D 3.6 COMMON CHALLENGES ANALYSIS AND TECHNOLOGY REUSABILITY EXPLOITATION

PUBLIC VERSION

WP 3

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
CC	Competence Center
DIH	Digital Innovation Hub
FIE	Flagship Innovation Experiment
IE	Innovation Experiment
KPI	Key Performance Indicator
RC	Regional Cluster
SAH	SmartAgriHubs
WP	Work Package

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PROJECT SUMMARY

Digital technologies enable a transformation into data-driven, intelligent, agile and autonomous farm operations, and are generally considered as a key to address the grand challenges for agriculture. Recent initiatives showed the eagerness of the sector to seize the opportunities offered by ICT and in particular data-oriented technologies. However, current available applications are still fragmented and mainly used by a small group of early adopters. Against this background, SmartAgriHubs (SAH) has the potential to be a real game changer in the adoption of digital solutions by the farming sector.

SAH will leverage, strengthen and connect local Digital Innovation Hubs (DIHs) and numerous Competence Centres (CCs) throughout Europe. The project already put together a large initial network of 140 DIHs by building on its existing projects and ecosystems such as Internet of Food and Farm (IoF2020). All DIHs are aligned with 9 regional clusters, which are led by organizations that are closely related to national or regional digitization initiatives and funds. DIHs will be empowered and supported in their development, to be able to carry out high-performance Innovation Experiments (IEs). SAH already identified 28 Flagship Innovation Experiments (FIEs), which are examples of outstanding, innovative and successful IEs, where ideas, concepts and prototypes are further developed and introduced into the market.

SAH uses a multi-actor approach based on a vast network of startups, SMEs, business and service providers, technology experts and end-users. End-users from the agri-food sector are at the heart of the project and the driving force of the digital transformation.

Led by the Wageningen University and Research (WUR), SAH consists of a pan-European consortium of over 160 Partners representing all EU Member States. SAH is part of Horizon2020 and is supported by the European Commission with a budget of €20 million.

EXECUTIVE SUMMARY

The SmartAgriHubs (SAH) project, under the H2020 program and led by Wageningen University and Research, aims at progressing the digital transformation of the European Agri-Food sector. SAH uses a multi-actor ecosystem to build upon the excellence, knowledge and innovation that is present all over Europe in start-ups, SMEs, business and service providers and end-users. Specifically, SAH aims at strengthening and maturing the services of Digital Innovation Hubs (DIHs) and Competence Centres (CCs) throughout Europe. The main purpose of DIHs and CCs is to support digital innovations in agri-food, in the form of Innovation Experiments (IEs). SAH already identified 28 Flagship Innovation Experiments (FIEs), which are examples of outstanding, innovative and successful IEs, where ideas, concepts and prototypes are further developed and introduced into the market.

This specific deliverable D3.6 "Common challenges analysis and technology reusability exploitation" aimed (1) to further identify and rank challenges experienced during the execution of the FIEs and to analyse solutions and (2) to collect reusability data with the focus on received and requested support, the availability, users, favoured stakeholders and the promotion plan. The SAH project does not claim to determine the best (non-) technological solutions, but all stakeholders and FIEs can learn from the chosen solutions for the specific agricultural challenges of each FIE.

The predominant ranked issues are related to the FIE execution, management, participants or general remarks. Fifty-eight percent of the problems are already solved, especially challenges about participants, technology, data collection and privacy, FIE execution, communication and general issues. The SAH work packages, regional clusters, FIE coordinators and their partners, and future initiatives can learn from this deliverable to continue or improve services and to circumvent some issues related to the topics:

- General remarks
- Participants
- Technology
- FIE execution
- Data collection and privacy
- Management
- Budget
- Communication
- Work Packages
- DIHS and CCs

In total, 76 technological and 38 non-technological requirements were collected. The percentage of fulfilment increased in comparison with September 2019. Support from current CCs and DIHs is often present and mainly satisfying. However, more support from CCs and DIHs is requested, especially for technological requirements, but can be mainly covered by current CCs and DIHs. A high number of reusable components are available: 103 out of 114 requirements, with 28 new available tools. The majority of reusable components are situated in the arable sector. Half of the non-technological requirements can be used in 5 or 7 sectors, making them less sector-specific. Additional support is requested for the promotion of the reusable components. Also a large need for trainings is observed with topics: (reusability) promotion, exchange of knowledge, data sharing, the FIEs' overall solution and business plans. Also public events should be organized for farmers, advisors and agronomists.

This is the public version of the deliverable.

1. INTRODUCTION

The H2020 project "SmartAgriHubs" aims to develop and support Agricultural DIHs in order they can help digitizing farmers and agricultural communities at local level by offering a variety of services (technical, business, ecosystem). The SAH project is collecting tools, material and good practices, provides these to DIHs and makes these available in the Innovation Portal. The 28 Flagship Innovation Experiments (FIEs), developing innovative digital applications, have also a specific function related to develop the DIHs. In each FIE at least one DIH is involved to provide one or more services. The FIEs are important to activate the system by connecting end-users, technology providers and DIHs.

The SAH project contains several Work Packages to ensure a good progress and support of the project. Tasks of WP 3, directed by BioSense Institute and ILVO, leader and co-leader respectively, are amongst others to closely monitor the progress of the (F)IEs, to identify synergies, reusable components and joint activities among the (F)IEs, based on common technological and non-technological aspects.

