

3.1. Reflection and conclusion

Although IPM by definition is an integration of a set of principles and practices to manage pests, diseases and weeds, the majority of European farmers still have not adopted such a holistic approach on IPM so far. They either still rely heavily on chemical PPPs or seem to have adopted single measures without actually integrating them. Rather than considering IPM as a 'toolbox' from which single 'tools' can be picked, farmers should consider IPM as an holistic approach to their farm system. IPMWORKS, focusses on this holistic IPM and aims to demonstrate that holistic IPM is an economically viable and an equally, or more, successful alternative for the use of chemical PPPs. Previous experiences indicate that this may imply the redesign of cropping systems.

In our interviews, we found multiple cases mentioning the importance to work towards a holistic view on pest management, however they rarely have techniques or templates available to show, visualise or schematise the links between the IPM practices. The few cases that do actually integrate implement protocols for combining several 'tools' and move into the direction of redesigning the cropping system.

The validation workshop confirmed that IPM is about building resilient cropping systems and that the current systems have been built on the fact that PPPs are available 'to fix the system failures'. They discussed on whether to explicitly define IPM as holistic and what this could mean. It was stated that the IPM principles are not sufficiently developed to show how they should be integrated and address systemic aspects of farming. This may be a challenge for IPMWORKS, taking into account that since the SUD and the accompanying NAPs, IPM has also become a legal instrument.

For concrete action, the interviewees stressed the importance to start from the farmer's needs, concrete problems and the barriers they perceive to the application of IPM. At the farm level, multiple barriers for the adoption of a holistic IPM were identified, as well in literature, as in the case interviews and the validation workshop. These barriers arise (1) from research and demonstration, which often are insufficiently long term or even lack evidence on the efficiency of holistic IPM; (2) from the context that farmers are working in, with other legislation than the SUD, market requirements and broader economic pressure, i.e. from the stakeholders around the farmers; (3) from the farmer themselves, who sometimes lack the necessary capacities, but also show high levels of perceived risk of loss by the reduction of PPP use and attitudes, subjective norms, and perceived behavioural control that do not favour the adoption of holistic IPM.

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Three recommendations for IPMWORKS follow from these barriers: (1) Research and demonstration need to focus on what holistic IPM actually is, and show the links between the IPM principles. Long-term demonstration are needed to show evidence that IPM does WORK. From an agronomic point of view, it makes sense to build hubs for the long-term, maybe even beyond the project duration. The hubs should also take the economic aspects of redesigning a holistic IPM system into account. (2) Stakeholders can influence the attitude and behaviour of farmers, so it may be important to include them in the networks. (3) Incentives to enhance adoption need to be adjusted to the economic and the socio-psychological aspects of IPM adoption and these aspects need to be taken into account when building hubs. It could be interesting to provide motivational strategies or other ways to address these aspects in a constructive way in the hubs. The coming tasks in WP1 will need to provide support to the hub coaches on how to recognise these barriers in their context and on how to link to learning activities to overcome these barriers.

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4. Objectives of the networks

Highlights

1. Both individual learning objectives of the farmers related to their own context as well as hub (group) objectives should be set.
2. Objectives can be focused on the reduction of PPPs, on the adoption of specific measures, on research and development of new knowledge and techniques, on dissemination, on the network functioning, competency development.
3. Hub coaches might need some support in how to develop group objectives based on individual interests and how to translate it into a program of learning activities.
4. Farmers must get involved from the start in the development of learning questions and objectives. This will increase their ownership of the hub activities, and make sure it links to their own individual objectives.
5. To allow for a holistic understanding of the system and practices, the performance of season-long training in the field and the connection to other objectives of farmers, the economic impact and the legal framing of practices is advisable.

4.1. Good practices from literature

In IPM*WORKS*, an emphasis lies on a holistic approach involving the entire farm as basic unit and not just one plot of the farm (similar to Wijnands *et al*. (2014). However, some exceptional field strip trials can be set up for comparison reasons. According to Papp Komaromi *et al.* (2010b), farmers will be more motivated to implement and adopt innovative and sustainable pest control strategies if they have a sound understanding of the agro-ecosystem and if they see the promising effects of the IPM strategies and approaches suggested. This means training has to be season-long and conducted in the field.

The mere focus on reduction of plant protection products could encourage efficiency and substitution strategies at the expense of a redesign of cropping systems. However, according to Hill and MacRae (1995), those redesigned cropping systems are better able to respond to the agro-ecological transition (Tairraz,2020). This stresses the importance of a holistic approach, also taking into account other related objectives. Papp Komaromi *et al.* (2010a) propose that farmers should consider IPM as an approach rather than as a 'toolbox'. The IPM approach considers time (pre-crop, planned crop for the next year) and space (neighbouring fields, surrounding cropped and non-cropped habitats), focuses on prevention and uses chemical controls as a last option (Papp Komaromi *et al.* 2010a).

The importance of a holistic approach is further stressed by the observation that the implementation of new IPM strategies on a farm can have impact on multiple aspects, including the investment costs, yield, work load (e.g. mechanical weeding, scouting for pests, …), changed risks (of productivity loss) (Tairraz, 2020), etc. In Bayot et al. (2011), farmers particularly expressed the need for economic evaluation and legal framing of IPM strategies.

Poulsen and Petersen (2009), state the importance of discussing the goals of the group in the hubs. Indeed, Knowles (1980) and Illeris (2017) (in Cooreman et al, 2020) state that immediate relevance is a determining factor for learning in adult and transformative learning theory. It is important to agree with all members on the goals of the group to have a common understanding of why this group is together and how they would like to meet their objectives (e.g. by agreeing on a curriculum of hub activities (Papp Komáromi et al. 2010b)). The starting point should be the questions farmers want to address, and from this a plan of activities can be constructed (Bayot et al. 2011). Setting such a common goal will highly contribute to the ownership of the participants towards their learning process. In setting this common goal the hub coach has the role of facilitator (Poulsen and Petersen, 2009).

Besides setting a common learning goal and the curriculum of activities, each member will also have to decide on his/her own strategy on how to implement IPM practices on their farm, because context specific characteristics can influence the suitability of IPM strategies. For example, on very clayey soils, small or sloping plots hinder the use of mechanical weeding (Tairraz, 2020).

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4.2. Inspiration from the interviews

4.2.1. Learning and networking objectives

Following are the general and learning objectives that were mentioned in the cases.

- Quantifiable objectives focusing on the **reduction of PPPs**, e.g. reduction of synthetic chemical PPPs by x% (through various measures within a defined cropping system), correlated with a maximum yield reduction of y%. This can also be quantified along the lines of a certification scheme.
- Objectives that focus on the **adoption** of specific pest management practices such as digital solutions, the expansion of a certain practice like stand and pest monitoring or the use of decision support systems. These general objectives can be translated to network objectives that give a very specific function to the networks. For example, a network can also be used to share the risks of testing new approaches.
- **Research and development** objectives that focus on gaining knowledge about the limits and possibilities of preventive and alternative plant protection measures. These are often related to testing and evaluation of (new) methods, techniques and cropping systems on optimisation, adaptation and implementation. This mainly includes planning and follow-up of experiments that are carried out, periodical evaluation of the (phytosanitary) situation and discussion on the results.
- **Dissemination** objectives that focus on showing the possibilities and limitations of IPM under practical conditions. This can be done on for example research stations, demonstration farms that implement and demonstrate IPM, or study days focusing on technical issues, benchmarking techniques and innovations. These activities are directed to other farmers and growers, technicians, consultants and/or the broader public.
- Objectives that relate to **the functioning of a network** or the formation of a group seem to be less frequently defined. They relate to communication, match-making, trust and informality, sharing and exchange, etc.
- Concerning **learning and exchange**, it is possible to define what will be exchanged, e.g. technologies, experiences, techniques, etc. or on how it has to be learnt, e.g. by guiding and mentoring each other. Often, the final objective is adoption of a technology or technique. In some cases the objective is merely limited to just having the exchange of experiences without a clear learning objective.
- **Competency development objectives**, such as building the farmers' autonomy to observe and identify irregularities at their farm and report them in an efficient way so the advisors can make good recommendations based on the observations. Further, farmers can be learned when to solicit for exceptional authorizations for phytosanitary products, and when there is a considerable crop loss due to pests or natural disasters. Regarding the objective of building the farmers' autonomy, the following quote is striking:

  PPS Groen: *"One important other role of the facilitators is to help farmers take charge themselves. They also need to help overcome scepticism among farmers. Plant protection is a field that is and will be changing in terms of what will be legally possible. The facilitator needs to help farmers to respond proactively to that situation, rather than waiting until they are pushed."*

In the cases, developing farmers' autonomy mainly means being able to make decisions based on observations and a systemic reasoning about the farm management and ecology. This often links to decision support tools and systems. Collaborations and social skills are mentioned in the cases, but not in the perspective of how these can enhance farmers' autonomy. The cases do not mention how personal and community capacities can enhance farmer autonomy and how learning could enforce this.

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4.2.2. How to define the (learning) objectives?

INNOSETA: "*At the beginning of the project there was a farmers needs assessment to define the baseline of technology use, adoption rate and willingness to adopt. Workshops need to address these priorities from the beginning. Activities have to be demand driven.*"

Besides the farmers' individual learning objectives, based on their personal interests, it is important to set network objectives.

The cases reported on different ways to define the network objectives. They mention the importance of working demand driven and to take into account the farmers' problems, needs, and lacking competences regarding the adoption of holistic IPM. These specific problems and solutions will show common potential learning objectives amongst the farmer group and specific potential learning objectives for individual farmers. The participation of farmers in this process of defining the objective can be more or less active:

- the objective can be defined rather top-down, e.g., based on policy objectives or projects, but taking into account pre-existing knowledge on the farmers' problems and needs. A way to include farmers in the decision process could be to provide a general framework, with a list of approaches, learning activities, or topics related to the top-down set objectives from which farmers are able to choose from.
- Existing farmer organisations, networks or meetings can be used to define priorities/objectives (potentially related to a specific agronomical context or sector), e.g., informal or formal meetings with groups of farmers, advisors, or at the cooperative level.
- The highest form of bottom-up participation is when farmers are engaged from the start in the design and development of the learning questions, with objectives co-developed by farmers (and if needed the support of an agricultural advisor) or that farmers totally decide their own learning objectives under the guidance of a network facilitator. Also researchers can be involved in this process and can propose their interests for which they want to learn from farmers. This option is much more an open dialogue between the network members. In this way, the objective can also be tailored to the specialisms of farmers and advisors.

In the cases of Ansari, IPM-APU and Viherriski (Finland), the method of 'change laboratories'was used as a way to involve the participants in setting the objectives and defining the required activities for change. This method is based on the Cultural-Historical Activity Theory (Chat) and the theory of expansive learning. The method prescribes 6 different steps that are taken in 6 different facilitated workshops, to come to a holistic problem analysis on landscape level, a common objective and a formulation of personal needs and learning objectives linked to the common objective.

For example, Ansari started from a specific need in Ostrobothia, were Finland has most of its production. , there is a very active seedling producer who was increasing the awareness amongst farmers on how pests spread and which measures companies should take to stop the spreading of pests (viruses and bacteria). The interviewee was invited to give a talk at the workshop with all the growers and propagator. There she realized that IPM in that area cannot be company based, but has to be regionally organised. That was the starting point for Ansari: how do you make a project that approaches plant protection in a network of few farms, at a regional level with all farms?

- **Session 1** starts with a diffused, not delineated, wicked problem, for example, pest spread without a clear responsible. It starts with understanding the problem, a consensus on the fact that there is a problem and afterwards defining the problem. For example, in Ansari, some farmers thought that the others were causing more problems than themselves, which resulted in different willingness to participate in the project. By showing the current situation and how everybody is contributing to the problem, this problem can be tackled. This was done by showing different perspectives on the

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problem, e.g., explaining the symptoms and consequences of the problem, by using photos and citations from interviews, reports, attempts to solve problems, cost tables on managing the pest, etc. By questioning the current situation everybody felt that there was a shared problem. When talking about the problem, it will get enriched with experiences from others.

- **Session 2:** Re-interpret the problem and start to nail down where exactly the contradictions are. The next stage is to analyse the problem and find the contradictions, which are the places for innovation and solutions. Growers were really eager to produce solutions, but it was important to first deeply analyse the situation to get a grasp of the systemic and holistic aspect of the problem. Determine where solutions are needed. Make the problem, the whole (activity) system and evolutions schematically visible. What has happened in the past, what is happening now, how did we get to this, what are the current tools we are working with, how do the solutions look like? Use drawings, tables, graphs, systems, etc. Get distance of the usual way of working by conceptualizing to see things in another way. Produce the model bit by bit.
- **Session 3:** Figure out what should change so that the problem can be handled. Find the necessary elements of the new way of working.
- **Session 4:** Discuss the new model of activity, new roles, how to share information on the pest, etc. Only the year-round growers came to the session. This was a shock and disappointment for them, because they believed it was clear that everybody was in it together. In the session, they took the time to reflect on this unplanned aspect. Year round growers contribute more to the problem, but also were very willing to do something and needed the seasonal growers for this. So they started to recruit the seasonal growers again.
- **Session 5:** New attempt to discuss the new model of activity and translate it in actions where they could experiment with. Also introduction of an IT-based knowledge bank where the growers could feed information in on the pest. But they were less willing to share information of pests in this way with each other. They only wanted to share information directly with their peers. Even cucumber and tomato growers were not that much interested in each other even though they are in the same region and horticultural sector and exchanging the pests.
- One summer was used to do monitoring, because it was needed to know how much pest everybody had. Also some experiments were tested to try some techniques (eg., sticky traps).
- **Session 6:** Discussion of the results of the monitoring and experiments. Monitoring got more adopted by the farmers. There is still need for help to define a threshold of pest, which now is more nominal based on experience of the growers.

> **Ansari:** *"Between the sessions there were conversations with several of the growers who were willing and active. To discuss what to do next in the next session, integrate them in the process."*

4.3. Reflection and conclusion

Translating the IPM*WORKS* objective into a learning objective results in something like: to provide the farmers with the necessary competencies to implement the advanced holistic IPM approach on their farm in the long term. Opposed to "single step IPM" (referring to the adoption of a single measure on the farm), "advanced IPM" requires a redesign of the farming system to include a combination of preventive and non-chemical measures with a holistic view on all available components of IPM (Annex I, project proposal). Such a redesign of the farming system requires a farm-specific strategy that is tailored to each farm separately, and requires the combination of local and expert knowledge. This requires a learning approach and curriculum that goes further than teaching a specific IPM measure, and empowers the farmers with the competencies needed to implement advanced IPM approaches on the long term. Thus, the aim is to focus on the capacity building of the farmer to decide which IPM practices are best suited for their farm. Therefore,

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a hub should not be based on the testing of a given IPM-based technological solution (or of a given combination of solutions) on a range of farm sites, but it should give each involved farmer the opportunity to build his/her own strategy, most appropriate to the local context.

The final aim of the project is adoption of holistic IPM, but therefore learning (new skills, knowledge, how to implement the learnings on the farm, etc.) by the farmers is needed. Besides setting a common learning goal and the curriculum of activities, each member will also have to decide on his/her own strategy on how to implement IPM practices on their farm, because context specific characteristics can influence the suitability of IPM strategies.

Literature stresses the importance of setting common hub objectives, through a group discussion. During the validation workshop it was mentioned that for a hub coach to facilitate this process, it is important that he/she knows every farm/er involved (cropping system, aim of the farm, pest issues, etc.). The surveys developed in WP5 of IPM*WORKS* will be very usefull tools for this. The involvement of the farmers in the common goal setting, also contributes to their engagement in the activities. Setting common hub objectives might be challenging for the hub coaches, as they might not be familiar with the process of doing so. During the validation workshop, IPM*WORKS* hub coaches questioned how individual farmer interests could be translated in common learning objectives and demo activities. They mentioned that support for the hub coaches on this account would be very welcome. This is a task that could be taken up by WP1 and 2 related to the trainings and guidelines of the hub journal, in which the hub objectives will have to be reported. During the validation workshop it was suggested to introduce tools, such as the dynamic learning agenda to support hub coaches in tracking the progress of short term goals in function of the pre-set long-term learning objectives together with the farmers.

When setting the learning programme based on the objective, the advice is to do the training season-long and conducted in the field, to allow for gaining insights in the whole system. Also taking into account related objectives of farmers, the economic evaluation and legal framing in the learning activities would contribute to learn the holistic approach.

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5. Decisions for network creation

Highlights

1. The decision on farmer characteristics for farmer participation highly depends on the objective of the network. Examples of characteristic on which decisions can be taken are the sector, production systems, geography, age, attitude, specific skills, experience with a specific practice. Consider that a choice for a specific characteristic might impact your activities (e.g. chosing for a representative sample of farmers might inhibit peer-to-peer exchanges because of huge travel distances). IPM*WORKS* aims for a mix of advanced farmers for inspiration, and less advanced farmers who can proof that changing their practices is possible.
2. Target farmers with an interest to experiment, exchange, and willingness to change their practices.
3. The involvement of stakeholder is highly recommended by other cases as they can contribute to an attitude and behaviour change of farmers, the sustainability of the network, the tailoring of solutions to the local context and landscape, and increasing the impact. The decision on which stakeholders to involve and their degree of involvement in the network will depend on the network objectives. And potential conflicts should be bared in mind.
4. Networks create opportunities to bring farmers into contact with other actors they would normally not meet, e.g., foreign farmers through cross visits, policy makers or other actors in the agri-food chain. Create and facilitate attractive opportunities for interaction between different actors, actively forging connections, discussion, exchange, etc. when needed. Consider for different actors what would make engaging relevant and interesting for them and cater to that.
5. Develop appropriate connectivity with relevant other initiatives, programmes, and organisations to increase the opportunity for network sustainability beyong temporary funding. Build a good reputation and visibility so that people will want to connect to you.