In the conceptual and proposal phase of the SAH project, a multi-criteria, multi-stage inclusive approach was applied by WP 3 to select the most suitable FIEs, as multipliers of the value proposition of our pan-European network of DIHs:

- Regional Cluster Leaders (RCLs) and Co-Leaders (RCCLs) were appointed based on the following criteria:
    o Geographical coverage and segmentation of Europe according to geographical criteria of similarity among farming systems
    o Institutionalization: balance was kept between different actors that would act as RCs, e.g. DIHs, CCs, ecosystem facilitators, government etc.
- Potential FIEs were harvested using a template, ensuring that the main aspects of the FIE, i.e. innovative character, maturity, impact on regional farming systems, are requested by interested parties.
- All RCLs and RCCLs were invited to inform their ecosystem about this informal request for ideas and a number of ideas were sent to them.
- A group of independent (from the project) technical/agronomic/business experts was established from Wageningen UR to support in the evaluation and ranking of ideas.
- The core proposal team introduced some additional criteria including differentiation across regions, value-chain coverage, relevance for DIHs services and multi-actor approach and also estimated the potential of FIEs to produce re-usable assets that could be exploited by our DIH network.
- The final short-list was created and negotiations were organized with each FIE separately, requesting improvements in content and securing reusability of results.
- All FIEs were presented in an Annex in the proposal, while main points were also high-lighted in the body of the proposal. The Execution Plans of the FIEs can also be found in Deliverable 3.2.

This deliverable D3.6 "Common challenges analysis and technology reusability exploitation" aims (1) to further identify and rank common challenges experienced during the execution of the FIEs and (2) to analyze the progress of the technological and non-technological requirements in terms of their fulfilment, received and requested support, reusability, availability, users, favored stakeholders and promotion plan.

The SAH project does not claim to determine the best (non-)technological solutions nor guarantees the usability of the solutions in another context, but all stakeholders and FIEs can learn from the chosen solutions for the specific agricultural challenges of each FIE.

The (non-)technological components are chosen based on the in-house knowledge, experience and tools of the DIHs, CCs and other partners within the FIEs and are further developed and tested within the FIEs in order to tackle the FIEs' agricultural issues.

This deliverables D3.6 (M24) results from the work in Task 3.3 "Technology Support and Synergies". This deliverable is closely related to deliverables (1) D3.3 "Learning takeaways from FIEs" (M18), summarizing the FIE-specific problems, challenges and lessons learnt, and (2) D3.5 "Technology requirement identification" (M11), identifying the technological and non-technological requirements and their reusability of the 28 FIEs from the start of the project till September 2019. A next analysis of the (non)-technological requirements and reusable components will be presented in deliverable D3.5 II (M36).

The identified technological requirements in Deliverable 3.5 were very divers ranging from hardware and sensors over data models, algorithms and data processing to datahubs, API management and software solutions. The non-technological requirements were categorized as procedures or workflows, trainings, networking, business models and knowledge and services. Both technological and non-technological requirements can be reusable. The reusability is estimated by the FIE coordinators and partners. Whether the solution is really reusable as such, is to be validated when it is being used by a number of other systems and users. Very often this will require modifications.

This inventory of challenges, reusable components and exploitation will add to the final goals of WP 3 as described in the Key Performance Indicators' list:
- Final number of (F)IEs by replication between DIHs
- Reusable components delivered by (F)IEs
- Reusable components used by (F)IEs
- Number of farms involved
- Number of digital solutions that are introduced into the market
- Successful connections of CCs with IEs in DIHs

These intermediate results (M24) will determine the future points of attention for WP 3 to reach the overall KPIs.

The content of this deliverable will also enable to look for synergies and matchmaking among FIEs, to continue or improve the support and services of the several Work Packages (WP) of the SAH project and to strengthen the close collaboration among the WPs:
- The communication team (WP 1) of the SAH project can gain insight from the ranked challenges and requested support related to the promotion of the reusable components, resulting in the organisation of trainings and webinars. Success stories and failures will be disseminated via the Innovation Portal.
- New partners from the RESPOND open call and future partners from the RESTART and EXPAND open call (WP 2) will benefit from identified challenges and given solutions.
- All summarized issues and requested support are very helpful for the monitoring work package (WP 3) to facilitate the progress and support of the FIEs, with emphasis on the reusability and sustainability.
- The summarized services of DIHs (WP 4) and requested support are significant feedback for the DIH network. DIHs can gain maturity and improve their services
- The identified Competence Centers' services (WP 5), extra demanded support and technological issues are meaningful to further expand the network of CCs and assist all current CCs.
- The SAH management team (WP 6) can learn from the ranked challenges and described solutions.

Also regional clusters, FIE coordinators and their partners and new partners can benefit from the drawn conclusions to circumvent and tackle certain problems when participating in future initiatives (within or outside the SAH project).

2. APPROACH & METHODOLOGY

2.1 COMMON CHALLENGES ANALYSIS

In Deliverable 3.3 "Learning takeaways from FIEs" the FIE-specific problems/challenges and lessons learnt were already summarized. Input was derived from the Annual Progress Report of the 28 FIEs, the 9 Regional Clusters' Annual Progress Reports as well as from a conducted questionnaire. The results were summarized, compared and grouped into 10 categories: participants, technology, FIE execution, management, budget, communication, data collection and privacy, DIHS and CCs, collaborations, and general. A summary of Deliverable 3.3 "Learning takeaways from FIEs" is given below.

The challenges and lessons learnt from and for the participants are mainly how to work closely together and be dedicated, to be less dependent (e.g. from technology providers), to select the appropriate companies and to circumvent problems when personnel is changing. Most end-users within the FIEs are farmers, who often lack the experience of working with digital technologies and don't have a lot of time, but are very willing to cooperate except when special IT infrastructure or test characteristics are required (e.g. several feed additives on 1 farm). A pragmatic approach in dedicated teams is necessary, the benefits for the end-users should be emphasized and awareness should be created about the farmers' work and world. The entire SAH ecosystem should be further expanded, but is already very useful for the stakeholders.

Technological challenges have been reported in many regions and are very FIE- and technology-specific. A lot of them are already solved, but more support is still requested. Almost half of the FIEs are also planning to extend their technology. The innovation portal of the SAH project can be a very valuable tool to allow partners to exchange their technological improvements and successes.

In the beginning of the project some teething problems occurred concerning the FIE execution. FIEs also learnt the importance of a good market analysis, product identification and promotion, customers' needs survey, good advisory services and an early validation of the results.

A lot of partners and subcontractors lack the experience of participating in a large EU project, resulting in several struggles related to contracts, deliverables and payments. Other management concerns are the amount of administrative requests and task, short deadlines, the number of obliged meetings and the monthly instead of seasonal focus.

A clear-cost benefit calculation seemed necessary and more support is demanded. In general the FIEs are happy with the chances and resources received from the SAH project. A platform or online tool with information about current and future funding opportunities would be very welcome.

The communication within a large project is very crucial and some challenges occurred. The project-specific terminology sometimes complicates presentations and pitches. A request for workshops, trainings, surveys and emails in native languages was launched. The innovation portal was assessed as very useful and should be further expanded and used. The (inter)national events are very fruitful for the SAH community.

Data awareness is created through this project. The importance of data privacy and IP agreements within FIEs was emphasized. GDPR issues should be solved at the EU level. Some extra support is asked for data models and analyses.

In general, a good collaboration with the DIHs and CCs was observed and the maturity of the DIHs participating in the FIEs was satisfying, but still more support is demanded. Several additional services of both DIHs and CCs were requested. The contact between DIHs and CCs was also stressed as very important. Benefits for DIHs are the ability to gain knowledge and experience, to be supported in their mission and to showcase their capabilities.

Half of the FIEs are already collaborating with FIEs within their region whereas one fourth is also interested in connections with FIEs outside their regional cluster, but these contacts are not yet made. The majority of FIEs is also in contact with new DIHs, CCs, WPs and

new companies both within and outside their region. The innovation portal and international (physical) meetings will enhance this process.

Also general advantages of participating in the FIEs of the SAH project were formulated, such as a decrease of economic losses, an increased animal health and welfare, new knowledge and experiences, and a positive image for the entire agri-food sector. A good spirit in the SAH project is perceived. Several regions are very satisfied with the structure of the project, i.e. with the WPs, RCs, and FIEs. Future initiatives, such as the open call and the development of new projects, can benefit from the conclusions from this deliverable.

All reported issues experienced during the execution of the FIEs reported by the FIE coordinators, RC leads and co-leads (Deliverable 3.3) were categorized and presented in a table (Table 1). The FIE coordinators were kindly asked to select their top 10 most prevalent and relevant issues and to give a short explanation of their potential solution to circumvent the indicated problem.

Table 1: Template "Common challenges analysis"

Category	Challenge[1]	Your votes[2]	Your solution[3]	Already applied?[3]	
General	SAH project-specific terminology			Yes	☐
				No	☐
	Lack of experience of participants			Yes	☐
				No	☐
	Sustainability of the developed solutions after the SAH project			Yes	☐
				No	☐
	Low productivity in agriculture and forestry			Yes	☐
				No	☐
Participants	Close collaboration of participants within the FIE, resulting in dependency			Yes	☐
				No	☐
	Collaboration with farmers (with less experience and a lot of work)			Yes	☐
				No	☐
	Willingness of participants/end-users to cooperate			Yes	☐
				No	☐
	Internal (personnel) changes within participating companies			Yes	☐
				No	☐
Technology	(FIE-specific and technology-specific) technological issues			Yes	☐
				No	☐
FIE execution	Outline of the FIE, aims, definitions not yet clear in the beginning (resulting in changes in the Execution Plan)			Yes	☐
				No	☐
	Seasonal impact (weather conditions, growth season of the crops)			Yes	☐
				No	☐
				Yes	☐

	(Unexpected) time-consuming activities			No	☐
	Lack of advisory services			Yes	☐
				No	☐
Data collection and privacy	GDPR, open source data and privacy			Yes	☐
				No	☐
	IP agreement among participants within the FIE			Yes	☐
				No	☐
Management	Administration, (short) deadlines and detailed time-consuming requests from the SAH project			Yes	☐
				No	☐
	High number of obliged meetings and events			Yes	☐
				No	☐
	General project management: contracts and payment of partners and subcontractors			Yes	☐
				No	☐
	Complex Work Package deliverables with not enough added value for all participants			Yes	☐
				No	☐
	Monthly follow-up instead of seasonal			Yes	☐
				No	☐
Budget	Unclear division and availability of the budget and budget shifts			Yes	☐
				No	☐
	Clear cost-benefit calculation needed			Yes	☐
				No	☐
Communication	No common (native) language			Yes	☐
				No	☐
	Difficult planning of meetings, bad organization of survey(s)			Yes	☐
				No	☐
	Need for trainings and demonstrations about digital technologies			Yes	☐
				No	☐
	Innovation Portal: final contact list and registration of DIHs			Yes	☐
				No	☐
	Merging interest of all participants of the FIE			Yes	☐
				No	☐
Work Packages	Visibility of future tasks of the different Work Packages and avoiding overload			Yes	☐
				No	☐
	Exchange of experiences among Regional Clusters, e.g. in WP 1 telco			Yes	☐
				No	☐
	Sectorial sessions			Yes	☐
				No	☐

DIHs and CCs	Non-interested DIHs			Yes ☐
				No ☐
	Need for trainings and clear definitions of DIHs and CCs			Yes ☐
				No ☐

[1]SAH Deliverable 3.3 "Learning takeaways from FIEs"

[2]Please select your top 10 challenges by adding numbers 1 to 10 in this column (one being the most relevant or burning challenge, and 10 the least)

[3]Add your solution/suggestions to your 10 chosen challenges and indicate if your solution is already applied

In order to get a clear understanding of the main joint <u>technological issues</u> all FIEs are facing, the FIE coordinators were also asked to complete an additional table (Table 2).