5.1. Literature on network characteristics

Based on literature, a distinction can be made between a farmers' "closed network" and "open network" (Cofré-Bravo *et al*., 2019). A farmers' **closed network** is comprised of peers, neighbours, friends and family (the farmers' inner circle of confidents) and provides the trust and cooperative relationships which are needed to successfully implement and exploit innovations. The new demonstration farm hubs set up in IPM*WORKS* could be interpreted as a closed network of the participating farmers.

A farmers' **open network** exists of extension officers, advisors, agri-business enterprises, consumers, and policy makers. All these actor types have a stake in the reduction of PPP use or IPM implementation and they provide the knowledge and resources to explore innovation options by providing links to the right knowledge and by generating the right innovation context. They can bring in expertise, new insights, or new issues to the farmers. Literature (Tairraz, 2020; Wijnands *et al.*, 2014) stresses the importance of involving these stakeholders from the open network in the hubs. For example, Telen met Toekomst (Wijnands *et al.*, 2014) became a bigger success when these stakeholders were actively involved in the initiative. Based on the pre-set goals of the hub, stakeholders can be invited as expert to some of the hub meetings, to demonstration events for wider audiences, or to co-create solutions for given problems (Wijnands *et al*. 2014). Further, they can also play an important role in the communication and dissemination of the (outcomes of the) hub activities (Wijnands *et al*. 2014). However, mobilising stakeholders requires some stakeholder management, to align interests, let stakeholders reflect on their positions and find scenarios for collaboration.

Wijnands *et al*. (2014) point that the support of stakeholders in the agricultural community is essential to create momentum and ambition among farmers to adopt IPM strategies. They posit that stakeholders can influence the attitude and behaviour of farmers, either directly because they are visitors on the farm such as advisors and commercial employees from suppliers and/or collecting industries, or indirectly because they deal and communicate with the agricultural sector and put the wider market and societal context into perspective.

5.2. Inspiration from the interviews

5.2.1. Which farmer types to involve

Veldleeuwerik: *"One of the strengths of the initiative was that participating farmers were a mix of differently oriented farmers. So they were surely not all frontrunners. That mix provides a fertile ground for exchanges within groups."*

The following farmer characteristics can be considered when making decisions on which type of farmers to involve:

- **General characteristics (e.g., commercial, experimental, or other; full-time/part-time; diverse or rather similar farm types)**
  Almost always, commercial farms are involved. We see that some cases are quite particular about who to involve and not, and some have a large variety of farms involved (e.g., NEFERTITI, and FABulous farmers where the group is as diverse as including organic vegetables, intensive cattle, arable land, and fruit cultivation). Having a diversity of farm types involved was considered by those initiatives as positive since there are more cross-fertilization opportunities. In AgriLink, the majority of the farmers are full-time farmers, but there are also part-time farmers with additional jobs. Other cases do not specify this, but it may be a relevant factor to consider as it may relate to different types of farm management as well as different interests as well.

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- **Farm size (e.g., small, medium, large)**
  Farm size is often not mentioned as one of the criteria for involvement, but INNOSETA was looking for all types of farmers, but specifically "small and medium" farmers.

- **Farming approach (e.g., organic, conventional, etc.)**
  There is a difference between the cases regarding the choice to involve organic (or agroecological) farms. In some, they are deliberately not involved where the focus is on conventional farms. But if they are involved (e.g. in DEPHY Ferme, FABulous farmers), they are usually a minority among farms involved. In some cases, e.g., INNOSETA, organic farmers were not involved because the focus was on phytosanitary products and organic farmers do not use the ones promoted. Some cases (e.g. PPS Groen) deliberately chose not to involve organic farms who often already adopt IPM practices, because they feared they would initimidate the farmers that they wanted to stimulate to change their practices towards IPM. On contrary, in NEFERTITI, the interviewee thought that it is good to involve at least one frontrunner farmer who can inspire the others. So it depends on what role they would play in the group, and also how that would affect the group dynamic. This may work well in one place and not in another.

GIEE: *"The majority of farmers that developed GIEE were already in an agroecological transition, so could be considered frontrunners, but now there is a top-down push to encourage more conventional farmers. The GIEE does include organic farmers, but also farmers from other sectors etc."*

- **Sector (e.g., particular crops)**
  Only some of the initiatives focused on farmers producing particular crops, such as AHDB that focused on cereals and oilseeds.

- **Production systems (e.g., field crops, greenhouse, etc.)**

- **Geography/topography (e.g., location, soil type, etc.)**
  In the case of German IPM demofarms, the issue of representativeness vs. proximity played a role. Their main purpose was to inform policy making, hence a representative population for Germany was needed. This had as a trade off that it was not always easy to form farmer groups for peer to peer exchanges that were located relatively close to each other. This example shows that the trade-offs in deciding about the selection criteria, need to be considered in terms of their implications for the main objectives and, for example, the potential for peer-to-peer exchange.

- **Age group (e.g., not specifically defined, or specifically focusing on young farmers)**
  In SmartAKIS, since the majority of farmers in Serbia are older and considered "very traditional" and difficult to persuade to change practices, they chose to target younger farmers. This focus grew through the project.

- **Attitude (e.g., willingness to learn, being interested to experiment, etc.)**
  A characteristic of farmers that basically all initiatives want to see in their participants was an interest to experiment (specifically to reduce use of PPPs, such as in the case of PestiRed) and to learn about new ways of farming. That is not easy to control, particularly not if candidate participants have external motives for participating (e.g. financial). AgriLink therefore considered themselves "*lucky with the specific community involved, because they are very open and sincere. They show themselves open to sharing their opinions, victories, and hardship, and communicate with the community*". And AHDB Farm Excellence was looking for farmers that are open-minded and innovators.
  Readiness to change was found by most initiatives to be something that they would prefer to see in all participating farmers, but in reality not all participants will be able to make significant changes in the end. As DEPHY Ferme shared: *"Farmer types are heterogeneous: some are receptive, sensitized and have changed their technical operation (e.g., low input rapeseed, rustic wheat species), for some it is more difficult to change. There are some steps in the evolution of*

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IPM understanding by farmers. Some can't even recognize the pests and diseases, and are not really observers."

- **Specific skills or competences (e.g., having experience with digitalisation)**
  In the case of Smart agrihubs in Greece, farms that participate in the project have previous experience in digitalisation because of the specific focus of the initiative.
- **Experience with the practice discussed (e.g., frontrunners, …, laggards)**

Regarding who decides about which farmers will be involved in the group, there is quite a lot of difference between the cases. In PestiRed, for example, farmers selected were identified and contacted by existing structures, in this case extension workers in each canton who knew the farms well and were well known by farmers. In the German IPM Demofarms, the choice was made in similar ways. But in other cases, such as LEAF, farmers need to apply themselves, and pay a fee, and not the other way around. Only, if farmers request specific benefits from LEAF (e.g. certification), they have to meet specific requirements.

> **LEAF:** *"LEAF UK is a bit of a special case with an extensive setup, network, and long history. It involves innovation centres (research farms), demonstration farms (frontrunners), and commercial farms (those with the ambition to catch up with frontrunners, and/or becoming a Marque certified farm). This offers a variety of choices regarding levels of intensity of participation. Participation is by choice (membership fees apply). So some can warm up to becoming more engaged and do not have to become full-blown (certified) LEAF Marque farms or even demonstration farms from the beginning."*

What did not become clear from the interviews, is the extent to which there was a systematic (and strict) application of criteria, or a more loosely organised process. That also relates to the extent to which it was easy or difficult to engage farmers. Being too strict could lead to having too small hubs/networks, or not attracting a particular type of farmers that one would actually want to have as part of the group. So choices regarding those invited to the hubs will often involve striking a balance between preferred specific criteria (wish list) and the realities of who is interested in participating anyway.

In conclusion, this section shows that the decision on criteria for farmer participation highly depends on the objective of the network. In some cases, trade-offs will have to be taken into account (e.g., representativity vs. ability for frequent peer-to-peer exchanges). The inclusion of farmers with an interest to experiment, exchange, and willingness to change their practices are highly favourable for a successful IPM demo network.

5.2.2. Which other actor types to involve

> **Veldleeuwerik**: *"Somehow you need to connect to initiatives that address systemic lock-in situations such as related to prices paid for farm products, and consumer demand. IPMWORKS needs to connect to initiatives that address such dimensions of the wider food system because that will for a large part define the space for manoeuvre of farmers to apply IPM. This also relates to how farmers are approached. Veldleeuwerik was insufficiently connected to relevant parties in the sector. This in the end turned out to have made them vulnerable as well."*

A first important choice relates to the involvement of research farms. Networks are often, but not always, linked to a research farm. In the case of COEXPHAL-Cajamar the central point is the Experimental Station of CAJAMAR, and only occasionally field visits are organised to commercial farms where there is something interesting to see. The Experimental Station is meant to test and de-risk solutions for farmers, transferring

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their results to the commercial farms. In contrary, in AgriLink and Veldleeuwerik, research farms were not directly involved.

A common actor configuration in the cases is a combinations of farmers, extension workers, scientists, and commercial technical advisors, etc. (e.g. in PestiRed, AgriLink, COEXPHAL). One may say that these initiatives are more oriented towards the agronomic/cropping system side of IPM practice. Initiatives approaching IPM in a more integrated way, will tend to connect to wider societal actors as well, including value chain actors and government (policy). Initiatives such as AgriLink may, however, connect to consumers, institutional agents or industry when analyzing the governance of farm advisory systems. And AHDB does seek to involve other actors than farmers and research institutions, but numbers involved from other actor groups are low and often in more passive ways, e.g. by receiving information only (similar to the experience of NEFERTITI-Spain). This is a challenge for many initiatives.

Other cases mentioned other collaborations. Veldleeuwerik was based on a collaboration of farmers, buyers, and processing industry. The public sector was not directly involved. FABulous farmers involved 5 partners in Belgium: Boerennatuur (farmers organization, advisory, project lead), ILVO (research institute, network management and communication), Biobest (producer organic pest control products, monitoring, advisory), VLM (government, subsidies management agreement), Hooibeekhoeve (experimental farm).

As for the German IPM demofarms, farmers, advisors, researchers, plant protection services were the more directly involved actors, while policy makers were only a target group for dissemination, and consumers/citizens and school classes were guests at open farm days. FABulous farmers connects to, for example, breweries (who use the grain), to governmental policy departments (to share experiences and advice), and to local entrepreneurs.

Almost by definition, Smart AKIS in Serbia is following a multi-actor approach in looking for joint definition of innovation projects and initiatives, however, not necessarily involving actors outside the Agricultural Knowledge and Innovation System (AKIS). The experience of GIEE – France illustrates how the choice of which actors to work with also depends on the particular objective for the initiative.

Other actors might also ask for participation in IPM networks because there is a sense of urgency to do so as in the following example:

> **Viherriski-Finland:** *"After the third session there was a beetle coming from China that had spread to a birch forest near Helsinki, which showed that the threat is a real one. This made also wholesalers, who were first not joining the project, start to attend the sessions."*

In conclusion, the interviews do not provide solid conclusions about when and why to involve specific actors. The basic idea is that network facilitators start from the implications of their objectives and decide upon which actors should be involved to increase to potential of reaching the objectives. The cases do show that the (active) involvement of other actors is seen as a challenge for a lot of networks. Initiatives approaching IPM in a more integrated way (with a broader focus than merely the agronomic aspects of IPM), seem to tend to connect to wider societal actors, including value chain actors and government (policy). Further, the involvement of a research farm may differ amongst networks. Although not specifically investigated, one may assume that the presence or not of research farm in the initiative can have an impact on the role/involvement of farmers in the network. The benefits of a research farm are clear, as they provide demonstration options, take away the risk of experiments from farmers, etc. However, not having a research farm involved, increase the farmers' role and engagement for demonstration and exchange, which allows for

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a bigger focus on what is happening on the farms and on the interaction between farmers. In addition, the involvement of a wide range of stakeholders can give more visibility to the network and contribute to the sustainability of the network.

5.2.3. The multi-stakeholder interactions

> **Veldleeuwerik:** *"Private sector partners [i.e., commercial companies in the agrifood chain] were very much involved, and were the main funders of the initiative. Special excursions were organised to factories for farmers as more of a social event. That was good for the group feeling as well. Unfortunately, in the end the private sector partners one by one pulled out and that was the end of Veldleeuwerik. A learning point from this experience may be that reliance on just private sector support may not suffice. On hindsight, Veldleeuwerik should have become a broader movement of the arable farming sector than it was."*

The intensity and breadth of multi-stakeholder interaction differed among the cases. In some, this would be more occasional and in the form of visits. Other cases paid more attention to creating opportunities for dialogue and exchange between different actor groups. A number of cases (e.g., INNOSETA and Veldleeuwerik) mention the rather unique opportunities that the initiative offered to connect farmers to supply chain partners (e.g. manufacturers) and/or farmers from other countries. That is something that is highly appreciated and something that will hardly take place outside these kind of initiatives. The Pestired case suggests that opportunities for dialogue and exchange are the key to a successful approach. In the experience of PPS Groen, most of the various actors involved will participate in, for example, field days, webinars, or lectures on specific topics.

Involvement and role of product buyers

However, it is often a big challenge to get buyers (such as supermarkets) around the table, but they need to help make the financial picture work for farmers (e.g., the price farmers receive for their harvest). The same applies to what supermarkets accept in terms of tolerance of microorganism residues. This can be a bottleneck for farmer decision-making. There is still a perception that IPM involves higher costs for the farmers, and that if IPM is going to be applied much more widely in the Netherlands, something needs to happen to the prices farmers get for their produce. One processing company (Hak) is paying a price premium to growers that reduce the use of PPPs, but so far that is an exception. Behind the buyers are of course the consumers, who will need to be willing to pay higher prices as well. This is also the idea behind the LEAF Marque: growers get certified for being more sustainable and the produce is sold (more expensive) under the LEAF lable. This lock-in of the system is a challenge if IPM is to be applied more widely, but currently the system is not changing. It remains a challenge to actively engage key stakeholders (buyers) that can help to really make a positive difference in making IPM practices (financially) feasible. Veldleeuwerik was very much connected to these actors, but these actors can be opportunistic as well (see quote at the start of this section), and not always truly committed to playing a significant long-term role in making more sustainable farming practice financially feasible. Some interviewees suggested that their interest may be more related to their public profile and not so much related to a genuine desire to play their part in sustainability transitions in agriculture.

Networks offer room for brokerage between actor types

In Smart AKIS in Serbia, an online collaborative area open to farmers, researchers, innovation brokers and companies, willing to find suitable partners for innovative projects and initiatives for the further

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development, transfer or dissemination of Smart Farming solutions will be available. This networking area will be open to farmers, farmer associations and unions, researchers, advisory services, agricultural consultants, innovation brokers, smart farming companies providing specific or integrated solutions, etc.

Role of researchers

PestiRed noted the importance of two types of actors for each farm group for its core activities: the group facilitator (usually the extension worker responsible for the canton), and a technical adviser who made the link with the scientists involved in the project. The interviewee felt that this organisation of the project engaging with scientists, extension workers and farmers was ideal, providing support and links, and encouraging dialogue between these three groups. And within such a setup, initiatives such as AgriLink-Spain highlight the importance of peer-to-peer learning.

Conflict between actors involved

Better Crops (Ireland) mentioned a potential conflict or confusions regarding the advice of some commercial advisors about appropriate crop protection practices, because it is hard to understand whether their motive is research drive or sales driven. They state to be cautious for introducing related double interests. A similar cause for confusion may be the involvement of politicians in, for example, events or a round table. It can help, but also cause unhelpful debate.

Wider impact of the cases

The RAP interviewee (France) noted that farmer members of a group rarely acted as "ambassadors that promote the spirit of IPM outside the different events of the Écophyto network". The same interviewee also highlighted the fact that RAP is only providing one piece of the whole puzzle of the transition towards more sustainable agriculture. So expectations of what can be achieved through the networks, also in terms of connecting actors effectively, need to remain realistic within the perspective of the wider transition process and landscape.

In conclusion, this section mentions the opportunities networks create to bring farmers into contact with other actors that they would normally not meet. These interactions can vary from small visits to structured interactions. The involvement of product buyers is some cases deemed as important to obtain better product prices for farmers who are producing more sustainable. However, there involvement and support in this is seen as a challenge for the networks. A collaboration between researchers, extension workers and farmers was mentioned as being ideal for obtaining successful outcomes. However, networks should bare in mind potential conflicts when involving actors who might also have another agenda (sales or policy) besides offering advice or information.

5.2.4. Decisions related to network sustainability

The experience of PPS Groen points to the need to connect projects that have a similar or at least an overlapping focus on IPM over time. This makes it possible to build up continuity over the years, even though the project itself is finished. People (notably coordinators) play a key role in maintaining such continuity. Continuity is primarily about relationships (among a range of actors) and keeping momentum in these relationships and related decision-making processes.

Similar to the experience of Veldleeuwerik, several cases (including IPM Demo farms in Germany) pointed to the importance of connecting broad enough to other initiatives, projects, and processes. This will also strengthen a basis for continuity beyond a mere project approach.

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LEAF - UK appears to be a good example of creating a long-term institutionalised set of relationships. It has become a well-known key institution in the UK, which is well-supported and widely appreciated. It gives a lot of visibility and credibility in which a wide range of actors want to participate, e.g., such as industry, farmer organisations, cooperatives, processors, suppliers, consumers, civil society, etc. Not being limited to only IPM (but focusing on an integrated farm plan) or any other specific focus also allows for drawing in wider participation and support. It has a history of close to 30 years now. So this is quite different from demo farm networks that are project based only and/or limited to a particular topic. In their experience, *"Farmers deciding to apply IPM has to do with a variety of factors that all need to be addressed. Addressing this variety of factors will require using different tools/methods for engaging farmers, for communication, etc. in combination. For example, it does also involve mindsets that need to be addressed. There needs to be a forum for conversation. It cannot only be about evidencing the financial feasibility. IPM (or in this case Integrated Farm Managent – IFM) needs to be considered in a broader picture of the future of farm management. The advice from this experience is that IPMWORKS would do well to appropriately diversify its ways of engaging with farmers and other actors, and this is not just about the technical/agronomic side of IPM application."*

5.3. Conclusion

Regarding the farmer types to involve, the cases show that the criteria for farmer participation highly depend on the objective of the network. This might involve taking into account some trade-offs (such as geographical representation versus the ability for frequent peer-to-peer exchanges). However, the networks should strive for farmers with an interest to experiment, exchange, and willingness to change their practices to obtain a successful IPM demo network. During the validation workshop it was stressed that in IPM*WORKS*, the aim is not representativity, but rather to have mix of advanced farmers for inspiration, and less advanced farmers who can proof that changing their practices is possible.