Table 2: Template "Common technological issues analysis"

	Technological issue	Your solution[1]	Already applied?[1]
Example 1			Yes ☐
			No ☐
Example 2			Yes ☐
			No ☐
Example 3			Yes ☐
			No ☐
Example 4			Yes ☐
			No ☐
Example 5			Yes ☐
			No ☐
Other[2]			Yes ☐
			No ☐

[1]Add your solution/suggestions to your examples and indicate if your solution is already applied

[2]In case >5 technological issues were experienced, please copy-paste this row

Both templates (Table 1 and Table 2) were sent to all FIE coordinators (end of September 2020). In the monthly RC meetings, organized and hosted by WP 3 management team, the templates were also explained to the FIE coordinators and the RC leaders and co-leads. The FIE coordinators were asked to complete the template for their FIE together with the FIE partners. WP 3 was in charge of the collection of the completed templates, actively supported the FIE coordinators and partners and checked the quality of the reports.

The number of selections per challenge (in top 10 ranking) were counted. Also ranking of the challenges (weighting factor) was analysed and visualized. The solutions and remarks were summarized.

2.2 TECHNOLOGY REUSABILITY EXPLOITATION

Deliverable 3.5 "Technology requirements identification" collected the technological and non-technological requirements and the reusable components among them. In this deliverable all progress is being collected with a FIE-specific prefilled template for all technological and non-technological requirements (Table 3 and 4). The white parts (September 2019) were prefilled by WP 3 based on the input from Deliverable 3.5 (a separate table for each technological and non-technological requirement). The FIE coordinators were kindly asked to complete the green parts of all tables in the template (September 2020).

Table 3: Template "Technology reusability exploitation: technological requirements"

#1[1]	Technological requirement 1				
	September 2019[2]	**September 2020**			**Comments**
Already fulfilled in the FIE?	Yes ☐ No ☐	Yes ☐ No ☐			

Did you receive support from a DIH?	Yes ☐
	 No ☐
		Yes ☐
		 No ☐
			A new[3] DIH? Yes ☐
			   No ☐
			
			 Satisfied? Yes ☐
			   No ☐
			
			 Services received (keys words): …		

Did you receive support from a CC?	Yes ☐
	 No ☐
		Yes ☐
		 No ☐
			A new[3] CC? Yes ☐
			   No ☐
			
			 Satisfied? Yes ☐
			   No ☐
			
			 Services received (keys words): …
			
			 Contact through your DIH? Yes ☐
			   No ☐		

Additional support needed?	Yes ☐ No ☐	Yes ☐ No ☐			
Additional support needed from a DIH?	Yes ☐ No ☐	Yes ☐ No ☐	A new[3] DIH? Yes ☐ No ☐		
Additional support needed from a CC?	Yes ☐ No ☐	Yes ☐ No ☐	A new[3] CC? Yes ☐ No ☒		
Reusable?	Yes ☐ No ☐	Yes ☐ No ☐			

Reusable component TRL?		Current TRL? ...	Target TRL? ...	
Reusable component impacted sectors?	Livestock ☐ Arable ☐ Fruit ☐ Vegetable ☐ Aquaculture ☐	Animal production ☐ Dairy ☐ Arable ☐ Fruit ☐ Vegetable ☐ Aquaculture ☐ Novel foods ☐		
Reusable component already available?	Yes ☐ No ☐	Yes ☐	Against payment? Yes ☐ No ☐ Existed before/at the start of SAH? Yes ☐ No ☐ Validated in SAH? Yes ☐ No ☐ Developed in SAH? Yes ☐ No ☐	
		No ☐	When? ... Against payment? Yes ☐ No ☐	
Who can benefit from the reusable component?		Farmers Technological companies Software developers Advisors DIHs CCs Retailers Consumers Other FIEs Other	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ FIE n°?	
Reusable component already in use by others?		Farmers Technological companies Software developers Advisors DIHs CCs Retailers Consumers Other FIEs	☐ Number? ... ☐ Number? ... ☐ Number? ... ☐ Number? ... ☐ Number? ... ☐ Number? ... ☐ Number? ... ☐ Number? ... ☐ FIE n°? ...	

		Other	… Number? …	
Reusable component promotion (plan)?		…		
Did you receive support from any DIH for the promotion or adoption of the reusable component in other businesses?		Yes ☐ No ☐	Approach? …	
Additional support needed for promotion?		Yes ☐ No ☐	When? …	
Need for a training or workshop in the upcoming period?		Yes ☐ No ☐	Topic … (promotion, reusability, exchange of knowledge…) and public?	

[1]In case of new technological requirements, since September 2019, please copy-paste the table

[2]SAH Deliverable 3.5 "Technology Requirements identification"

[3]Other than the one(s) in September 2019

The templates with all tables (Table 3 and Table 4 for each technological and non-techno-logical requirement, respectively) were sent to all FIE coordinators (end of September 2020). In the monthly RC meetings, organized and hosted by WP 3 management team, the templates were also explained. The FIE coordinators were asked to complete the tem-plate for their FIE together with the FIE partners. WP 3 was in charge of the collection of the completed templates and checked the quality of the reports.