Both literature and the cases stress the importance to involve stakeholders (in the value chain, policy, or related projects) in the networks. They can contribute to an attitude and behaviour change of farmers, the sustainability of the network, and the tailoring of solutions to the local context and landscape. Again, the decision on which stakeholders to involve and their degree of involvement in the network will depend on the network objectives. In the cases, the involvement of other actors is seen as a challenge. During the validation workshop, it was also questioned whether the hub coaches in IPM*WORKS* would have the capacity to identify the relevant stakeholders and know how to approach them. The national focal points (NFP), under guidance of WP7 (IPM policy engagement and sustainability strategy), could have an important role of assisting the hubs to connect to these stakeholders. Further, also within the hubs, the farmers can provide suggestions to invite stakeholders related to specific issues they perceive when implementing IPM practices.

Further, the cases mention the opportunities (temporary) networks create to bring farmers into contact with relevant stakeholders and foreign farmers. In IPM*WORKS*, the cross visits will be an important tool for this. It is the ambition to make the farmers in the hubs aware of their participation in a larger European network community. The hubs are also linked to local organisations through the hub coaches, which can contribute to their anchoring in the region and the AKIS around IPM.

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6. Attracting and engaging farmers

Highlights

1. Farmers can be attracted to the initiative by making use of divers types of media, adapted to the target group.
2. Besides a first general introduction of the network, a follow-up activity (e.g., visit to the farmer by the hub coach) to explain more about the objectives and expectations seem to be valuable.
3. For the recruitment process, less known networks tend to personally approach farmers from the own network, but for better know networks free access to everybody can be taken as the main approach. When very specific objectives are set for the network, application and selection procedures can be used.
4. Farmer motivations to participate in a network can vary from instrinsic (e.g. genuine interest to become more sustainable) to extrinsic (e.g., to obtain benefits or because they feel obliged). These motivations can also change during the project. In some cases, primary motivations might be more extrinsic, but when they recognize the value of the project become more intrinsic. It might be interesting to respond to these types of motivations by offering flexibility in the level of engagement for the participants.
5. Important motivations for farmers to join an initiative are: access to new knowledge and experiences, genuine sustainability interests, improving the business case for the farm, getting access to particular funds/subsidies, help improve the image of farming, concerns about toxidity of chemicals, anticipation of new (restrictive) rules and regulations, and loyalty to an organisation or local adviser.
6. Related to the specific objective (e.g., PestiRed requesting a commitment of six years), circumstance, and funding structure of the networks, different approaches can apply. Committment for participation can be based on trust or go as far as signing official contracts and MoU to make the expectations clear. In some cases, participation is compensated by the intiative in various ways (monetary or in-kind) to commit farmers to the network. But in a lot of cases farmers are not paid or even have to pay themselves to benefit from the services of the network.
7. For keeping farmers motivated to engage in the networks, ownership in the planning, being demand-driven and creating group feeling and trust is seen as key.
8. To keep the motivation up during the project it is important to 1) connect as much as possible to farmer interests and questions, and foster ownership by keeping farmers involved in the organization and planning of activities without overloading them, 2) create enough possibilities for (knowledge) exchange and comparison of performance, and 3) support trust and a group feeling by actively fostering the development of social relationship through e.g. informal (social) events and communication (e.g. whatsapp).

6.1. Literature on attracting and engaging farmers

6.1.1. Attracting farmers

Farmers can be attracted to participate in a network through local media, personal invitations, telephone calls, posters (Papp Komaromi et al 2010b). According to Poulsen and Petersen (2009), farmers must have common professional interest, be interested to exchange experiences, and should be willing to change practices (lacking open mindedness or willingness to change are a barrier for IPM adoption). They further posit that farmers should not know each other too closely before starting the group, because it might set the agenda for the rest of the group. According to Tairraz (2020), farmers should be located not too far away from each other. Further, he posits that the level of ambition of the individual farmers should also be balanced. For example, frontrunner farmers sometimes have the feeling that they do not learn much in a group.

6.1.2. Farmer motivations

Knowing the motivation of farmers to participate in IPM demo networks might provide the hub coaches in IPM*WORKS* with some arguments to attract farmers. For example, Tairraz (2020) mentions that certification that valorises the farmer's efforts could work as a lever in vineyards. Further, Tairaz (2020) suggests that to allow for a more complete transition of farms (towards a total redesign of the farm system), it could be interesting to work on a more holistic environmental certification instead of keeping the focus on IPM.

Other examples to stimulate participation of farmers, is to attract them with the promise of dealing with specific topics for discussion, trips, etc. and the invitation of external people or experts (Poulsen and Petersen, 2009).

Triste et al. (2018) found that those characteristics of sustainable farming initiatives that are appropriate to attract farmers, are not necessarily the same as those that successfully maintain persistent participation. As not all farmers immediately recognize the value of participating in a social learning process on IPM, for example, the organisers might need to use incentives to attract farmers who are not yet inherently motivated to participate. Nudges, like rewards (e.g. certificate, extra services offered to them, …) and social pressure (e.g. from processors, retail or neighbours) can help to attract farmers to participate. However, such nudges do not guarantee engaged participation in the activities of the initiative. To increase the engagement and performance of the participating farmers, the initiative should contribute to the satisfaction of farmers' basic psychological needs of autonomy, relatedness and competence. The satisfaction of these basic needs contributes to the farmers' personal endorsement and a feeling of freedom of choice regarding their participation. Such a higher quality motivation is related to more persistent farmer participation and deeper learning. Initiatives can contribute to the satisfaction of these basic needs by offering an environment that is autonomy supportive to increase the farmers' feeling of control and volition of their own behaviour, well-structured to increase the feeling of competence and efficacy in the activities of the initiative, and warm and supportive to increase the feeling of relatedness to important others within the initiative (Ryan and Deci, 2000a; Vansteenkiste, Niemiec and Soenens, 2010; in Triste, 2018). Triste et al. (2018) show that farmer group meetings, in which farmers discuss their plans with peers, and the support for personal goal achievement within the initiative contribute to the satisfaction of all three basic needs. Further, previous sections already mentioned characteristics that contribute to these 3 needs. For example, providing farmers flexibility in the actions that they will take on their farm and the activities that will be organised in the discussion groups contribute to autonomy support. The structured knowledge exchange and being aware of its own contribution in the knowledge creation process contributes to the competence support. Further, frequent interactions and a building of a trustful community feeling contributes to the relatedness support.

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6.1.3. Interaction, hierarchy and social capital

Interaction and hierarchy are relevant both amongst farmers and between the farmers and the other actors (hub coach). Regarding the latter, the input and experiences of farmers should be regarded equally important as the advisors' and researchers' opinions (Papp Komáromi et al. 2010b).

The presence and building of social capital within farmer discussion groups (Farmer field schools) contributes to their successful outcomes (Charatsari *et al*., 2020). According to Charatsari *et al.* (2020), social capital triggers group reflection and elicits farmers' involvement for collective action, because it improves the in-group communication, fosters the development of a sense of community amongst participants, and advances the prioritisation of group goals. Charatsari *et al*. (2020) describes the building of social capital in farmer field schools as a "*a gradual process, spanning from the build-up of social ties between farmers to the construction of affective connections that facilitate group embeddedness and motivational contagion, and finally to the development of a feeling of group centrality which enhances group coherence"*. A farmer centred approach that includes their experiences and objectives and the creation of a sense of community seems to be conducive for building this social capital and to contribute to knowledge construction and innovation co-production (Charatsari et al. 2020). Specific learning approaches that seem to contribute to the building of social capital are "l*aunching group inquiry activities, animating farmers to engage in team reasoning, encouraging their active involvement in the knowledge discovery process, and helping trainees to make sense of their learning experiences through the collective elaboration of knowledge"* (Charatsari et al. 2020).

6.1.4. Trust

Trust is an important issue both in the hubs between peers and between farmers and the facilitator as well as during demonstration. In the hubs, according to Poulsen and Petersen (2009) the following rule should apply: there is openness inside the group towards each other and confidence towards people outside the hub. If deemed useful, such agreements could be written down. The creation of trust and reciprocity within a network is supported by the hub coach, who organises and directs network management activities for the members (Giest and Howlett, 2014, in McKey *et al*., 2019). There should be a strive for continuity of the hub coach, because frequent change of hub coaches could inhibit the climate of trust (Tairraz, 2020).

6.2. Inspiration from the interviews

6.2.1. Recruiting farmers

According to DEPHY (France), the recruitment of farmers is key. In section 5.2.1, some information is provided on which criteria to use to define the target farmers for the network, with as key characteristic their genuine motivation to change their.

For many cases (NEFERTITI-Spain, PPS Groen, FABulous farmers, Smart-AKIS Serbia, etc.), advertising in farmer magazines and on social media is an important start for attracting new farmers. This is often complemented with activating already existing connections (e.g. formal and informal meetings) with past or ongoing other projects/initiatives. INNOSETA mentions the importance of using the appropriate communication channels for reaching your target farmers. In FABulous farmers, they mention it is key to follow up on these general announcements through visits to the farmer to explain more about the network. So for initial contact, the public domain can be used, but that has to be appropriately followed-up on with private contacts.

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> **INNOSETA:** *"To give visibility to the initiative and to motivate participation, many dissemination seminars have been organized both nationally and internationally. We have several appearances on the radio, in the press, in technical articles, and in publications at congresses, as well as on social media. All partners are actively involved in motivating the participation of farmers and other stakeholders. In each area, the most appropriate means are analyzed because, for example, in Spain, the farmer does not usually read technical articles."*

The actual recruitment processes reported in the cases can be divided into "hand picking" by the facilitators, free for all to join, or through a selection process.

First, the "hand picking" is often done by cases in which attracting farmers with the right profile is perceived as difficult. In the experience of the German IPM demo farms, at first, it was not so easy to attract farmers and the Plant Protection Office had to approach farmers they already knew. Later, when the initiative got better known, it became easier to attract farmers. GIEE France mentions the important role of the advisor facilitators to seek out farmers who might be open to an agroecological transition to join the GIEE. Additionally, GIEE France mentions the benefits of having the regional agricultural chamber involved in the network, as they often have strong links with different types of farmer organisations (e.g. cooperatives, organic farming organisations, etc .) and can connect the network to the farmers of these organisations.

Second, a free access for everybody seems mainly relevant when networks are already better known. These initiatives are open for all farmers and stakeholders who are interested and matching with pre-set criteria. As for LEAF (UK), that is well-known across the country, farmers that want to participate have to approach LEAF themselves. There is a good website, and there are various easily accessible events that offer opportunities for getting acquainted with LEAF. Educational programmes further broaden the scope of LEAF becoming known to farmers. In addition, the German IPM demo farms mentioned that farmers becoming aware of changing regulations on PPPs and the need for preparing for a future with less access to biochemicals proved a strong motivation for farmers to join. This applies to other cases as well, and these more stringent EU and national regulations on the use of chemical PPPs may be considered a general trend in terms of motivating farmers.

> ***GIEE – France:*** *"Any new farmer can join a GIEE at any time, and can also leave the GIEE. For example, if a conventional farmer converts to organic and no longer sees a benefit in being part of a GIEE, they can leave. Also, in some instances of inter-personal conflicts in a GIEE, farmers can leave without breaching any commitment or contract"*.

Third, the use of selection procedures for farmers to access is used, for example, by Better Crops (Ireland). They follow a clear 4-step process of 1) recruitment campaign, 2) interview process, and 3) making a shortlist and 4) making a final decision on a selection of farmers. AHDB even set up the opportunity to participate as a nationally advertised competition for farmers, with as a gain opportunity to take a critical look at their business in a supportive environment and to make positive changes with community support.

The following quote from GIEE-France also shows that the recruitment process changed over the years to find the right profile of farmers for the network.

> **GIEE – France:** *"Motivations to join varied over time. In the first phase (2015-2016), the farmers joining were already carrying out agroecological farming and wanted to join GIEE to get the recognition of their work. In the second phase (2016-2018), the newcomers were motivated to try out or move to agroecological farming and found the GIEE to be a good way of carrying out this transition. In the last phase (2018 onwards), the process has*

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been less bottom-up, with agricultural advisor seeking out farmers who might be open to an agroecological transition – in this last, more top-down phase, agricultural advisor have been a central actor in getting farmers to joining the GIEE."

In conclusion, recruitment of farmers can differ regarding the reputation and knowledgeability of the network. For less known networks, personally approaching farmers from the own network might be the necessary way to go, but for better know networks free access to everybody can be taken as the main approach. When very specific objectives are set for the network, application and selection procedures can be used.

6.2.2. Motivations for farmers to join

LEAF: *"Because LEAF UK already exists for close to thirty years, membership means becoming part of a well-known initiative and that brings with it a kind of identity. So that will be attractive to some farmers (strong reputational attraction)."*

There is clear commonality in what the different initiatives mention as key motivations for farmers to decide to join the initiative. They include:

- Opportunities for knowledge exchange, and particularly for getting access to new knowledge and experiences
- Genuine sustainability interests (including in relation to biodiversity)
- Opportunities for improving the business case for the farm (e.g. AHDB Farm Excellence)
- Desire to help improve the image of farming because of the increasing criticism on farmers for their allegedly unsustainable practices
- Concerns about toxicity of chemical PPPs used (and related health concerns)
- Anticipation to rules and regulations regarding the tightening of chemical PPP use
- Getting access to particular funds/subsidies. E.g., in case of the GIEE farmers receive official recognition by the state for committing to increase their economical, environmental and social performance. This recognition opens up funding for them that they would not be able to access without membership of GIEE. In addition, they can also benefit from advice on the available funding sources.
- To get access to a market. For example, participation might be required for being able to sell to specific product buyers (e.g., the LEAF Marque certification)

In a number of cases, such as AgriLink-Spain, DEPHY Ferme, INNOSETA, some farmers had already been part of an earlier project. This made it easier to convince them to participate when they were satisfied with results of the previous initiative. Better Crops-Ireland also mentioned "loyalty to organisation and local adviser" as well as "social and community benefits" as motivation of farmers to join.

LEAF – UK points to the fact that motivations of farmers also change over time. Initially they may be looking more for (financial) benefits (which in the case of Smart AKIS-Serbia included free tickets to farm fairs), and gradually become more intrinsically motivated in IPM/IFM. LEAF offers flexibility in the level of engagement to its participants: from loosely staying informed as a member to being involved as a demonstration farm. This may be considered a strength for attracting farmers and dealing with their changing motivations. If farmers are not required to participate from product buyers, they are often more intrinsically motivated.

In conclusion, farmer motivations to participate in a network can vary from instrinsic (e.g. genuine interest to become more sustainable) to extrinsic (e.g., to obtain benefits or because they feel obliged). These motivations can also change during the project. In some cases, primary motivations might be more extrinsic,

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but when they recognize the value of the project become more intrinsic. It might be interesting to respond to these types of motivations by offering flexibility in the level of engagement for the participants.

6.2.3. Rules of participation

AgriLink – Spain: *"The only "rule" to participate was a certain level of commitment in terms of participating in the meetings and activities, and the majority complied with it. They keep motivated and engaged because they see real benefits, that we test solutions and these tests show results. They are motivated when they see that advisors and others actors have a real interest in helping them without other unknown intentions, and to enhance farms' performances or fight crop diseases."*

In basically all initiatives, certain conditions have to be met to participate, such as a willingness to exchange knowledge and participation in some activities (also see chapter 5.2.1). Unless it is only about membership (LEAF UK) to gain access to resources.

Furthermore, in the case of LEAF UK, because there are several levels of participation and engagement, expectations will be different accordingly. As for the process of becoming a demonstration farm, there is a particular procedure. It starts with an expression of interest, then a visit by LEAF staff, then a six-month process to help the farmer get up to speed, and then there is an Memorandum of Understanding (MoU) signed regarding what being a demonstration farm means concretely in terms of expectations (includes agreements about hosting visit, etc.).

To guarantee the quality of its design, Veldleeuwerik developed a system with specific rules for participation: e.g. participation in a minimum of eight farmer group meetings per year and annual renewal of the farm sustainability plan. Since 2015, farmers obtained a Veldleeuwerik sustainability certificate when they complied with these rules.

Contracts and agreements

Networks can be quite different in terms of making or not making specific contracts, MoUs, or agreements. For example, in the case of FABulous farmers, GIEE-France, NEFERTITI-Spain, AgriLink, no contracts are made, but there is an agreement along the lines of the expectations as mentioned in the above. This also means, in the case of GIEE-France, that farmers are free to leave at any time (of course losing their affiliation with GIEE as a result). The interviewee of AgriLink reported that a high level of commitment, trust, and collaboration was already present between farmers and advisors prior to their participation in the project and that this was considered much better than any agreement, because it is long-lasting, natural, and spontaneous. Better Crops – Ireland works with an informal agreement.

DEPHY Ferme – France worked with a written agreement for farmer engagement to provide data, communicate-disseminate, open its farm for visits. DEPHY does not offer payment nor financial support, but commits itself to providing a half time advisor-facilitator for the farmer groups (individual and collective support).

Ansari (Finland) made official contracts with the farmers after explaining the plan so they knew what was going to happen, what they committed to and what was required from them.

Similar to the MoU set up by LEAF, AHDB Farm Excellence worked with a Letter of understanding outlining expectations and this would involve: (i) a commitment term of 3 years, (ii) a willingness to share financial benchmarking data, (iii) a commitment to upholding environmental, social, health & safety and animal welfare standards, (iv) baseline assurance scheme certification, (v) operation within legal guidelines, and (vi)

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demonstrating a "positive moral compass". In return, AHDB covers for event costs and support of £1000 per year per farm to support field trial demos, for example for, seeds, works, etc.

In the case of PestiRed, a (rather extensive) contract is signed with the farmers, and this has to do with the importance for PestiRed to have a long-term engagement between the initiative and the farmers. Farmers are paid to be part of the project. The maximum contribution is CHF 12,000 per year (CHF 6,000 for 2019 and 2025). In return, farmers have to commit themselves to: (i) have a plot of 0,5 to 1,5 ha and a control plot, (ii) keep the innovative plot and the control plot in the same place and with the same area for 6 years, (iii) to have a farm plan, (iv) to implement the crop rotation and measures agreed with the other farmers in his/her PestiRed group on the innovative plot, (v) to carry out the weed, disease and pest surveys on the innovative plot and the control plot according to the instructions given by the regional manager (survey manual provided), (iv) to record in the ACORDA field book the agricultural practices carried out on the two plots, (vii) to participate in the workshops and exchanges of experience organised by the regional manager (1-2 meetings per year until harvest, etc.)

Financial support/compensation

There are significant differences in approaches to financial support/compensation in the different initiatives. There are six types of configurations mentioned in the cases:

- ***Farmers receive payment for participating***
  In PestiRed and IPM Demofarms Germany, farmers did receive significant compensation for their participation. In the case of the German IPM Demofarms, each farm received max. € 8000 per year, which related to a fixed amount for participation, compensation for yield losses, etc., and the organisation of a field day. Though it was said that motivation to participate did not come from the financial compensation, it is difficult to say what would have happened if there had not been such compensation. For PestiRed, paying farmers also means they can make clear agreements, which is necessary since the project is based on a 6 year rotation cycle. That would be difficult to organise without payment.
- ***Farmers receive no payment, but have certain indirect financial benefits through associated projects/subsidies***
  In the case of FABulous farmers, participating farmers may get easier access to subsidies from the government. Besides this, there may be other non-monetary benefits for participants as well, such as the status and the effect this has on potential buyers of crops.
- ***Farmers receive no payment but are compensated for specific activities***
  AHDB did not speak of payment for participation, but did pay £ 1000 per year per farm to support field trial demos, such as seeds, and labour. Other event costs are covered by the organisation from an annual budget. So this relates to the question of what is called payment and what compensation. Better Crops – Ireland said that they would provide compensation occasionally, nominally, and in kind through technical access, soil analysis, or advice, but not for engagement, data or time.
- ***Farmers receive no payment and does not have to pay***
  The majority of initiatives did not pay any financial compensation , including PPS Groen, COEXPHAL-CAJAMAR, AgriLink. INNOSETA mentioned that there was no financial support "*because it was not necessary, nor are we in favour of financially encouraging their participation. They have only been invited to lunch on the workshop days, and we also make sure that participants don't have to travel a large distance for participating.*"
- ***Farmers pay for participating, but also have certain indirect financial benefits through associated projects/subsidies***
  In the case of LEAF, though they do not directly provide financial support, there are projects (other than LEAF itself) that do offer compensation.
- ***Farmers pay for particular services (notably certification) that lead to higher prices paid by product***

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buyers
For example, in LEAF, membership of farms involves paying fees which relate to the size of the farm. But for the LEAF Marque they can receive better product prices from buyers.

- ***Farmers pay for participating in the network***
  In many cases, participating farmers pay to be able to do so. In Veldleeuwerik, farmers also had to pay to participate, according to their farm size (wwith a maximum of ca. € 1100). Some farmers recognised that they earned this fee back quickly through the access to knowledge/insights of other farms and applying that on their own farm.

There are probably different philosophies involved regarding what is an appropriate way of committing farmers to the initiative. Related to the specific objective (e.g., PestiRed requesting a commitment of six years), circumstance, and funding structure of the networks, other approaches can be more favourable than others.

6.2.4. Keeping the motivation up

Ownership of the planning

> **AgriLink:** *These farmers were participating in the development of the learning activities, mainly informing us about the contents that they are interested in. So, for example, we started with co-working on what they want to learn, or what topics they want to discuss in future activities and meetings. They asked to talk about GPS technologies, for example. Or an exotic leguminous specie –Crotalaria– which has a short vegetative cycle, so they wanted to learn about it."*

Basically, all initiatives intend to actively engage farmers, also in the planning of learning activities, but in varying degrees.

In the case of COEXPHAL and NEFERTITI-Spain, the field advisors take the major decisions in deciding on the learning activities, rather than having farmers participate in this.

PestiRed is interested in ensuring a strong continuity in what is done on the farms, so will also be more directive. However, the measures are not imposed, and have a level of flexibility, in which farmers are able to choose which measures to implement in addition to a selection of basic ones.

Other initiatives engage farmers in planning on an annual basis. For example, in AHDB Farm Excellence farmers participate in the development of the learning activities through annual planning and priority setting sessions. Better Crops follows a similar process. In Veldleeuwerik, involvement in planning and choice of activities was kept up throughout the whole process, and not only on an annual basis. In LEAF – UK demonstration farms are quite autonomous in what exactly they do on their farms.

Demand-driven

> **Veldleeuwerik and PPS Groen experience:** *Take the position and interest where farmers are as a point of departure. It is better to move slowly based on intrinsic motivation, than trying to move fast and then at the end find out that practices are discontinued.*

Basically all interviewees recommend new initiatives to focus as much as possible on the needs of farmers and stakeholders.They highlight the importance of activities being demand-driven and the importance of connecting to farmer-specific conditions and farmer-relevant questions and interests.

At the start of a network, a survey or workshop to gather information about the farmers' interests and needs could be helpful. All this information serves as the basis for developing the learning and activity program. For

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example, if many mention that they do not use technologies because they are very expensive, the focus will be on demonstrations with affordable technologies.

FABulous farmers advises to keep it as practical as possible, do real-life tests, sit together with farmers and researchers to make sure everybody is on the same line, and search for/involve partners with the right expertise.

AgriLink – Spain points to the fact that farmers will keep participating when they see results, solutions to their problems, and the benefits of working with advisors. *"They are motivated to learn, but what makes this possible in the long term is the real contributions to their farms and community. We also let them know how important their participation is since it facilitates a better definition of what we need to focus on in further research and innovation to make these adjusted to their real needs."*

To keep farmers motivated, participating and showing interest, it is important to adjust to what they are looking for. For example, initiatives have big interest from farmers if they can show that farmers can save money, with gradual changes, in a simple, progressive and efficient way. This also influences trust, because if initiatives show them drastic changes and a high cost, they distrust the initiatives.

PPS Groen also stresses the importance of relating the information to the farm-specific context and making it relevant fro them.

> **PPS Groen:** *"On-farm interactions are crucial to connect to farm-specific conditions and farmer-relevant questions and interests. It is important to take their situation as the starting point and then connect IPM to it, rather than the other way around."*
>
> **PPS Groen:** *"There was an outbreak of* phytophtera *at a certain point. They went there and first got the information on what exactly happened, and then discussed options regarding what could be done. So this is about this tailor-made approach. It was not just about sending information on IPM, but making it relevant in a particular context and setting."*

6.2.5. Knowledge exchange and benchmarking

> **KPODR – Poland:** *"Training on the best farms and inviting farmers or showing good examples of other farmers for training makes sense. If farmers feel that the support is effective they request more of these kind of meetings. Farmers also get together after the training. KPODR is encouraging to get together in, for example, cooperatives."*
>
> **LEAF:** *" LEAF is developing a new feature which is about some kind of acknowledgement of "beacons of excellence" which can be farms from any of the categories which are doing very well in a specific field (so not overall) of integrated farm management. This is an interesting example of a way of making participation more interesting for farmers."*

Veldleeuwerik mentions that exchanging knowledge and experiences (without pressure) between farmers is key. That is what motivates them most of all to participate: starting from what is relevant for the farmer, but also bringing in knowledge about trends in terms of e.g. regulations. Learning from each other is a key success factor. That also kept many of the groups going when Veldleeuwerik as such ceased to exist. It is said more than once, but the starting point has to be the experience, needs and preferences of farmers. So go where the energy and motivation of farmers is in terms of what exactly to apply in terms of IPM on a particular

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farm. Not using a fixed approach developed from outside. In Veldleeuwerik a certification provides a basis for benchmarking and developing farm plans towards enhanced sustainability on the farm.

The attractive aspect for farmers is the analysis they will be provided with. And they will be able to compare how they are doing in the field of IPM with peers (not with names). For example, they will see in a graph that shows several farm performances where about they are. It helps them in their decision-making and motivation and choice of priorities. Farm tours are important as well, also for peer-to-peer learning exchange! And webinars (4x per year) are appreciated. (PPS Groen).

Still, there may sometimes be disagreement among farmers. For example, in Veldleeuwerik, some farmers, e.g., left because they thought things were not moving fast enough towards sustainability and some left because they felt too much pressured in a direction in which they were not prepared to move.

6.2.6. Group feeling, informality and trust

Trust is a topic that drew out quite a few responses from the informants. It is considered by all as critical to the success of the network:

- Ansari / Viherriski / IPM-APU – Finland: Trust comes from showing them that everything discussed in the group will be anonymous. Also informal interactions like coffee sessions once a month on the initiative of one of the growers are important. They started to understand that they have to know what is happening at their peer's greenhouse.
- Smart AKIS – Serbia: Trust means being objective, professional and perfect logistics, not trying to persuade anything, not promoting companies or own solutions, clear communication on aims.
- COEXPHAL– Spain: A certain level of confidentiality is maintained. In the minutes of the meetings, mentioning names of people or companies is usually avoided, so the conclusions are presented in a generic way.
- NEFERTITI-Spain: Group feeling is achieved by animating farmers to engage in group discussions and their active involvement in the knowledge discovery process. Trust is gained by time and communication.
- FABulous farmers: Trust is generated through communication, commitment of the project partners and a professional organisation with the needed knowledge present, and with the promise that the right support will be there during the project.
- Veldleeuwerik: "*The peer-to-peer learning very much happened in the groups of around ten farmers. There was time to build trust, and they would meet on-farm, which created a good environment for peer-to-peer exchange. The group facilitator played a practical role in terms of taking notes and sharing these within the group, making plannings, etc. (...). Group meetings is where trust could be built and where farmers could exchange knowledge and experiences and be together in this risky business of applying new practices. Facilitation in the form of leaving farmers in the driver's seat, is important to support continuity.*"

The Veldleeuwerik – interviewee mentions to not only focus on the planet and profit side of things, but to also pay attention to the fun factor. It also needs to be about "pleasure and pride". Farmers need to feel they are in it (a journey) together (as group).

AgriLink mentions two important aspects regarding group feeling and building trust. First, a very good relationship between farmers and advisors, and second, the advisors' ability to identify and answer to farmers' needs, expectations, and interests. The type of language used and a lot of fieldwork and activities make farmers trust and test new strategies to achieve better farm performances and sustainability. *"There is no specific organization, all interactions are more like a round table. A very natural conversation process emerges and this motivates farmers to share. No one takes the lead, a topic enters the conversation, and*

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farmers and advisers share their views and knowledge. The more natural the better because bonds of trust are created and these influence the peer-to-peer learning process."

Veldleeuwerik mentions that it works well to have interactions between farmers as much as possible on-farm or near the farm because farmers will feel more at ease there. It creates a good atmosphere for building up trust and getting to know each other better. It takes time before they trust the facilitator and other farmers. But it is a crucial part of the functioning of these groups.

Barriers for trust

There may be institutional barriers for building trust, as in the case of COEXPHAL. The interviewee commented that growers hardly ever visit other growers´ farms. "*Maybe if they are in the same cooperative (or same family, but then they are probably in the same cooperative). In fact, some cooperatives are quite strict about any mixing of advisors with advisors from other cooperatives, or having their farmers share knowledge with other farmers. In fact, one of the most prestigious cooperatives here forbids their farmers to share info outside the group of cooperative growers. So, having a technical commission, and independent third party so to speak, is a good way to deal with this.*"

The Veldleeuwerik interviewee from experience warned that initiatives such as IPM*WORKS* may be seen as a risk for the farmers. For example, when specific IPM practices are found effective in the project and when policy makers or retail parties are informed about this, they can make these practices mandatory for all farmers. So in this way, the project may be seen as a threat for the farming sector when they are not ready yet for such changes. This is not easy to address, but needs to be taken into account. It may also make farmers reluctant to participate, either directly or indirectly.

In the German demo farms, fostering a strong group feeling was not really part of the project. The focus appears to have been more technical. The scouts (supervisors with technical expertise) did work individually with farmers and a lot happened there in terms of learning, discussion, etc. The relationship with the scout played a key role in how farmers felt about the initiative, and this was generally positive. The change of scouts in some cases (for example, because people changed jobs) evidently did not help in building/sustaining trust. This was also reported by DEPHY Ferme. It seems that trust cannot be build with a sole focus on the technical side, without room or time for building up social relationships.

6.3. Conclusion

Farmers can be attracted to the initiative by making use of divers types of media, adapted to the target group. Besides a first general introduction of the network, a follow-up activity (e.g., visit to the farmer by the hub coach) to explain more about the objectives and expectations seem to be valuable. During the validation workshop it was mentioned that different approach might be needed for different sectors. For example, grape farmers have more free time in the winter, while vegetable growers are busy the year round.

The actual recruitment process of farmers seems to be related to the reputation, knowledgeability and objectives of the networks. For less known networks, personally approaching farmers from the own network might be the necessary way to go, but for better known networks free access to everybody can be taken as the main approach. When very specific objectives are set for the network, application and selection procedures can be used.

Farmer motivations to participate in a network can vary from instrinsic (e.g. genuine interest to become more sustainable) to extrinsic (e.g., to obtain benefits or because they feel obliged). These motivations can also

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change during the project. In some cases, primary motivations might be more extrinsic, but become more intrinsic when they recognize the value of the project. It might be interesting to respond to these types of motivations by offering flexibility in the level of engagement for the participants. According to literature, these instrinsic motivations result in more persistent farmer participation and deeper learning. Extrinsic motivations can become more intrinsic, when the psychological basic needs (autonomy, competence and relatedness) of people are fulfilled in the networks. Examples on how to create such an environment are (i) the involvement of farmers in setting the programme and providing flexibility in actions for being autonomy supportive, (ii) organizing structured knowledge exchange and creating awareness about their own contribution in the knowledge creation process for being competence supportive, and (iii) organizing frequent interactions, integrating aspects of fun and building a trustful community for being relatedness supportive. These are important guiding principles for hub coaches in IPM*WORKS.*

Committment for participation is guaranteed in different ways in the cases, from being mainly based on trust to signing official contracts and MoU to make clear the expectations. In some cases, participation is compensated by the intiative in various ways (monetary or in-kind) to commit farmers to the network. But in a lot of cases farmers are not payed or even have to pay themselves to benefit from the services of the network. Related to the specific objective (e.g., PestiRed requesting a commitment of six years), circumstance, and funding structure of the networks, different approaches can apply.

For keeping farmers motivated to engage in the networks, ownership in the planning, being demand-driven and creating group feeling and trust is seen as key. Specifically, the ownership of planning is maybe not highly integrated in the way of working of most of the hub coaches. Further, to be demand driven, hub coaches can start with a workshop/survey on the farmers needs and interests in the first year to set a programme for the coming year. With frequent evaluation on whether these needs and interests still apply. Further, networks seem to create trust when they can assure that costs can be saved with gradual, simple and progressive changes to their practice. Also relating to information to farm-specific context and making it relevant to the farmers' daily practices seems to be a very important factor for both being demand-driven and creating trust. During the validation workshop, also the use of apps (e.g. care4growing) was mentioned as a way to keep farmers involved and motivated.

Issues with creating trust can either have an external or internal origin. An external origin could be related to, for example, farmers fearing that the outcomes of the project will become integrated in the regulation (thus obliging farmer to change practices) or cooperatives not allowing their farmers to exchange with other farmers. During the validation workshop the latter was indeed mentioned as an existing problem in some hubs. In this way, the cooperatives decide on who is allowed in the hub and who not. An example of internal reason for barriers in creating trust is the discontinuity of the hub coach and the lack of build-up relationships over time.

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7. Learning activities

Highlights

1. Peer-to-peer interaction is essential and depends on trust and shared issues.
2. Learning activities can vary in: learning objectives, theme or topic, format (often linked to location or platform), activity (what you do in a certain format), location and the timing of an activity, type of information shared, the different actors involved including their number and role, the learning tools that are used, the facilitation methods used and the level of interactions and rules.
3. Learning activities should have clear learning objectives, be practical and be applied to certain context and farmer's needs. Group discussions, on-farm demonstrations and webinars are the most common activities, but also group exercises or co-designing a farm management plan could allow to bring in the holistic approach to IPM.
4. Out of the manifold learning themes of holistic IPM, mainly the technical aspects and farm management issues are commonly tackled. How to link those to environmental impact, personal opinions and a framing in a full cropping system or management plan is less known.
5. It is advised to combine multiple complementary types of learning activities, interactions and formats into an entire learning programme, as pieces of the holistic IPM puzzle.
6. On-farm is the preferred meeting location for both hubs and demonstration activities. Frequent meetings are an important lever for hubs.
7. More inspiration and guidance could be used on how to translate objectives into learning activities, how to vary in the different aspects of learning activities to address different learning needs, and how to compose all the learning activities in a curriculum or a program that is consistent and works towards IPM. Other needs for the coaches have been listed in the concluding section of this chapter.

7.1. Literature on learning activities

7.1.1. Learning approaches (How?)

Learning approaches refer to the methods and formats used to facilitate knowledge exchange, i.e the 'How?' of learning activities. Examples are farmer discussion group, demonstrations, seminars, leaflets, reports, etc. In IPM*WORKS* we distinguish approaches for closed network knowledge exchange (see also 5.1), so within the hub, which might involve the exchange of more confidential information and is more frequent, and approaches for knowledge exchange within the open network (see also 5.1), which is less confidential and frequent.