Table 4: Template "Technology reusability exploitation: non-technological requirements"

#1[1]	**Non-technological requirement 1**			
	September 2019[2]	**September 2020**		**Comments**
Already fulfilled in the FIE?	Yes ☐ No ☐	Yes ☐ No ☐		
Did you receive support from a DIH?	Yes ☐ No ☐	Yes ☐ No ☐	A new[3] DIH? Yes ☐ No ☐ Satisfied? Yes ☐ No ☐ Services received … (keys words):	

Did you receive support from a CC?	Yes ☐ No ☐	Yes ☐ No ☐	A new[3] CC?	Yes ☐ No ☐	
			Satisfied?	Yes ☐ No ☐	
			Services received (keys words):	…	
			Contact through your DIH?	Yes ☐ No ☐	
Additional support needed?	Yes ☐ No ☐	Yes ☐ No ☐			
Additional support needed from a DIH?	Yes ☐ No ☐	Yes ☐ No ☐	A new[3] DIH?	Yes ☐ No ☐	
Additional support needed from a CC?	Yes ☐ No ☐	Yes ☐ No ☐	A new[3] CC?	Yes ☐ No ☒	
Reusable?	Yes ☐ No ☐	Yes ☐ No ☐			
Reusable component TRL?		Current TRL? …	Target TRL? …		
Reusable component impacted sectors?	Livestock ☐ Arable ☐ Fruit ☐ Vegetable ☐ Aquaculture ☐	Animal production ☐ Dairy ☐ Arable ☐ Fruit ☐ Vegetable ☐ Aquaculture ☐ Novel foods ☐			
Reusable component already available?	Yes ☐ No ☐	Yes ☐	Against payment?	Yes ☐ No ☐	
			Existed before/at the start of SAH?	Yes ☐ No ☐	
			Validated in SAH?	Yes ☐ No ☐	
			Developed in SAH?	Yes ☐ No ☐	
		No ☐	When?	…	
			Against payment?	Yes ☐	

				No ☐	
Who can benefit from the reusable component?		Farmers	☐		
		Technological companies	☐		
		Software developers	☐		
		Advisors	☐		
		DIHs	☐		
		CCs	☐		
		Retailers	☐		
		Consumers	☐		
		Other FIEs	☐ FIE n°? …		
		Other	…		
Reusable component already in use by others?		Farmers	☐ Number? …		
		Technological companies	☐ Number? …		
		Software developers	☐ Number? …		
		Advisors	☐ Number? …		
		DIHs	☐ Number? …		
		CCs	☐ Number? …		
		Retailers	☐ Number? …		
		Consumers	☐ Number? …		
		Other FIEs	☐ FIE n°? …		
		Other	… Number? …		
Reusable component promotion (plan)?		…			
Did you receive support from any DIH for the promotion or adoption of the reusable component in other businesses?		Yes ☐ No ☐	Approach? …	
Additional support needed for promotion?		Yes ☐ No ☐	When? …	
Need for a training or workshop in the upcoming period?		Yes ☐ No ☐	Topic … (promotion, reusability, exchange of knowledge…) and public?	

[1]In case of new non-technological requirements, since September 2019, please copy-paste the table

[2]SAH Deliverable 3.5 "Technology Requirements identification"

All collected data were inserted in an Excel spreadsheet in order to make pivot tables and graphs and to perform analyses related to the fulfilment, received and requested support, reusability, availability, users, favored stakeholders and promotion plan.

3. RESULTS

3.1 COMMON CHALLENGES ANALYSIS

Selected challenges

Twenty-three FIEs selected and ranked 10 challenges whereas 2 FIEs choose 9, 1 FIE 7 and 1 FIE only 3 and 1 FIE even 11 challenges, resulting in 269 selections (Figure 1). Most of the problems concerned the execution of the FIE, management, participants or are general issues (Table 5). The need for a clear-cost benefit calculation (budget) was not selected although mentioned in deliverable D3.3 "Learning takeaways from FIEs". Detailed results per RC and per FIE can be found in the confidential version of this deliverable in Annex 5.1.

Figure 1: Selected challenges experienced during the execution of the 28 Flagship Innovation Experiments belonging to the categories: General, Participants, Technology (Tech.), FIE execution (FIE ex.), Data collection and privacy, Management, Budget, Communication (Comm.), Work Packages (WPs), and DIHs and CCs

Beside "being selected" the ranking of all issues is very important. A weighting factor was used to calculate and identify the most prevalent and relevant problems (Table 5 and Figure 2). The predominant issues belong to the categories FIE execution, management, participants and general. Communication-related remarks and Work Packages challenges were often given, but were not high ranked.

Tabel 5: Number of selected (N) and weighted challenges (%) and number of solutions (N), experienced during the execution of the 28 Flagship Innovation Experiments

Category	N selected challenges	Weighted challenges (%)	N solutions
General	40	**14**	24
Participants	44	**17**	36
Technology	18	8	12
FIE execution	50	**23**	31
Data collection and privacy	11	5	7
Management	49	**19**	20
Budget	4	1	2
Communication	25	6	15
Work Packages	20	4	6
DIHs and CCs	8	2	3
Total	269	100	156

Fifty-eight percent of the described and selected issues are circumvented or solved (156 solutions of 269 selected issues). Already 82%, 67%, 64%, 62%, 60% and 60% of the problems related to participants, technology, data collection and privacy, FIE execution, communication and general issues, respectively are solved whereas the issues concerning Work Packages and DIHS and CCs are still pending though there are fewer in absolute numbers.

FIE execution

The <u>outline and aims of the FIE</u> were not always clear in the beginning of the SAH project neither were several FIE-specific definitions, causing some delays. This resulted in changes in the Execution Plans and reframed solutions according to several FIE coordinators. The FIEs' kick-off meetings, bilateral meetings between partners and open discussions with all partners helped to solve these issues mainly in the first year of the project. Continuously monitoring and reassessing work done and work planned help to avoid further issues related to the FIE execution. Future initiatives might benefit of the use of more smart aims and clear objectives.

A <u>seasonal impact</u> often occurred e.g. data collection of spring calving cows, frost or dryness destroying a whole crop season. FIE partners tackled this problem by being more flexible in experimentation sites, data collection in controlled (lab) conditions, rescheduling experiments or extending data collection. Also the current Covid 19-crisis is amplifying the seasonal effects. New experiments should start in time (not in January) in order to be prepared for the seasonal data collection.

Many <u>(unexpected) time-consuming activities</u> were criticized, such as (Covid 19-)online meetings and non-defined (also non-funded) activities at the start of SAH, and were even complicated by the absence of a common native language. Solutions were found in available templates for monthly meeting minutes, a strong focus, extra effort, revised Execution Plans, evaluations, in real time updates, support from experienced partners, and running smaller scale experiments, e.g. in controlled (lab) environments. Future activities (IEs) should take potential delays into account, especially when determining deliverables

and milestones, have a clear planning at the beginning of the project, and involve native speaking colleagues.
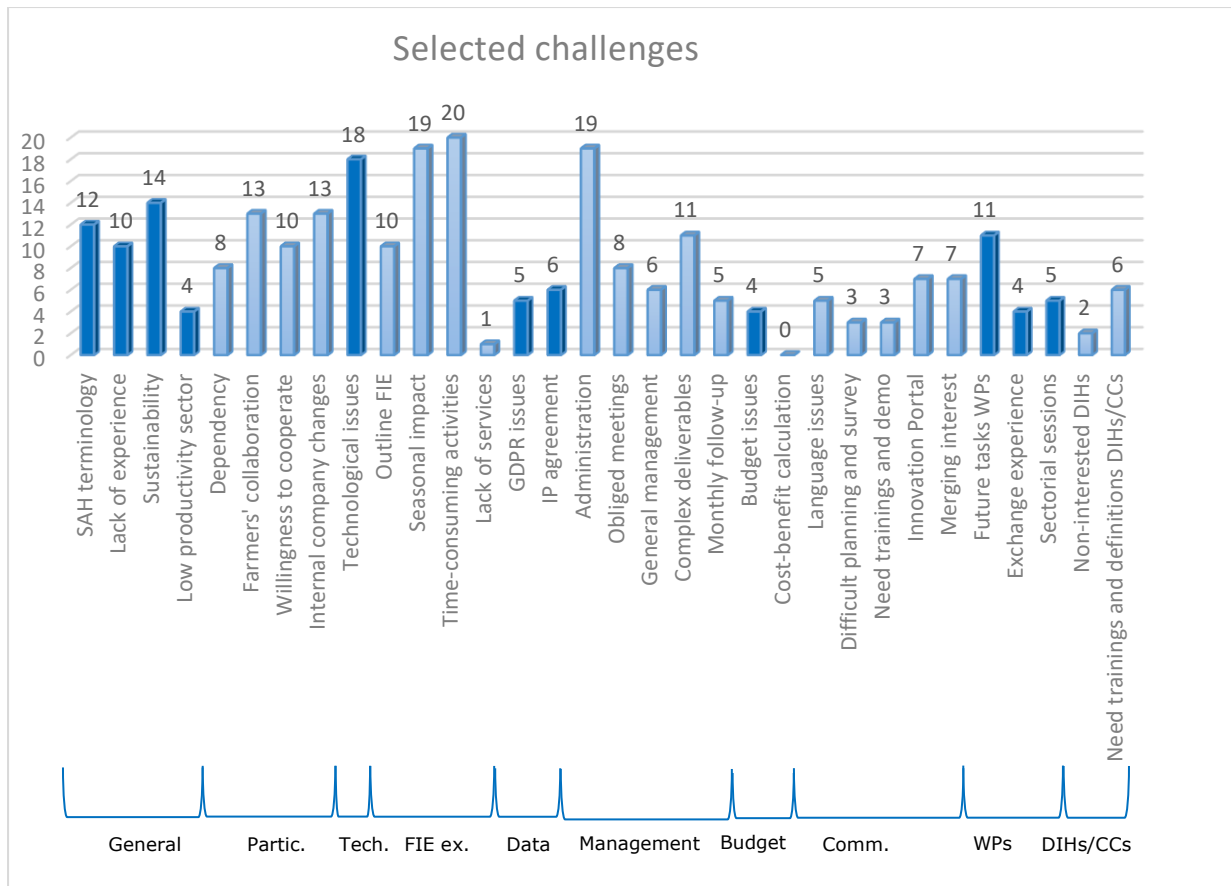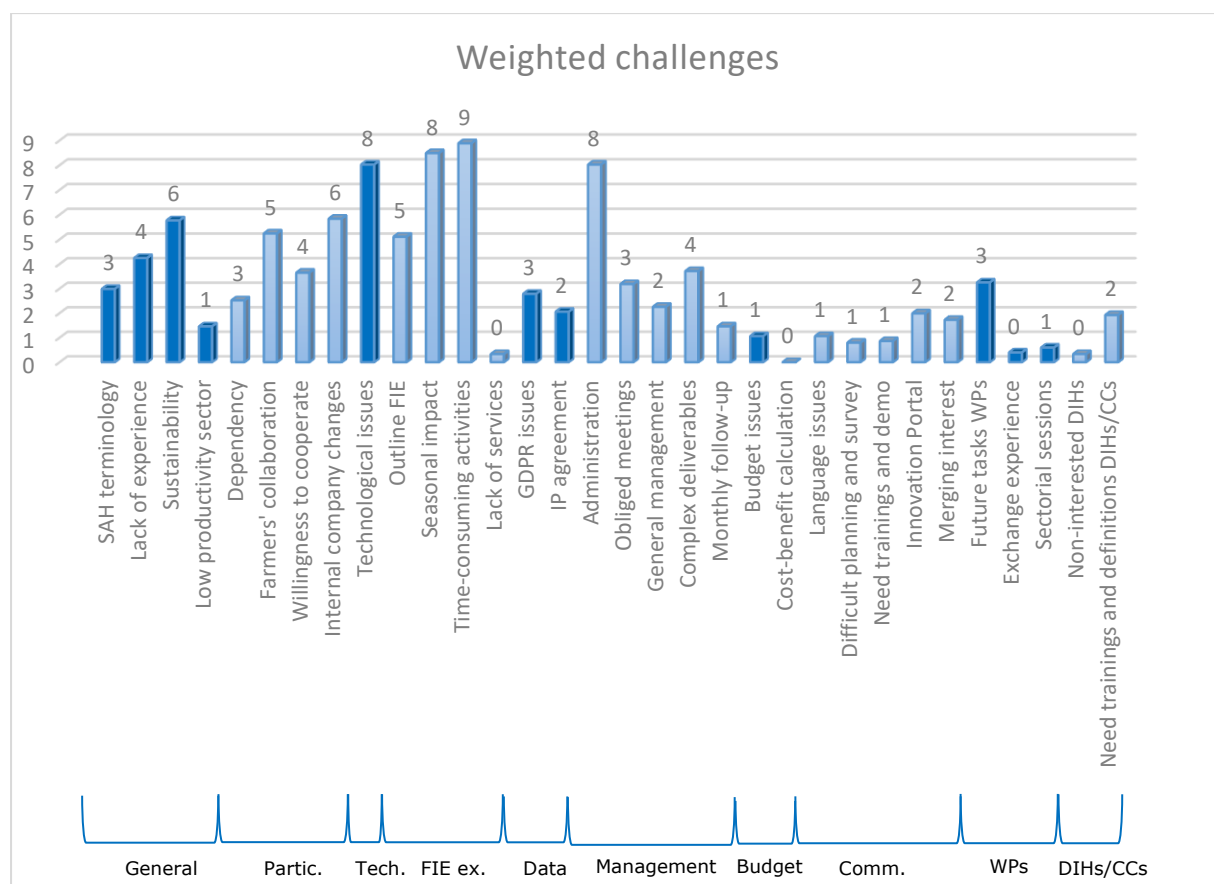