In the IPMWORKS network, different types of activities will be organized to stimulate the adoption of IPM practices. Peer-to-peer knowledge exchange and group coaching facilitated by advisors will be set up to reach a wider adoption of advanced IPM practices based on longer-term strategic advice. Such participatory and farmer driven approaches are associated with increased knowledge and skill empowerment, higher adoption rates, and increased practice change compared to the traditional top-down approaches (Cooreman, 2020) .

Peer-to-peer learning

Farmers' learning about holistic IPM in IMP*WORKS* is focussed on peer-to-peer learning in farmer hubs. Previous research has shown that peer-to-peer (or farmer-to-farmer) learning is a promising strategy for **knowledge sharing and creation among farmers** (Cooreman, 2020). She describes peer learning as "*people learning from and with each other on a scale anywhere between informal, spontaneous sharing and formal organised activities*".

Peer-to-peer learning is an example of a non-formal educational setting as opposed to a formal educational setting (e.g. classical school education). Taylor and Caldarelli (2004) characterize such education as more learner-centred, present-time focused, responsive to localized needs and less structured. The relationship between the learner and facilitator in this case is non-hierarchical. The facilitator should give priority to a hands-on approach to learning in a dialogic process (Merriam and Caffarella, 1999; Norland, 2005; Taylor and Caldarelli, 2004; in: Thomas, 2010).

Approaches for closed networks

A farmers' closed network consists of peers, neighbours, friends and family (the farmers' inner circle of confidents) and provides the trust and cooperative relationships which are needed to successfully implement and exploit innovations. In IPM*WORKS,* new small demonstration farm groups, the so-called IPM Demo farm hubs, will be launched. These should be interpreted as the participating farmers' closed networks on IPM.

By sharing experiences in small groups with an advisor, farmers' uncertainties can be diminished (Poulsen and Petersen, 2009). They agree upon a common goal for their hub and organise their activities in accordance. Bayot et al. (2011) mention that farmers shows great interest in alternative methods for knowledge exchange, other than the classical one-way presentations. Such alternatives, for example, can be brainstorming, case studies, etc. that can take place in the closed networks.

Papp Komáromi et al. (2010a) refer to participatory training as an interesting learning approach for farmers. It encourages farmers to explore and discover for themselves, which eases the internalisation and adoption. Participatory training is centred on the participants and developed according to their needs. It is important that the participants feel ownership of the whole process.

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Further, Charatsari *et* al (2020) mention specific learning approaches that seem to contribute to the building of social capital (see also section 6.1.3) in farmer groups, such as "l*aunching group inquiry activities, animating farmers to engage in team reasoning, encouraging their active involvement in the knowledge discovery process, and helping trainees to make sense of their learning experiences through the collective elaboration of knowledge"*.

A few testimonies on learning activities that DEPHY hub coaches used with their group are available (only in French for now unfortunately) on https://ecophytopic.fr/search/ecophytopic?keys=%20%22Fiche%20%22Accompagner%20les%20agriculteurs%22%20DEPHY%20FERME%22&items_per_page=10&f%5B0%5D=type_de_publication%3A999.

Approaches for open networks

A farmers' open network exists of farmers, extension officers, advisors, agri-business enterprises, consumers, and policy makers, i.e. all the actors who have a stake in PPP use and/or IPM implementation may be involved. In IPM*WORKS,* two main activities are foreseen for knowledge exchange in the open network, namely demonstrations and cross visits.

Demonstration events will mainly be set up within hubs to prove to the wider farmer community that IPM works, based on success stories within the hub. Farm demonstrations can be described as "*a demonstration activity (or event) for providing farmers with an explanation, display, illustration, or experiment showing how something works*" (Collins English Dictionary) that can be subsequently applied in their own farming practices to bring about positive changes on their farm. One of farmers' most cited sources of information are other farmers (Oreszczyn et al. 2010) and other farmers explaining proven successful farming practices tend to influence farmers the most (Hamunen et al., 2015; Kilpatrick and Johns, 2003; Schneider, Ledermann, Rist, and Fry, 2009; Warner, 2007; in Cooreman, 2021). "Seeing is believing" is an important way to learn in agriculture. This shows that on-farm demonstrations have strong potential and are a preferred way to learn by farmers (Cooreman, 2021). Cooreman (2021) in her PhD on on-farm demonstrations, came up with a new definition for *embedded* on-farm demonstrations: *authentic learning space[s] where farmers and other stakeholders can explore and discuss agricultural practices together in a socially and physically embedded manner*. (Cooreman, 2021)

The inclusion of peer-to-peer learning activities and good facilitation have been proven to increase the participants' perception of the effectiveness of a demo event (Marchand et al.; in review). For example, Cooreman . (2020) found that the inclusion of facilitated dialogues during a demo event increases the potential for transformative learning by stimulating surprise and reflection amongst the participants. Cooreman et al. (2021) found that by incorporating core factors to foster transformative learning in demo events (e.g. include individual hands-on experiences, fostering disorienting dilemma, critical reflection and (facilitated) dialogue; Taylor et al., 2012), the chance of adoption could be increased.

Previous H2020 projects, branded as FarmDemo-projects, resulted in some interesting insights on farm demonstrations, that could be relevant to include in this project. On the website Trainingkit.farmdemo.eu, good practices and tools for organizing on-farm demonstrations are collected in a user-friendly booklet (https://trainingkit.farmdemo.eu/demo-design-guide/; downloadable in multiple languages).

Cross visits are activities in which hubs are able to visit other hubs to exchange knowledge and experiences on IPM approaches. Indeed, as Bayot et al. (2011) noticed, farmers seem to show interest in exchanging experiences with farmers in other regions. Good practices and tips and tricks are included in the NEFERTITI guidelines available on: https://trainingkit.farmdemo.eu/tools-for-delivering-a-demo-event/#cross%20visits

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7.1.2. Location (Where?)

Farm demonstrations, as the word implies, take place preferably on actual working farms, or in a context as realistic as possible (Cooreman, 2021).

For closed network meetings, meeting venues are preferably shifted between the farms of the group members so the group sees how crop protection strategies work in different situations (Poulsen and Petersen, 2009). Preparation of a meeting is important for its effectiveness. This should be done by the hosting farmers and the hub coach (Poulsen and Petersen, 2009).

Any in-field meeting should include field observations and samplings (soil & weather conditions, plant development, plant health status, diseases and pests present (in traps), weed incidence, etc.) and discussion (in sub-groups) about findings and observations in the field (Papp Komáromi et al. 2010b).

7.1.3. Timing (When?)

The previous statement implies that in-field meetings are preferably organised during the growing season. Papp Komáromi et al. (2010a) state that for farmers to acquire a sound understanding of the agro-ecosystem and to see the promising effects of the IPM strategies in-field learning has to be season-long. Triste et al. (2018) note that frequent interactions and a building of a trustful community feeling contributes to the relatedness support in farmer hubs. Tairraz (2020) confirms that frequent meetings are an important lever for networks. Papp Komáromi et al. (2010a), however, also mention that frequent activities are time and energy consuming for farmers, specifically in the crop growing season, so the timing, frequency and duration of the activities should be taken into account. Tairraz (2020) mentiones a network where this issue was overcome by having weekly virtual meetings to discuss current issues and observations.

7.2. Learning activities in the cases

The cases were asked to explain the learning activities and their learning objectives. We wanted to know how the project objectives were translated into learning objectives on how these on their term were translated into different types of learning activities. On the learning activities it was also asked to describe their practical organisation and their success factors and difficulties for a good knowledge exchange. We also focussed in the questions on demonstrations as a specific learning activity.

Most cases stress that learning activities should have **clear learning objectives**, be **practical** and be **applied** to certain context and farmer's needs. Also peer-to-peer interaction and their dependency on trust and shared issues are described as essential. LEAF and DEPHY furthermore mention the need for multiple and complementary learning activities. The most cited learning activities in the cases are on-farm demonstrations, group discussions and webinars. Hence, in the cases peer-to-peer learning mostly means either one farmer explaining other farmers how he/she has implemented a certain technique, which decisions were made, etc. or farmers engaging in a group discussion. The case interviewees see it as the facilitators role to organise and moderate these interactions. Except for G30000, who organised games and competitions to create a 'gamy atmosphere', no other interactions than farmers showing and explaining their experiences were imagined.

Overall, in the cases we analysed, learning activities could be different with regard to the following factors:

- **Why** the activities were organised: learning objectives, presumed outcome;
- **What** was studied: the theme or topic of the activity;

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- **How**: format of the activity (often linked to location or platform), type of activity (what you do in a certain format), type of information shared, the learning tools that are used, the facilitation methodology and level of prescribed interactions and rules;
- **Who**: the different actors involved including the number and role of each,;
- **Where**: the location and link with location and context;
- **When**: the timing of an activity, and its embeddedness in a program.

These variables can be interdependent and case specific. Most cases are clear about the theme, format, activity and location. What was not clear from the cases was how learning activities differ or link to: (1) facilitation methodologies and pedagogic perspectives and how these could help to (2) link a learning activity to general barriers to learning and adoption; to more specific (3) different types of learning styles, needs and profiles of the different farmers; and (4) link to learning processes in general, as for example how to build on previous knowledge or trigger moments of reflection. NEFERTITI mentioned that they (5) evaluate learning activities to understand barriers of adoption, but **in general not much is known on how to evaluate a learning activity and assess it's impact on the learning and adoption of farmers**.

What we miss is some inspiration on how to organise different kinds of learning activities by varying the abovementioned factors . Peer-to-peer learning could also be set up as engaging together in for example an exercise, a situation planning or collaborative documenting. Some oppose this, stating that all interactions should be as 'natural' and spontaneous as possible, but in IPM*WORKS* it seems worth trying out some new types of interactions that are adapted to the context and content of a hub.

It is clear that organising a learning activity requires time, capacities and skills. Guidance, extra inspiration or an example of a learning program could be useful to assist the hub coaches with less experience in facilitating group learning activities. Also a methodology to evaluate and assess the impact of a learning activity is needed.

In the following subsections, some differing factors of learning activities are elaborated on.

7.2.1. Theme of the learning activity (What?)

The following themes were addressed in the analysed cases:

- Different **IPM methods** like flower strips, beneficial insects, ecological infrastructures to promote biological control, soil tillage or novel phytosanitary products, and how these are possible solutions to minimize or prevent crop damage with certain pest issues. It is found useful to interact in relation to the full crop cycle or even a full rotation to get a good overview, and being able to consider options in that wider perspective and not just for some parts of the cycle in isolation;
- The more **technical aspects** of how to use these methods like sowing, monitoring, technologies and smart farming, spraying and equipment, or the technical management of results;
- **Farm management** issues rooted in the farm history and trajectory, for example, decision making, sustainability plan, intensification, fertilization programs, weed management plan, or technical feasibility in one farmer context;
- The **economic aspects** of IPM methods, specific costs and specific labour needs;
- The **impact** of certain methods on agri-environmental programs or the protection of the natural environment and the natural landscape, with, for example, a link to indicators and technical insights gathered from field data;
- **Socio-psychological aspects,** such as preferred focus of the project, motivations, barriers to adoption, best practices, responsibilities and contributions, rules, regulations, policy and legislation. A learning theme can, for example, also be the personal skills needed to interact and learn from others, like how to report experiences and feedback to the group, their decision making processes

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and outcomes regarding the implementation of farm practices.

For holistic IPM it could be argued that all these themes should get addressed and touched during learning activities. In the cases, the themes of pest management methods are mostly discussed with a focus on the technical aspects and the farm management issues. How to link these to the themes of agri-environmental impact, personal opinions and a framing in a full cropping system or management plan is less known.

7.2.2. Learning approaches (How?)

The how of a learning activity links to organisational and pedagogic choices on format, location, timing, activity and type of knowledge shared during the activity. Formats can be considered as the general setting in which the activities take place. The format often links with the location where a learning activity will take place. The format and location can affect the possibilities of which theme, activity or type of information and knowledge, and facilitation method to choose.

Formats and types of interaction

- Outdoors, in-field and on-farm settings. A **tacit format** where one can see, touch, smell, point and interact with an environment. This is a good format to host activities like: scouting sessions showing how to scout and determine pests, diseases or weeds; demonstrations; butterfly hunts; or meetings where farmers host other farmers to talk about for example options for redesigning a management plan. Another format where these activities could take place is on agricultural fairs. These kind of formats are very much linked to practical activities and a more technical knowledge. Conversations are based on seeing and doing. Online these formats are translated into innovation case study videos, best practices webinars and video messages and testimonies.

  Cajamar mentioned following difficulties with in-field formats.

  "It has to be acknowledged that giving demonstrations and farm tours might be stressful for farmers and does require extra organisation, with which they could get help from the project or advisor."

  "Field visits with groups are not always possible, e.g. for phytosanitary reasons. An important limiting factor in tomato is the threat of the infection with a plant virus (like ToBRFV or PepMV), that can be spread mechanically. In many cases, crops cannot be touched by people other than the growers or their personel"

- Other formats make less links to practical and contextualised atmospheres and host more **abstract discussions**. Although these kind of discussions could also be done on farms, the format is more one of a 'round table conversation'. These meetings make a platform for activities like problem analysing sessions, evaluation sessions, sector or project meetings, knowledge exchange and study groups, group counselling, knowledge workshops and social skills trainings. Other examples given in the cases are: presenting and discussing results, findings and experiences, conflict and SWOT analysis, mapping and matchmaking between actors, identigying plant protection challenges and formulating subsequent learning challenges, filling in management plans as a group, or training people to access and filter info for online learning/ knowledge exchange. Online these formats are translated into online meetings, online workshop, App groups, online platform interactions, etc.

  G30000: *"Visit to a horticulture enterprise, on the thematics of biodiversity. An entomology specialist gives a theoretic input, then each farmer proposes their own plan of agroecological infrastructure and then the plan-maps are discussed."*

- Besides the two formats mentioned above which link to group interactions, there are also formats that link to more **one-on-one interactions** like consultancy, assisted sustainability plan development, individual meetings with extension workers, phone calls, surveys and interviews, a follow-up, control on certification requirements, supporting participants in submission to open calls, etc.

- Where the above three formats strongly link to interaction, the cases also mention formats that focus

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on **one-way information sharing,** like theoretical classes and lectures, courses and seminars, presentations, study days, winter lectures, reporting, etc.

NEFERTITI nuances: *"A webinar is an easy form to reach many actors, but you have to make sure that the setup is really interactive, so that questions from the audience are integrated in the process. Meaning that the sharing of more formalised information could also include interaction."*

- **G30000** mentions formats that host **playful interactions** like quizzes or photo contest. These games could be done in different locations and serve different purposes like testing existing and new knowledge or braking the ice for a conversation.

  "Recreational activity coupled with serious ones: photo contest, challenge, recognize biodiversity auxiliaries and "hunt" with butterfly net, after or before a theoretical input on entomology, are fun activities to create a nice, challenging and gamy atmosphere to capture the attention, get them receptive and more open, and spread the message in a funny way."

- **Combinations of formats** are also recommended:

  PPS Groen*: "What was found effective was a combination of factsheets, (winter) lectures, on-site demonstration, and articles in newspapers/magazines. However, for those involved in the initiative, a follow-up by face-to-face discussion in the farmer group adds a lot to effectiveness." And the following example: "There was an outbreak of Phytophthora at a certain point. The farmers went to the plots and first got the information on what exactly happened, and then discussed options regarding what could be done. So this is about this tailor-made approach. It was not just about sending information in IPM, but making it relevant in a particular context and setting."*

Where?

As stated before, the format of a learning activity often links with the location of the learning activity. Farmers generally feel more comfortable in the farm settings than in other meeting places and prefer where it is possible to make a link to an **actual context and setting**.

When?

On the **timing** of learning activities it has to be noted that farming is a sector with seasonal differences in work load and a dependency on other variable factors. The timing of an activity, meaning when and how long, determines the possibilities of farmers to join or not. On the other hand, when one wants to go into the fields at the time that pest/diseases/weeds or the effect of treatments can be seen, meaning in the growing season, the bussiest time of the year.

In conclusion we can state that several formats and types of interaction are possible for the hubs in IPM*WORKS*, their pros and cons need to be carefully considered, together with the issues of location and timing. However, combining different types into an entire learning program, may be the best option, as explained in the next section.