Figure 2: Weighted challenges experienced during the execution of the 28 Flagship Innovation Experiments belonging to the categories: General, Participants (Partic.), Technology (Tech.), FIE execution (FIE ex.), Data collection and privacy, Management, Budget, Communication (Comm.), Work Packages (WPs), and DIHs and CCs

Management

Solved <u>administrative issues</u> concerned the short deadlines also in the beginning of the SAH project and the late introduction of BaseCamp (causing double work). Efforts have been made to simplify administration and FIE partners have often chosen one person to be in charge of the entire coordination of their activities. Support from experienced partners was very helpful. However, a better view on expected tasks and deadlines and a better communication is still demanded despite all monthly meetings. One also suggests to distill all necessary FIE information from the meetings instead of using several templates for deliverables and progress reports.

The <u>high number of obliged (monthly) meetings</u> could be tackled (and is often already solved) by having focused prioritized meetings with clear agendas, grouping meetings in the same timeframe to align communication, an increased management effort, and a good coordination of the activities. The suggestion arose to have less meetings, e.g. only every second month.

<u>In general</u>, difficulties occurred for subcontractors' contracts and rules. A quick and efficient communication with WP 3, a close contact with the regional cluster and one person in charge of the coordination helped solving several general management issues.

Some <u>WPs' deliverables</u> have no clear impact on the FIEs. The WPs helped the FIE coordinators with prefilled and/or easy-to-complete templates, although sometimes

subjective, for their deliverables. Less tangible tasks might be easily accessed by dedicated colleagues.

Instead of a monthly follow-up, requesting a high effort, one suggest fortnightly meetings with partners whereas others do not find benefit in the often too close follow-up, especially in cool-down periods in between seasons and propose meetings every three months.

Participants

A certain dependency results from the close collaboration. An efficient communication, the implementation of monitoring tools, the optimized organization of joint actions, the planning of back-up solutions, the isolation of technical activities and collaborative efforts resolved the issues. Some FIEs organize fortnightly virtual meetings to track the progress of all partners.

Several FIEs include a close collaboration with farmers, often lacking experience and time. Farmers' discussion groups, training courses, presentations and demonstrations (on the field) were organized as well as support for reporting and administration. Only working with experienced end users, an accurate timing for visiting the end users' sites and a good planning of activities are also suggested. Working with farmers' cooperatives, a close contact between farmers and local contacts and clearly showing the benefits of technologies will help to onboard and motivate farmers.

To overcome the refusal of participants to cooperate they should be clearly informed about the usefulness and benefits of their contribution. Demonstrations, small pilot projects, understanding of the end-users' pain points, an available accurate planning and a clear targeted communication will convince (new) farmers/end-users to cooperate. Some FIEs had to replace end-users and used their previously established connections. Without market and fair payment there will be no sustainability and participants will doubt merit of cooperating.