7.2.3. Learning program

As mentioned above, it is not easy to compose a learning program that (1) considers the timing between activities (e.g., how many activities per year, in which order and following on which external events); (2) links to a curriculum on holistic farming approaches and integration of pest management in cropping systems and

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farm managements, but is in the mean time adapted to the specific contexts and learning objectives of the participating farmers and (3) are based on pedagogical principles, learning processes and tailored to the participants learning needs and capacities. Concerning the third point, this also means a **combination of different types of learning activities, interactions and communications**, as explained in the quotes of DEPHY and LEAF:

> **DEPHY:** *"All the formats are making a puzzle. It is not only 1 demo or 1 testimony that triggers farmers and move forward, some farmers may find it interesting but without any follow-up nor thinking to the potential implementation. It is not enough to transfer. It is a cumulative effect that triggers a change. Multiple forms and types of learning are necessary. And time is needed : change occurs after some years for some farmers."*
>
> **LEAF***: "It probably is not about the success of one or another activity as much as the diversity of options that allows for connecting to different information needs, different interests, different learning styles of farmers, etc. (…) In other words, we may focus on the loose activities in terms of their effectiveness, but probably the wider embedding in well-organised range of learning activities is more important than the activity in itself."*

7.2.4. Examples of learning programmes

Some of the cases described their activities sufficiently as a 'program'. An attempt to compile them is made in table 2. The columns in the table describe following aspects:

- Theme: what was studied in the learning programme? The themes are organized according to the 8 IPM principles
- Objective and outcome: why was this theme studied? We tried to describe both the project objective and the learning objective that links to the specific theme. So some cases might have another project focus, but we organised each example in a certain theme, when the case had an elaborated example of a learning objective that links to this theme.
- Format and location: How and where were the learning activities organized?
- Activity: What type of interaction took place?
- Which facilitation and learning tools were used?
- Case that provided the example

Table 2: Examples of good practices for learning programs described in the case interviews

Theme	Objective & outcome	Format & location	Activity	Facilitation & learning tools	Case
Preventive cropping system	Create opportunities for a participatory type of sense-making on the basis of what is visible in interactive experiences.	**On-field interactions**: There was an outbreak of Phytophthora at a certain point.	They went to the field and first got the information on what exactly happened. They discussed options regarding what could be done.	Interact in relation to the **full crop cycle** to get a good overview, and being able to consider options in the **growers' perspective**. Take their situation as the starting point and then connect IPM to it.	PPS-groen

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Theme	Objective & outcome	Format & location	Activity	Facilitation & learning tools	Case
Monitoring	The main objective is reduced use of PPPs through the implementation of FAB measures, such as flower strips, that support beneficial insects. Farmers are trained to independently continue the FAB-measures after the project, by e.g. being able to monitor which insects are present and which pests they control.	Excursion with farmers and the partners Biobest and HoGent to the different fields with flower strips.	**Scout** for beneficials and pests and discuss the first results.	Using practical and basic tools like a magnifying glas and a short **brochure** of the project with the major species and pest properties.	FABulous Farmers
Combination of non-chemical methods	To support redesign. Learning between farmers to have a global reflexion at farm level or at cropping systems level. The objective is to make the farmers autonomous in their decision making.	farm visits	Group discussion to foster a **collective reflexion** to find a collective solution. during the visits sub groups discussed defined topics and problems.	The facilitators had a collective **training** on barriers for change, active listening, facilitating farm visits, etc. Discussions and demonstrations are prepared with a **historic timeline** and/or with figures.	DEPHY
Use of biological control agents and products	Biological control by releasing commercial natural enemies and/or attraction via habitat creation and decision making on whether to spray or not. A combination of specific biological knowledge and skills required to use, understand, find and/or recognize biological elements in real field conditions.	On-farm demo event	1. encouraged participants to **share their experiences**, to understand the knowledge and attitudes of each participant towards the pest, and the control methods 2. demo activity with **hands-on** activities 3. **group discussion** on what they learnt, and to share their point of view, and the potential to be integrated into their farms.	We use **simple, cheap tools** such as magnifying glasses to detect and/or identify certain crop pests and natural enemies during the demonstration events. It is important to try to understand and **evaluate their attitudes** after the demo was conducted.	NEFER-TITI (Cajamar FABulous farmers)

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Theme	Objective & outcome	Format & location	Activity	Facilitation & learning tools	Case
Reduced doses and application	The goal of the living labs is to **co-create** and share knowledge and skills. The Living Lab from Navarra is about topics such as herbicides or what methods to use as for weed prevention.	Both in meetings and after farm visits we form a circle of approximately 15 people and talk.	**Monthly or bimonthly meetings**, to talk about specific topics, such as sowing techniques, technologies, fertilization programs, novel phytosanitary products, etc. **Farm visits** to see what crops were chosen, why, and what benefits and difficulties are showing. Every farmer relates the cycle he/she applied to their parcels.	We try to put all information shared during activities together in kind of **protocols** to enable knowledge transfer and continuous learning and exchange process.	AgriLink (PestiRed)
Record and evaluate the success of measures	The purpose of Veldleeuwerik was to help arable farming become more sustainable along the lines of a certification scheme.	Advisor-to-farmer interaction. Group meetings. Yearly feedback on the progress in the sustainability plan.	Farmers need to develop a sustainability plan at farm level concerning the themes of 10 sustainability indicators for, assisted by a farm advisor.	Sustainability plan with indicators to monitor progress. The ten **indicators** used to assess progress related to: Soil fertility, product value, nutrients, pest control, water, energy, human capital, local economy, biodiversity, soil loss. A common identity (“Veldleeuwerik farmers”) arose from being linked to the initiative and because of the common reference framework.	Veldleeuwerik

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Theme	Objective & outcome	Format & location	Activity	Facilitation & learning tools	Case
Farm management planning and evaluation	Integrated Farm Management (IFM). To enable farmers to monitor and set targets for improvement of sustainability across the whole farm.		The assessment tool is used to help **monitor their performance**, identify strengths and weaknesses and **set targets** for on farm organisation and planning. The IFM themes come back in a whole range of other activities, e.g. a three-day training on IFM essentials.	The LEAF Sustainable Farming Review, an online annual **self-assessment tool** composed of around 90 IFM related indicators. Simply Sustainable **series of knowledge materials**.	LEAF
Financial aspects	Improve the performance and profitability of the host Monitor Farm and the wider industry. To encourage openness and cooperation thereby building **sector resilience**. **Business efficiency and benchmarking** sit at the heart of programme activity		Improve performance on a real farm by **setting goals, recording progress, benchmarking**, sharing information and ideas, adopting new systems and techniques, having a market led approach, ensuring knowledge transfer to the wider community, enhancing the natural environment and developing people.		AHDB (RAP)
Rules & regulations	Establish, support and analyse a network of demonstration farms that implement and demonstrate integrated pest management in the best possible way to other farmers, consultants and the public.	Guidelines based on the sustainable use Directive (2009/128 /EG)	Information sharing.	The use of multiple communication channels and formats.	DIPS

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7.2.5. Reflection and conclusion

Peer-to-peer learning in farmer networks is essential in IPM*WORKS*. It encourages farmers to explore and discover for themselves, which eases internalisation and adoption, but depends on trust and shared issues. Two types of networks will be set up: (1) closed networks, the IPM Demo farm hubs and (2) open networks, who can take part in demonstration events. Both rely on the "Seeing is believing" principle, which is an acknowledged way to learn in agriculture.

For both types of networks, the learning activities can vary in: learning objectives, theme or topic, format (often linked to location or platform), activity (what you do in a certain format), location and the timing of an activity, type of information shared, the different actors involved including their number and role, the learning tools that are used, the facilitation methods used and the level of interactions and rules.

Learning activities should have clear learning objectives, be practical and be applied to certain context and farmer's needs. The most cited learning activities in the cases are group discussions, on-farm demonstrations and webinars. The activities thus most often take the form of either farmers engaging in a group discussion, or one farmer explaining other farmers how he/she has implemented a certain technique, which decisions were made, etc. The validation workshop noted that activities in IPM*WORKS* should not be limited to those formats. Activities like group exercises or collectively designing an ideal farm management plan might just be the type of activities that allow to bring in the holistic approach to IPM. They also suggested to link learning activities to a trigger change model: (1) trigger farmers / incite a sense of urgency to change; (2) explore alternatives together; and (3) train/learn/adapt concrete IPM-measures.

To learn about holistic IPM, the potential learning themes can be manifold, i.e. IPM methods, technical aspects of how to use these methods, farm management and the economic, environmental and socio-psychological aspects linked to them. It could be argued that all these themes should get addressed and touched during learning activities. In the cases, the themes of pest management methods are mostly discussed with a focus on the technical aspects and the farm management issues. How to link those to the themes of agri-environmental impact, personal opinions and a framing in a full cropping system or management plan is less known. Moreover, the validation workshop also warned against having too many topics to deal with or too many messages in one activity, which may cause farmers to loose attention.

Therefore, it is advised to combine multiple, complementary types of learning activities, types of interaction and formats into an entire learning programme, as "All the formats make a puzzle. It is not only 1 demo or 1 testimony that triggers farmers and move forward. Multiple forms and types of learning are necessary. And time is needed: change only occurs after some years for some farmers." Thus, the wider embedding in well-organised range of learning activities is more important than single activities in themselves. Although the validation workshop also found it hard to link the different activities (linked to the multiple needs) into a programme with an overarching objective.

Concerning some of the practical issues of organising (programmes of) learning activities quite a good consensus exists. (1) On-farm is the preferred location for both hubs and demonstration activities. This makes an authentic learning space, where can be linked to an actual context and setting. For hub meetings, it is recommended to shift the venues between the farms of the group members, so the group sees how crop protection strategies work in different situations. (2) Frequent meetings are an important lever for hubs. This both links to the group dynamics and the multiple learning topics of holistic IPM, which stretch over the entire growing season or even over rotations. However, the value of frequent meetings should be levelled with the time and energy farmers can spend during the busy seasons. Short, virtual meetings in-between physical meetings may also provide opportunities there.

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Other issues concerning learning activities remain less clear, and thus give rise to needs for hub coaches (as identified by the case interviewees or the validation workshop):

- Organising a learning activity requires time, capacities and skills. Guidance, extra inspiration or an example of a learning program could be useful to assist hub coaches with less experience in facilitating group learning activities.
- Which activity to choose for which learning objective is not sufficiently clear yet.
- Also a methodology to evaluate and assess the impact of a learning activity is needed.
- Exchange on applied learning approaches amongst hub coaches is seen as a mean to achieve this.
- Finally, working with the hub coaches on how the hub journal can help structure the different activities to build a coherent program for the hub, is needed.

These needs will have to be dealt with in the continuation of this work package and in close collaboration with WPs 2 and 3.

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8. Facilitation and learning tools

Highlights

1. Peer-to-peer exchanges on holistic IPM can be highly effective, depending on the trust and reciprocity within the hub, which is supported by the hub coach. For a successful hub, a good facilitator is key.
2. The facilitator (i.e. the hub coach) needs multiple competencies. Next to at least basic technical competencies regarding IPM practices, he/she also needs social, communication and pedagogical competencies in order to support group dynamics and farmers' learning.
3. The facilitation style may be highly organized or rather non-structured. Cultural preferences regarding the degree of formality need to be considered when choosing an appropriate facilitation style and tools.
4. Learning tools can support facilitation and the learning process, such as inspirational documents, monitoring and benchmarking tools, evaluation sheets, decision support systems, cost-efficiency evaluations, and reflection tools. Moreover, online tools and platforms may support facilitation and learning.
5. Tools to assess the impact of the learning activities on farmers' learning and adoption of holistic IPM are largely missing. It could be helpful to elaborate on those tools that could help to understand how peer-to-peer learning actually takes place.

8.1. Facilitation and learning tools in literature

8.1.1. Hub coach as facilitator for farmers' learning

For a successful hub, a good facilitator is key. The **creation of trust and reciprocity** within a network is supported by the hub coach, who **organises and directs network management activities** for the members (Giest and Howlett, 2014, in McKey et al, 2019). According to Papp Komáromi *et al*. (2010b), the tasks of a hub coach are: to introduce an activity, clarify the process, set participants to work and ask open-ended and 'What if?' questions. The input and experiences of farmers should be regarded equally important as the advisors' and researchers' opinions (Papp Komáromi *et al*. 2010b). Besides the facilitation skills, of course, also the agronomic skills are important. An advisor should at least have basic skills on IPM practices, and if more expertise is needed be able to tap into this expertise through his/her network.

There should be an effort to maintain strive for continuity of the hub coach, because frequent change of hub coaches could inhibit the necessary climate of trust (Tairraz, 2020).

A final lever for trust and a pleasant group culture, mentioned by several authors, is leaving time for socializing after the formal part of the activity (coffee and cake, etc.).

8.1.2. Learning tools

Learning tools refer to **instruments used to facilitate the learning process and knowledge exchange** amongst farmers. Examples are benchmarking tools and evaluation sheets to enable comparison between farmers; decision support tools that help farmers to gain insight in their situation and help them in deciding on potential solutions; videos and presentations that can help farmers to better understand a specific situation, context or practice; etc.

In IPM*WORKS*, the networks will organise field-based **cost-efficiency evaluations** of IPM strategies by using Decision Support Systems available on the 'IPM Decisions' platform and by calculating sustainability indicators based on detailed cropping systems in the course of the project. The availability of decision support systems have been put forward as a lever for IPM adoption by Tairraz (2020). In contrast, the lack of reliable decision support systems seems to function as a barrier for IPM adoption (Tairraz, 2020).

As mentioned in the previous chapter, co-designing an innovative farm management plan could make an interesting learning activity. Guides for co-design are available (only in French for now) on https://ecophytopic.fr/sites/default/files/2019-12/2018_Guide_atelier_conception_Reau%20et%20al.pdf and https://www6.paca.inrae.fr/ueri/Actualites/Guide-co-conception-Friendly-Fruit.

8.1.3. Evaluation and reflection

Evaluating the results allows to assess the effectiveness of the tested IPM technologies and helps farmers to choose their best option. A participatory discussion on the general conclusions from the whole season, supports the farmers' understanding of the outcome and conclusion of the activities (Papp Komáromi et al. 2010b) and thus can contribute to their learning process. Having a say in how the outcomes of the activities should be evaluated, can contribute to the ownership of the farmers.

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8.2. Facilitation and learning tools in the interviews

8.2.1. Peer-to-peer facilitation styles

From the cases, it is clear that peer-to-peer exchanges can be highly effective, depending on the trust and shared issues. Cooreman (2020) describes peer-to-peer learning as "people learning from and with each other on a scale anywhere between informal, spontaneous sharing and formal organised activities" (see section 7.1.1). This scale of formality can also be found in the cases. Exchanges can differ by how they are facilitated, if they are in more formal and highly organised style or more informal style, if they are directly between farmers or have mediator who channels information, and if they are online or offline.

Underneath is the example of NEFERTITI, with a highly organized style and **prominent role for the facilitator**, following a schedule of prescribed interactions. The described event has a formal character, although this can also host more informal conversations.

> **NEFERTITI:** *"At the beginning of the demo events, I encouraged participants to share their experiences with Tuta absoluta. This was crucial to understand the knowledge and attitudes of each participant towards the pest, and the method(s) to control it. Then, the "core" of the demo activity was carried out, and then, at the end, a group discussion followed, in which each of the participants had the opportunity to discuss what they learnt, and to share their point of view, and the potential of the knowledge/methods presented to be integrated into their farms. Again, this final point was also key – which was also mainly based on peer-to-peer exchanges - to understand and evaluate their attitudes after the demo was conducted."*

In contrast, in the example of AgriLink it is much **less clear what the role of the facilitator is** in facilitating peer-to-peer learning and the conversations aren't very steered towards an objective. There is no structured interaction or prescribed rules of conversation and so has a more informal character.

> **AgriLink:** *"There is no specific organization, all interactions are more like a round table. A very natural conversation process emerges and this motivates farmers to share. No one takes the lead, a topic enters the conversation, and farmers and advisers share their views and knowledge. The more natural the better because bonds of **trust** are created and these influence the peer-to-peer learning process."*

In online settings different kinds of facilitation skills and methods are required to get interaction and peer-to-peer learning. Many other cases on the contrary reported successes with online events, but it isn't clear how those were facilitated.

> **NEFERTITI:** *"Despite the successful number of participants, my personal point of view is that online events don't work as well as on-farm events. Particularly in this case, where a wide diversity of strategies involving several plant species and insects was presented, it is clearly more appropriate to carry it out in 'real' conditions. Also, I found it harder to 'break the ice' when people are online. Some people are reluctant to participate, and that makes harder to integrate everyone into a group discussion."*

More experiences are needed to pinpoint which facilitation style, either non-structured or with strictly structured interactions (or anything in between), can be used in which situations and in which kind of learning it results.

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8.2.2. The facilitator's roles and capacities

Roles

In the cases, **the facilitator (i.e. hub coach) has multiple roles**. He/she is (1) the one that analyses the farmer's needs; (2) the organiser of group activities; (3) the moderator in group discussions and (4) the one who reports. NEFERTITI mentions the role of the facilitator as (5) the evaluator of learning activities and learning progress (see quote in section 8.2.1). In the other cases, **no explicit distinction was made between the facilitation of group interactions and the facilitation of learning processes.**

> **Veldleeuwerik:** *"The peer-to-peer learning very much happened in the groups of around ten farmers. There was time to build trust, and they would meet on-farm, which created a good environment for peer-to-peer exchange. The group facilitator played a practical role in terms of taking notes and sharing these within the group, making plannings, etc."*

There is a cultural dimension to this as well. What motivates one farmer may not motivate another. Similarly, what is appreciated by one farmer, may not be appreciated by another. In some countries, a more formal way of interacting is appreciated where the focus is on expertise and knowledge, including a certain associated high status of the expert (facilitator). In other countries, the facilitator will need to be knowledgeable, but will especially need to acknowledge the farmers' expertise and knowledge about local conditions. He or she will be more of a knowledgeable process facilitator than 'the' expert. Therefore, **each country needs to consider cultural preferences in this regard and choose facilitation styles and tools accordingly.** Though facilitation styles and tools may be appreciated differently (see chapter 10), it is clear that factors such as the importance of connecting to the interests and needs of farmers (rather than only having pre-planned programmes) applies everywhere.

Competences/skills

To fulfill these multiple roles, most cases also mention the need for facilitators to have the **competence to motivate and to create trust and informality**. The interviewees had a clear vision on which capacities are needed to facilitate a farmers group and a learning process. For the case of DEPHY facilitators get a training adapted to agricultural topics, but in general the cases were less familiar with facilitation methodologies that can structure a learning process and support the facilitators in building up these capacities. In none of the cases standard questions are mentioned to help facilitators to structure and deepen a discussion. Also **no supportive services that could help facilitators build their competencies** to be communicative, adaptive and pro-active, coming from the overarching project or organisation **were mentioned**.

In general, facilitators require a combination of skills and compentencies. These were mentioned in the interviews:

Technical competencies

- It is important that he/she has a basic knowledge of the sector, on the practical aspects of farming, and on the technical aspects of IPM. Rather than being very specialised, a global approach with **technical and economic knowledge** and the ability to get an overview at farm level is needed. The advisor can invite specialized expert speakers on very precise technical or scientific aspects.
- Focus on creating an atmosphere of appreciation and motivation, starting from what is relevant for the farmer, but also bringing in knowledge about trends, for example, in terms of regulations. Facilitators should address trends and upcoming changes (regarding pest management) and help farmers to find ways forward in a holistic farm picture.
  Ansari: *"It's important to **have some solutions in vision** to go through the project. Bring in good practices and models from elsewhere in the project to stimulate and create positive feeling that it is possible. There is a need for small steps to advance."*

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Social competencies

- To be able to work with people in general by being empathic, communicative, motivational and other relational and **inter-personal skills**. This also means for example acknowledging barriers like fear of change or stress linked to taking risks .
- To be able to **create trust**. Therefore they need to be frank, discrete, confident and act with rigor. Also continuity, leaving farmers in the driver's seat and independency by not promoting commercial events, but focusing on science are important to create trust. The name and history of an institute can also create trust.
- To know how to **build bridges** between farmers, farmers and the project, farmers and other stakeholders, etc. And to make sure that all farmers and stakeholders are well represented in meetings, webinars, workshops, and other activities.
- To facilitate a group by being well organized and **support the group/network dynamic** at the initial stage and to keep it alive over time. The social function of the network and the fun things and playful atmosphere have a very important role in group dynamics. Also being able to adapt to the rhythm and speed of the group (some are progressing more directly, other more sinuously). This requires a **service-oriented role** of the facilitators, where the facilitators support the groups, but the farmers set the agenda.

Communication competencies

- To be a clear communicator and have a feeling for priorities.
  G30000: *"Choose the most important messages, because it is not effective to drown farmers under lots of information they could not keep and learn, it is better to repeat the same messages via different ways and learning methods"*

Pedagogical competencies

- To understand what is important to farmers and have a sound understanding of the knowledge that needs to be exchanged. From this he/she has to be able to define real learning goals and objectives, adapted to field conditions. Frequent, evaluation of pre-set objectives is requested, to keep updated on changing knowledge needs and common interest. The programme of activities can be adapted accordingly. A **proactive attitude** in this is helpful, by for example suggesting a suite of measures ahead of the workshop, which farmers could discuss and select jointly at the workshop.
- To be able to facilitate discussions by having a taste for constructive exchanges and knowing how to draw out input from farmers in stimulating ways by not being afraid to ask sensitive questions when needed or to have a contradictory position. They need the **ability to induce questions and to solicit feedback** in a small group. Also convening, steering, summarising and designing discussions by choosing the right subject to be discussed and structuring an agenda can be useful skills. In general, he/she should enjoy in meeting, talking and exchanging. Opportunities for dialogue and exchange are the key to a successful approach.
- To be **self-reflexive** and collect the information to evaluate the success of each activity and learn which aspects can be improved. Also to exchange experiences with other facilitators.

Summing up, a hub coach needs, besides basic technical knowledge, also multiple social, communication and pedagogical skills in order to support group/network dynamics and farmers' learning.

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8.2.3. Learning tools

Learning tools can **support facilitation and the learning process**, but they have to serve a clear function and be as much focussed on the specific context and objectives. Tools should not become a purpose in themselves. It is important to think about what really adds value and addresses relevant questions. The cases mentioned **inspirationals documents** (e.g. brochures, film), **monitoring tools** and **tools to reflect** on one's own situation. Moreover, online tools and platforms may support facilitation and learning. Cases like AgriLink see learning tools mainly as communication channels and so mention app-groups or newspapers as important tools. As for facilitation and learning activities, we miss examples in the cases how these learning tools could specifically link to the IPM principles and be based on known facilitation and pedagogic methodologies, so they can address different learning processes.

A good example is the case of FABulous Farmers, who work with mirroring, reflecting, confronting, evoking reactions, evaluation and **inspiration** to induce learning.

> **FABulousFarmers:** *"A tool that is used is a brochure with the major species, pest properties and how to manage these. Possibly other materials will be introduced to make monitoring easier, like insect capture plates and bowls. (…) During the webinars they for example showed dreamed images of how the fields and environment could look like, implementing the FAB-measures, to inspire"*

Also **monitoring** is necessary to get to know one owns situation. Monitoring can be done to obtain technical data like timing and type of cultivation, fertilization, doses and frequency of PPPs; soil biota; soil weed seed bank; pests and diseases; crop yields. This can be done with different timing like weekly, yearly, biannually, etc. Besides technical data also more behavioural information can be gathered to reflect on, like attitudes and stress.

> **DIPS Germany:** *"…farmers provided their field records and information on yields, the DIPS scouts conducted the monitoring and therefore also the monitoring data collection, the PPP use data and the assessment of the necessary minimum. JKI did the evaluation and analysis of all data. No real advice was shared in relation to this, but it did become clear that farmers had problems with the level of "bureaucracy" involved in filling out forms, etc. And it is evident that quite a bit of learning was moved to outside the farm (in terms of analysis and drawing conclusions)."*

Besides monitoring, **mirror and reflection material** can help. This could be information flyers, brochures, leaflets, information boards for the farms, technical sheets, guidelines based on EU Sustainable Use Directive (2009/128/EG) and the associated National Action Plans, videos, evaluation sheets, self-assessment tools, etc. These materials can be used during sessions and brought back in at different moments. They can make things visible and concrete and will also help to identify strengths and weaknesses and set targets. **Reporting** on the practical outputs of the activities is a very important first step in this. Summarize main results on leaflets that farmers could use during the session and take home afterwards. These kind of reports are important to indicate the status of a process and progress and also to confront and evoke reaction, to make things visible and concretize. In the case of Ansari, this reporting also created a bound of trust, professionalism and appreciation.

> **Ansari:** *"new ways of working together with research. They had the feeling research was something far away that could not help them. In the project their ideas were valued in research and it was clear that the project was totally dependent on their input. Research*

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took up input and brought it back to them and showed what they got out of the sessions. So in the next session they could respond to processed information."

Last, but not least, a methodology is needed to evaluate and **assess the impact** of a learning activity. Some reporting is often done on the network's activities. A questionnaires at the end of events could also help. Networks reported on quantitative indicators (such as number of events, attendance at events, return attendees) as well as qualitative indicators such as improved knowledge, impact on practice, changing farmer attitudes and adoption, interactions within the hub and the network. However, measuring the impact of learning activities remains an issue many cases are struggling with.

> **RAP:** *"It is difficult to have a follow-up : what do they learn? What do they do with it? In each communication event, it is always frustrating, because it is an investment to organize such events. Ok, the day went good, the number of attendees was good, they are satisfied/happy. Even a satisfaction questionnaire is difficult to have replies, because it is outside, the configuration is not adapted, it is not convenient, people are dispersing afterwards."*

Finally, to support facilitation and learning, there also are options to work with **online platforms and portals** on websites or like WhatsApp groups, which can be used to have room for discussion, upload documents and share other content, to have a place where people can see everything in relation to farming type, cropping system, size, etc. and people can react on.

In conclusion, facilitating learning about holistic IPM requires a set of tools for inspiring, monitoring, reflecting and reporting on the network's activities. Online platforms and portals may support these actions. Tools to assess the impact of learning activities are, however, largely missing.

8.3. Reflection and conclusion

From the cases, it is clear that peer-to-peer exchanges can be highly effective, depending on the trust and shared issues. The creation of trust and reciprocity within a hub is supported by the hub coach, who acts as the group facilitator. Facilitation is about making people listen to each other by creating a safe space and group culture in which people feel confident to share their opinion and feel free to ask questions. For a successful hub, a good facilitator is key.

The facilitator (i.e. the hub coach) has multiple roles and needs multiple competencies. First, agronomic competencies are important. A facilitator should at least have basic competencies on IPM practices, and if more expertise is needed be able to tap into this expertise through his/her network. Second, a facilitator needs to have the competence to motivate and to create trust and informality. He/she thus also needs multiple social, communication and pedagogical competencies in order to support group/network dynamics and farmers' learning. In the cases, needs remain for supportive services that could help facilitators build their competencies to be communicative, adaptive and pro-active, both in physical and online meetings (that require specific skills). The validation workshop acknowledged this need for social competencies for creating a natural way of getting together with the growers and organise pleasant group learning experiences. Methods, tools and assistance for advancing social competencies of hub facilitators will be developed in task 1.4 of IMPWORKS and task 2.4 foresees capacity building for hub coaches in technical, economic and various soft skills.

The facilitation style may be highly organized, with a prominent role for the facilitator, following a schedule of prescribed interactions; or non-structured, with a less visible facilitator, without a schedule for interaction

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or prescribed rules of conversation, and thus having a more informal character. More experiences are needed to pinpoint which facilitation style can be used in which situations and in which kind of learning they result. However, it was mentioned by the cases that cultural preferences exist concerning the degree of formality, each country thus needs to consider those and choose facilitation styles and tools accordingly.

Learning tools can support facilitation and the learning process, but they have to serve a clear function and be as much focussed on the specific context and objectives. Examples found in literature are benchmarking tools and evaluation sheets to enable comparison between farmers; Decision Support Systems and cost-efficiency evaluations of IPM strategies. The cases mentioned inspirational documents (e.g. brochures), monitoring tools and tools to reflect on one's own situation. Moreover, online tools and platforms may support facilitation and learning.

Tools to assess the impact of the learning activities on farmers' learning and adoption of holistic IPM, however, are largely missing. It could be helpful to elaborate on those tools that could help to understand how peer-to-peer learning actually takes place.

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9. Communication

Highlights

1. A distinction should be made between internal and external communication strategies. Internal strategies should focus on strengthening the hub and peer-to-peer learning. External strategies should focus on sharing results and answering questions of stakeholders.
2. The combination in different type of communication and dissemination approaches is important, because people respond in different ways to data. A combination of hard data, with story telling to show the people and the effort behind the figures is favourable.
3. Story telling could be an interesting approach to convey messages.
4. Comics might be an interesting way to communicate from a cross-generational communication perspective.

9.1. Communication approaches mentioned in the interviews

There is a distinction in approaches used to communicate within the networks and disseminate information and outcomes towards stakeholders who are not directly involved in the networks.

> **AgriLink:** *"We have a Whatsapp group and broadcast lists. We have different roll-ups in the cooperative with relevant information such as efficacy of different products, or seed doses. Videos are also created for dissemination of test results. In general, farmers are adapting very well to digital communication tools, they are asking for example for videos of meetings that they couldn't attend."*

The following approaches were mentioned to disseminate the outcomes of IPM initiatives to stakeholders. These included:

- Written and hard-copy materials such as project reports, research papers, other publications (e.g. the LEAF Simply Sustainable Series, including on Integrated Pest Management), newsletter, annual survey results, brochures, information panels along walking routes in the field, pedagogic flyers, posters, factsheets, etc
- Social media (Twitter/Linked-In, WhatsApp, etc.)
- Face- to- face activities such as training activities (and associated materials), workshops, meetings, and of course visits to demonstration farms, field days, open door days, demonstration of IPM during events at demonstration farms, etc.
- Online materials such as videos (e.g. testimony of a farmer on the evolution of his farm, or a remarkable practice), dedicated youtube channels, podcasts, websites, webinars and lectures (e.g. in winter time in relation to topics of interest for farmers).
- The use of comics, perhaps less usual but potentially very interesting from a cross-generational communication perspective.
- Media items such as articles in the popular press (and press releases), interviews and news items on the national television and radio for dissemination outside the farming community.

For communication within the networks the following approaches were highlighted, including:

- Meetings: (regular) project meetings, project council meetings, project supervisor meeting, steering group meetings, network meetings – and minutes available for participants
- Annual conference
- Survey data to inform ongoing development of programme and design of activities.
- Individual farm reports, findings and implications- nutrition, finance, soil analysis.
- Reporting to funders
- Phone calls
- Emails
- Co-working platform
- WhatsApp groups
- Facebook pages

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9.2. Reflection and conclusion

When setting up a communication strategy, a distinction should be made between internal and external communication strategies. Internal strategies should focus on strengthening the hub and peer-to-peer learning. External strategies should focus on sharing results and answering questions of stakeholders.

During the validation workshop, the importance of combining multiple communication and dissemination approaches was mentioned, because people respond in different ways. For the wider public, it was suggested to base the communication strategy on numbers and hard data. However, it is also important to show that behind numbers also farmers are making efforts to change and reaching these numbers. Story telling was mentioned as an approach to help convey messages. Within IPM*WORKS*, WP6 will provide guidelines and assistance for setting up a communication and dissemination strategy in the different countries, but all partners are responsible to contribute to bring this strategy into practice.

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10. Conclusions

This deliverable, tried to provide some inspiration and good practices from literature and through interviews on cases of (IPM) (demo) farmer networks across Europe. The insights in this document will provide a good basis for upcoming tasks, materials, guidelines, tools and trainings that will be developed in the coming years. Besides the highlights and conclusions in each chapter, we provide in this chapter some key messages from the interviewees towards the IPM hub coaches for setting up there hub. Further, we also look forward, as this deliverable also elicits some gaps in knowledge and understanding on the creation of a successful environment for farmers to learn on IPM.

10.1. Key messages from the interviewees

A number of key messages were conveyed by interviews based on their experiences of IPM initiatives.

The first key message is the need to ***share experiences between participants and connect to other initiatives***. For example, in the AgriLink project, and more specifically, in the Spanish living lab, '*peer-to-peer interaction enhances farmers' knowledge and skills for IPM*'. As part of this, a key feature is the need to foster 'group feeling', exchanging knowledge and experiences (without pressure) between farmers, as this can be a strong motivation for farmers to join. As one interviewee puts it, we need to "*pay good attention to making this an enjoyable journey together. It also needs to be about "**pleasure and pride**". Very very important. It should not become some problem-solving process, but indeed a journey which as much as the market and policy allows, goes at the speed that the farmers can handle. This is also very much about the social side of innovation. Innovation is not just about changing agronomic/technical practices. Farmers need to feel they are in it together (as group)*". An important part of which is **to make initiatives more participatory in terms of their design and implementation**, taking the interests and needs of farmers as a point of departure. Such a process could progress throughout the project and beyond, with lessons learnt, knowledge, experiences, remaining accessible (especially to farmers) well after the end of IPM*WORKS*. Finally, the connectivity with other initiatives and institutes was considered important, particularly those that target other actors in the wider food system, such as supermarkets, policy makers, consumers, etc. Such an approach can help address systemic lock-in situations such as related to prices paid for farm products, and consumer demand, and help define the space for manoeuvre of farmers to apply IPM.

A second key message was the need to ***understand and address incentives and motivation of farmers to adopt IPM.*** It might be that the take up of IPM strategies needs an initial economic motivation to encourage farmers to get into the initiative in the first place. Others suggested that it was better to move slowly based on intrinsic motivation, rather than trying to move fast and then at the end find out that practices are discontinued. In any case, it is important to focus on the identification and response to the needs, expectations and interests of farmers - and this of course often relies on good relationships between farmers and advisors.

Finally, there are a number of ways in which *demonstrations, hubs and hub coaches can improve.* The first included the need for ***tailored and contextualised approaches.*** As mentioned above, this starts with a focus on engaging farmers and advisors, by acknowledging their interests, and then supporting them with practical,

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hands-on advice. This can help create a hub of active, participating actors. Once the hubs are created in different regions, the project can gain momentum and visibility to external, EU-level stakeholders and institutions, which can in turn help support its long-term sustainability. The focus therefore is very much on local needs, and is therefore user- and demand- driven. As part of this, there needs to be some flexibility, with not all approaches applied in the same way to different target groups, but rather a differentiation based on the needs and interests. The second consideration was around a ***focus on practical aspects,*** in particular practical skills and knowledge. One suggestion here was to frame demos in terms of practical aspects, rather than policies such as the Green Deal, or big political agendas. Practical activities were seen as essential to avoid resistance or lack of interest. In the same line, demonstrations are essential for farmers to trust novel technologies and strategies, and to ensure good comprehension and long-lasting engagement. The higher awareness achieved in the sector, especially regarding the multiple possibilities for a farmer to progress to IPM and to higher use of technology, impact on multiple stakeholders: a better link and communication between science and end-users, a more probable implementation of IPM strategies, impact on the national market, and better relationships between farmers and technology and phytosanitary suppliers. Demos therefore need to be attractive, understandable and something they want to copy, especially if we are talking about converting conventional farmers to IPM. As part of this, interviewees highlighted the ***importance of hub coach/independent third party in engaging farmers.*** Such individuals can help create an atmosphere of appreciation and motivation, starting from what is relevant for the farmer, but also bringing in knowledge about trends in terms of e.g. regulations, help provide a total-farm picture. They can also ensure that all farmers and stakeholders are well represented in meetings, webinars, workshops, and others activities. Indeed seeking out opportunities for dialogue and exchange seem key to a successful approach.

10.2. Taking this deliverable further

This deliverable and the validation workshop we organized in frame of this deliverable showed a lot of aspects on which support for the hub coaches can be provided in the coming years. Specific requests are information, guidance and training on, for example, how to develop common objectives in a hub, which learning activities to choose for which learning objectives, facilitation techniques to build trust, how to evaluate and adapt the common objectives to keep the farmers engaged, provide interviewing tips on how to keep the conversation going and to the point, how to decide on which stakeholder to involve and in which way. During the validation workshop various ideas were posited on how this deliverable could be translated in useful tools for the hubs. Suggestions were FAQ document linked to the guidelines for hubs (on how to overcome frequently occurring problems), information sheets, training, documents with hints, facilitate knowledge exchange between hub coaches on specific topics, a toolbox linked to this deliverable that gathers tools for each chapter. The project offers sufficient tasks to meet multiple of these suggestions, such the capacity building for hub coaches (Task 2.4) and the methods, tools and assistance for advancing social skills of hub facilitator (Task 1.4), the stimulation of learning through self-assessment (Task 1.2).

Further, this deliverable elicited some learning questions for IPM*WORKS* on how to set up an effective IPM learning environment for farmers. These can be addressed in course of the project, mainly through the analysis of the self-assessment reports (Task 1.2) and the case studies on newly launched hubs (Task 1.3). Here are some of the learning questions formulated based on this deliverable:

- How can farmers learn **holistic IPM** approaches? How to design learning activities and what are suitable learning methods and tools to address it?
- Which kind of learning activities address which specific type of learning processes and knowledge needs for IPM?

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- How can trust be built in peer-to-peer exchanges? How can we foster group interactions as part of a learning activity?
- How can networks and learning activities be made context specific? It might be interesting not to assume too much about commonality between ways in which networks work across Europe, and look more into needed variety in ways of working.
- Which facilitation methods and tools are appropriate for hub coaches with few experience in group facilitation? How to address the lack of natural social skills of some (more technically gifted) hub coaches? What is the impact of a duo-coach (one with facilitation skills and one with technical skills)
- Which ways of communication and motivations could attract the broader farming public and not just the frontrunners?
- How can we ensure the sustainability of the hubs post project?
- How to evaluate a learning activity and assess it's impact on the learning and adoption of farmers?
- How to deal with the multiple networks on specific topics being set up in EU projects? How can an integrative farm approach be promoted in this way?

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11. References

Barzman M., Bàrberi P., Birch A.N.E., Boonekamp P., Dachbrodt-Saaydeh S., Graf B., Hommel B., Jensen J.E., Kiss J., Kudsk P., Lamichhane J.R., Messéan A., Moonen A.-C., Ratnadass A.., Ricci P, Sarah J.-L., Sattin M. (2015) Eight principles of integrated pest management. Agronomy for Sustainable Development 35 (4): 1199–1215. https://doi.org/10.1007/s13593-015-0327-9.

Bayot M., Mouret J-C., Nougaredes B., Hammond R. (2011) Learning from ORPESA: A participatory approach for growers and researchers. raining in Integrated Pest Management – N°6, ENDURE, http://www.endure-network.eu/content/download/6247/46193/file/Training%20in%20Integrated%20Pest%20Management%20Number%20Six.pdf

Boller E.F., van Lenteren J.C., Delucchi V. (2006) History of the first 50 Years (1956–2006). International Organization for Biological Control of Noxious Animals and Plants (IOBC), https://www.iobc-global.org/download/IOBC_History_Book_1956-2006.pdf

Charatsari, C., Lioutas, E. D., & Koutsouris, A. (2020). Farmer field schools and the co-creation of knowledge and innovation: the mediating role of social capital. Agriculture and Human Values, 37(4), 1139-1154.

Cooreman, 2021, Enhancing peer learning for sustainable agriculture. On-farm demonstrations as spaces for embedded, embodied and transformative learning. Faculty of psychology and educational sciences, KULeuven, p. 203.

Damalas C.A. (2021) Farmers' intention to reduce pesticide use: the role of perceived risk of loss in the model of the planned behavior theory. Environmental Science and Pollution Research, https://doi.org/10.1007/s11356-021-13183-3.

Despotović J., Rodić V., Caracciolo F. (2019) Factors affecting farmers' adoption of integrated pest management in Serbia: An application of the theory of planned behavior. Journal of Cleaner Production 228: 1196-1205, https://doi.org/10.1016/j.jclepro.2019.04.149.

EC (no date) Integrated Pest Management (IPM), https://ec.europa.eu/food/plants/pesticides/sustainable-use-pesticides/integrated-pest-management-ipm_en, last consulted 6/7/2021.

Hill S.B., MacRae R.J. (1995) Conceptual frameworks for the transition from conventional to sustainable agriculture. Journal of Sustainable Agriculture 7(1): 81-87, https://doi.org/10.1300/J064v07n01_07.

Kemper L., Messean A., Viguier L., Paresys L., Willer H., Stilmant D. (2021) Crop Diversification: Making European Agriculture More Sustainable. https://zenodo.org/record/4783328#.YOSPkOgzY2y

Koutsouris et al, n.d, The analytical framework demonstration farms as multi-purpose structures, providing multi-functional processes to enhance peer-to-peer learning in the context of innovation for sustainable agriculture, D2.1 H2020 AgriDemo-F2F.

Lechenet, M., Dessaint, F., Py, G., Makowski, D., & Munier-Jolain, N. (2017). Reducing pesticide use while preserving crop productivity and profitability on arable farms. Nature Plants, 3(3), 1-6.

Meissle M., Romeis J., Bigler F. (2011) Bt maize and integrated pest management - a European perspective. Pest Management Science 67: 1049-1058, https://doi.org/10.1300/J064v07n01_07.

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Papp Komáromi J., Kiss J., Pálinkás Z. (2010a) Participatory training: principles, methods and experiences. Training in Integrated Pest Management – N°2, ENDURE, http://www.endure-network.eu/content/download/5223/41856/file/Number%20Two%20-%20Participatory%20training%20-%20principles,%20methods%20and%20experiences.pdf

Papp Komáromi J., Kiss J., Pálinkás Z. (2010b) Advanced participatory IPM training. Training in Integrated Pest Management – N°3, ENDURE, http://www.endure-network.eu/content/download/5320/42408/file/Number%20Three%20-%20Advanced%20Participatory%20IPM%20Training.pdf

Poulsen R.T., Petersen, P.H. (2009) Using experience groups to share knowledge and reduce pesticide use. Training in Integrated Pest Management – N°1, ENDURE, 8 p., http://www.endure-network.eu/content/download/5016/40751/file/Number%20One%20-%20Using%20experience%20groups%20to%20share%20knowledge%20and%20reduce%20pesticide%20use.pdf .

Stern V.M., Smith R.F., van den Bosch R., Hagen K.S. (1959) The integration of chemical and biological control of the spotted alfalfa aphid. The integrated control concept. Hilgardia 29: 81-101, http://www.entsoc.org/PDF/2009/2009-IntegratedControlConcept.pdf.

Tairraz J. (2020) Freins à la réduction de l'ultilisation des produits phytosanitaires. Enquêtes au sein des filières viticulture et grandes cultures du réseau ÉCOPHYTO DEPHY FERME. l'Institut Agro, Montpellier, 51 p.

Taylor, E. W., & Caldarelli, M., 2004, Teaching beliefs of non-formal environmental educators: a perspective from state and local parks in the United States. Environmental Education Research, 10(4), 451-469.

Thomas, T., 2010, The essence of being “non”: A phenomenological study of leaders’ beliefs within non-formal educational settings. A thesis submitted in partial fulfilment of the requirements for the degree of Master of arts in the Department of educational psychology and leadership studies, University of Victoria, p. 142

Triste, L., Vandenabeele, J., Van Winsen, F., Debruyne, L., Lauwers, L., & Marchand, F. (2018). Exploring participation in a sustainable farming initiative with self-determination theory. International journal of agricultural sustainability, 16(1), 106-123.

UNESCO Institute for statistics, 2012, A place to learn: lessons from research on learning environments, Canada, p.89, http://www.ibe.unesco.org/sites/default/files/resources/geqaf-2012_eng.pdf

Wijnands F.G., Brinks H., Schoorlemmer H., de Bie J. (2014) Integrated Pest Management Adoption in the Netherlands: Experiences with Pilot Farm Networks and Stakeholder Participation. In: Peshin R. & Pimentel D. (eds.) Integrated Pest Management. Experiences with Implementation, Global Overview, Vol.4, Springer, Dordrecht: 513-554.

Wijnands F., Malavolta C., Alaphilippe A, Gerowitt B. and Baur R. (2018) Integrated Production. IOBC-WPRS Objectives and Principles. 4th edition, International Organisation for Biological and Integrated Control – Western Palaearctic Regional Section https://www.iobc-wprs.org/ip_integrated_production/IOBC-WPRS_IP_objectives_and_principles_4th_edition_2018_EN.pdf Tomato greenhouses without pesticides myth or reality?

Wustenberghs H., Van Damme V.M., Berckmoes E., Moerkens R., Casteels H., Marchand F., Lauwers L., Tirry L., De Clercq P. (2016) Tomato greenhouses without pesticides myth or reality? Communications in Applied Biological Sciences, Ghent University, 81/3: 283.

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12. Annex

Annex 1: interview guide and reporting template

- Bold = main question
- Pink = interview guide with reporting questions
- Grey = space for reporting

• Start with introducing yourself and the research (not too long), and refer back to the informed consent. *Explain to the interviewee that this interview is part of the H2020 IPMWORKS project, in which an IPM demonstration network will be set up across countries, with the aim to increase the IPM adoption and decrease the pesticide use. Therefore, some existing networks will be connected and newly to develop hubs will be created in multiple countries. To allow a good start of these new hubs, we would like to capture the good practices for learning and adoption through IPM demo networks. Through interviews with coordinators/facilitators of already existing (IPM) (demo) networks, we will try to collect barriers and good practices for learning and adoption in these networks.*

1. General characteristics of the initiative

1. Introduction (complete based on the survey in Annex 1)
1. Name of the initiative: 2. Country of the initiative: 3. Website of the initiative (if relevant): 4. Start date of the initiative: 5. The initiative is coordinated by: 6. The initiative is funded by: 7. Annual funding budget: 8. Number of farmers involved in the initiative:

2. How is the initiative governed and sustained on longer term?
• What was the origin of the initiative? (e.g. project, introduction of new legislation, etc.) • What is your role in the initiative? • How is your initiative governed (E.g., who is coordinator, who takes decisions, which actor types are involved? how is the network structured?) • How is the initiative sustained on the longer term? (E.g. funding, embedding/institutionalization, …) • Which organisational or institutional aspects of your initiative/network can you clearly recommend to other networks? • Are the farms organised in (sub)groups (e.g. hubs) within the initiative? If so, roughly how many farmers are part of a (sub)group?

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• Please give examples of organisational difficulties of your initiative/network which should be avoided by other networks.

3. What is the objective of the initiative? If the objective is specifically focused on IPM, provide some information on the type of IPM promoted and examples of how it is promoted?
What is the objective of the initiative? • If the objective is focussed on IPM adoption, go into detail on the type of IPM promoted. For example, is there a focus on prevention, substitution, optimization of spraying, or combined. Do you focus on particular issues in particular crops? • What IPM methods (e.g. cultural practices, choice of varieties, crop rotation, intercropping, enhancement of biodiversity, pests control, decision making) are applied on the initiatives in your network? • Are innovative technologies (e.g. DSS, breeding, machinery, precision farming, optical detection) tested in your initiative/network? • Is IPM applied on the entire farm or limited to certain fields / crops? • Is there a focus on single step techniques or on systemic/holistic approaches? • Are participating farmers more interested in single step techniques or more in holistic approaches? • If relevant, can you give an example of how holistic IPM is promoted in your initiative?

4. Which farmer and other actor types are involved in the learning activities?
Who is involved in the (learning) activities of the initiative? • Which farmer types are involved in the initiative? E.g. frontrunner, early majority, organic, specific sector, multiple sectors … • If relevant, are the demo farms involved in your initiative commercial farms or research farms, or both? • Which other actor types are involved? How and what is their role? E.g. industry, farmer organisations, cooperatives, processors, suppliers, consumers, civils, … • Which stakeholders are actively involved in your initiative (e.g. farmers, advisers, researchers, policy makers, educators, suppliers, consumers, citizens)? • Are benefits and/or drawbacks related to the involvement of these types of farmers and other actors?

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2. Learning objective

5. What are the learning objectives of the different actors involved?
How are the objectives of the project and activities translated in learning objectives for the different actors involved? • What do they have to/want to learn? • Are specific knowledge, skills, competences or methods learned?

6. Describe the types of (learning) activities organised in the initiative and provide some good practices associated with them. Learning activities can be face-to-face advice, seminars, farmer discussion groups, demonstrations, …
What **type of (learning) activities** are organised for the implementation of IPM or other sustainable farming techniques? *Pay specific attention to peer-to-peer learning activities and demonstrations. Make sure you understand exactly the format/details of the activities (e.g; location of the activities, frequency of the activities, type of knowledge exchanged, target participants in the activities, …) based on the following interview questions:* • What type of knowledge is exchanged? • What are successful places for these activities to take place? • How many times and when do farmers meet? And do you think it is a beneficial meeting rate? • Can you give examples of successful knowledge exchange methods amongst farmers? (e.g. workshops, demonstration events and field days)? • What is the role of peer-to-peer learning in the (learning) activities? And how is it facilitated? • Ask for each activity what makes these activities successful according to the interviewee and why. • Ask for each activity what are difficulties in making these activities successful and why (and how do they deal with these difficulties). • Give any examples of knowledge exchange with organic farms your initiative has engaged in.

Activity description	Success factors	Difficulties
Activity 1 *Description (e.g; location of the activities, frequency of the activities, type of knowledge exchanged, target participants in the activities, …)*		
Activity 2		

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3. Learning space

7. Describe the role of demonstrations and how they are organised in the initiative.
What is the role of demonstrations and how are they used in the initiative? Are there any benefits/drawbacks related to the function they give to the demonstrations in their initiative? • Can you give an example of a successful demonstration format in your initiative? Why was it successful according to you? • If relevant, can you give an example of a successful way to demonstrate holistic IPM? • What was demonstrated? Give examples of very attractive content related to holistic IPM-demos. • Please give examples of ways of demonstrating IPM practices or other sustainable farming techniques (facilitation) that have been particularly effective in your network. What is the role of peer-to-peer learning in the learning activities? • Can you give any examples of how peer-to-peer exchanges are facilitated?

8. Describe the tools used to support the learning? How are they used, and what are their benefits and what are their drawbacks?
Do you use **specific tools** to support the learning in your initiative? (For example, decision support tools, evaluation sheets, data collection tools, communication tools (report, video's, …), …) • How is knowledge generated? • Who collects which kind of data or information in your initiative network? What is the purpose of the data collection? • In which activities are these used? • How are they used? • What is the benefit of their use? • What are (potential) drawbacks of their use?

9. Who facilitates the knowledge exchange and learning activities in the initiative? What is their role in the initiative and how are they trained?
Who facilitates the knowledge exchange and learning activities in the initiative? • What is their profile and required skills? • What is their role in the initiative? • What is the role of the advisors (coordinators, facilitators, hub-coaches) in capacity building? • Is there a coordinator/ stakeholder inside the network/ institution responsible for the data analyses?

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• How do they further develop these required competencies? (training, peer-to-peer exchange, …) • Does the initiative provide training for the facilitators? If so, which kind of training? • Do you organize peer-to-peer knowledge exchange for advisors and how? (e.g. seminars, farm tours, webinars)

4. Farmer engagement

10. How are farmers attracted to become member of the initiative?
How farmers are attracted to become a member of the initiative? • How do you motivate / convince farmers to join the initiative network? E.g. approached by the local advisor, article in local media, … • Is the initiative open to new members? If yes, how are they attracted? • How are farmers committed to the network? E.g., contract, agreement, motivation letter, … • Is any farmer welcome to participate in the initiative? • What is expected from farmers to join the initiative? • What are the farmers' motivations to join the initiative?

11. How are farmers engaged to actively participate in the initiative?
How farmers are engaged to actively participate in the initiative? • How are farmers committed to the network? E.g., contract, agreement, … • Do the farmers participate in the development of the learning activities? If yes, how? • How is a sense of group feeling fostered in the network? E.g., Launching group inquiry activities, animating farmers to engage in team reasoning, encouraging their active involvement in the knowledge discovery process, and helping trainees to make sense of their learning experiences through the collective elaboration of knowledge, • How is trust generated in the initiative? • Do the participating farms receive project related financial support (e.g. compensation for yield losses; support for additional costs such as seeds, additional farm operations, machinery and field days; or reimbursement for other activities)?

5. Evaluation and outcomes

12. What are successful outcomes of the initiative and what contributed to these outcomes?
Can you give examples of successful outcomes of the initiative? • What contributed to the success of the outcomes? • If relevant, can you give an example of IPM strategies that have been successfully implemented by participants of your initiative? What contributed to their success

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(e.g. financial support, being part of a demo network, enough (financial) space to experiment, experience of farmer him/herself, etc.)?
- If relevant, could you give an example of successfully adopted IPM decision support tools in your initiative? Could you say what contributed to their success?
- If you are targeting multiple sectors? Do you see different outcomes in different sectors and could you explain why?
- Which sociological effects do you observe in the project? (e.g. increased awareness among farmers, policy makers, consumers; changes in advisory services)

13. How are the success/impact of the (learning) activities measured?
How do you evaluate the **success/impact** of the (learning) activities (incl. demonstrations)? • Which indicators are used to measure success the success of the activities (qualitative and quantitative)? (e.g. changing farmer attitudes and adoption, interaction within the network, attendance to the activities) • Which indicators are used to evaluate tested IPM strategies or other sustainable farming techniques (qualitative and quantitative)? (E.g., pest control (pest/disease incidents), economic (yields), social (decision making, labour (monitoring effort), health), environmental (use of pesticides), legal, societal) • Can farmers evaluate the organised activities? How? • Is the adoption of IPM strategies or other sustainable farming techniques by farmers monitored and how?

14. How are outcomes of your initiative communicated inside and outside of the initiative?
How are outcomes of the initiative communicated/disseminated towards stakeholders How are outcomes of the initiative communicated/disseminated within the initiative?

15. Which factors hinder the adoption of IPM strategies/sustainable farming practices by the participants?
Which factors hinder targeted outcomes of the initiative or hinder the adoption of IPM strategies/sustainable farming practices? *Don't stick to initiative-related factors, but also ask for context-related factors such as legislation, stakeholders, economics, opinions, other initiatives, attitude in the sector, …* • Are there factors that stimulate or hinder farmers to adopt sustainable farming practices? (e.g. legislation, farming and environmental stakeholders, financial incentives, inhabitants, other farmers or economic sectors, opinions, political statements, other initiatives…) • If relevant, please give examples of barriers to adoption of specific IPM practices by farmers.

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• If relevant, please give examples of IPM practices which turned out to be less effective than anticipated. • If relevant, what is the impact of the National Action Plans on the success of the initiative? • What is the impact of other regulations/factors on the success of the initiative? • How does the awareness/attitude in the sector influence the success of the initiative? • Do you have any examples of the contribution or resistance of stakeholders to the success of the initiative? And how do you deal with it? • If you are targeting multiple sectors? Do you see different outcomes in different sectors and could you explain why?

6. Conclusions

16. Conclusions
Finalise with a positive note and some main conclusions. Check the main points with the interviewee, give the opportunity to evaluate the interview and the questions, point out the next steps that will be done with the given information. • What would be your main recommendations to new initiatives? Outline what will happen with the data. The report will first be send to the interviewee to give the opportunity to check it.

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