One FIE had to remove a participant from the SAH project due to non-fulfillment of its duties, which was partially caused by an internal change in the company. A clear hand-over process is necessary when introducing new persons and includes specific (monthly) meetings, a SharePoint group, trainings, good project implementation plans, a close follow-up and individual work sessions.

General

Presenting the SAH project is often challenging due to the very project-specific terminology, abbreviations and acronyms and would be easier with a mentoring and project glossary/dictionary. Regional clusters and WP 3 offered support and helped to clarify this issue.

The lack of experience of several participants (in EU projects) was tackled by the support of WP 3, experienced colleagues, trainings, SAH documentation and guidelines, events and webinars and decreases when actively participating in the project. A close collaboration with the partners, e.g. experimental testers, and SMEs and a lot of patience also seemed helpful.

The sustainability of the developed solutions is questioned and support is requested, a.o. from RCs. New projects and development efforts as well as new financial partners are searched for, contacts are made and implementation plans are created. Techno-commercial interventions and surveys should be organized and support is requested for designing customized payment plans.

As a consequence of the variable (low) agricultural productivity as in some seasons yield and harvest is lower, experiments should have a longer life-spam and process performance should be optimized.

Technology

Technological issues are very FIE- and technology-specific as are their solutions, ranging from replacement of sensors, a good maintenance of equipment, over solving wireless connections. Research about potential alternatives, using contacts, the support of DIHs, the close collaboration with end-users and focused meetings (with key personnel only) helped to tackle and hopefully further avoid these problems. Surveys and a good contact with the end-users will also help to solve these issues. Details can be found in the confidential version of this deliverable in 3.1 Technological issues.

Communication

The lack of a common language is mentioned as an unsolved problem for a lot of farmers and is hampering cooperation with FIEs from other regions, although watching English series seems to help.

Some FIEs noticed a better communication and coordination of general meetings and surveys, found new tools, but some criticize the amount of BaseCamp emails.

Organizing trainings and demonstrations can easily be done remotely, support is demanded for trainings about the benefits of the digital solutions.

Meetings were organized to create awareness of the SAH Innovation Portal (IP), which had a complex registration start, and administrative colleagues solved the issues. Some request an IP guide and some common standards and requirements for functionality of DIHs.

Merging the interest of all participants (within a FIE) often seemed very difficult, with 1 FIE already having some partners who will not cooperate anymore in the future. Others were more successful to tackle this issue and were able to shape a common mission and vision by keeping the focus on the planning and achievements, accurately timing visits, periodically monitoring the partners, showing good leadership, discussing benefits and business opportunities and respecting the partners' individual needs.

Data collection and privacy

Contracts, related to GDPR and privacy of data, were developed and signed, in combination with good direct communication, in several but not all FIEs.

A lawyer and other legal services were asked to develop IP agreements among partners or to establish clear boundaries between developed products (isolated IP of each developed product). Not all FIEs created a data management plan yet and more guidance from the management team is requested.

Work Packages

A better clear planning of future tasks, based on synergy among the WPs, is necessary according to several FIEs. Some FIEs started early in contrast with the general SAH project management and communication activities. A simple information collection tool or form is requested.

The SAH project and all participants would benefit from an exchange of experiences, e.g. in monthly meetings with the WPs and FIE coordinators and in match making sessions among the FIEs and SMEs.

During the SAH yearly event, when again allowed, sectorial sessions, with all related actors in SAH, should be organized beside the regional sessions.

DIHs and CCs

To better understand the opportunities offered by SAH to the DIHs, the DIHs need to gain maturity. Support is demanded to help partners when developing or starting a DIH.

Trainings and clear definitions of DIHs and CCs are again asked.

Budget

A quick and efficient communication and support was offered by WP 3 to resolve budget-related issues. Also the in-equal subsidy for FIE partners, often SMEs, and DIHs, often non-profit organization, (75% versus 100% SAH contribution) was criticized.

Technological issues

In total, 42 technological issues are reported by the FIE coordinators and are shown in the confidential version of this deliverable per cluster and per FIE.

The described problems are very FIE- and technology-specific and depend on the content and scope of the experiments, e.g. validating sensors versus developing decision support systems, as well as on the sector the FIEs are working in, i.e. dairy, animal production, arable, vegetables, fruit, aquaculture and/or novel foods.

Thirty-six (86%) of the collected technological issues are already cleared within the FIE. Only 6 (14%) are not yet circumvented or solved. For instance, new casings for sensors will be developed as the barn environment seemed harmful for the sensors, potentially (partially) impacting the quality and consistency of sensor data. Flagships might also wonder how to reuse their solution in another FIE and how other FIEs (from other regions) proceed and circumvent their issues. A lot of FIEs are facing a lack of Wi-Fi coverage, necessary for data transfer, in the productive or test environment.

3.2 TECHNOLOGY REUSABILITY EXPLOITATION

Requirements' fulfilment

Technological and non-technological requirements and reusability data were collected from all FIEs. The SAH project and FIEs do not claim to use the best technologies, but (non-) technological components were chosen based on the in-house knowledge, experience and tools of the different DIHs, CCs and other partners within the FIEs and are appropriate to tackle the agricultural challenges of the FIEs.

In total, 76 technological and 38 non-technological requirements were collected ($n_{total}=114$, $n_{fulfilled}=80$, $n_{notyetfulfilled}=34$) of which 75% and 61%, respectively, were already fulfilled (Figure 3), clearly showing an increase from 2019 (55% and 30% fulfilment, respectively).
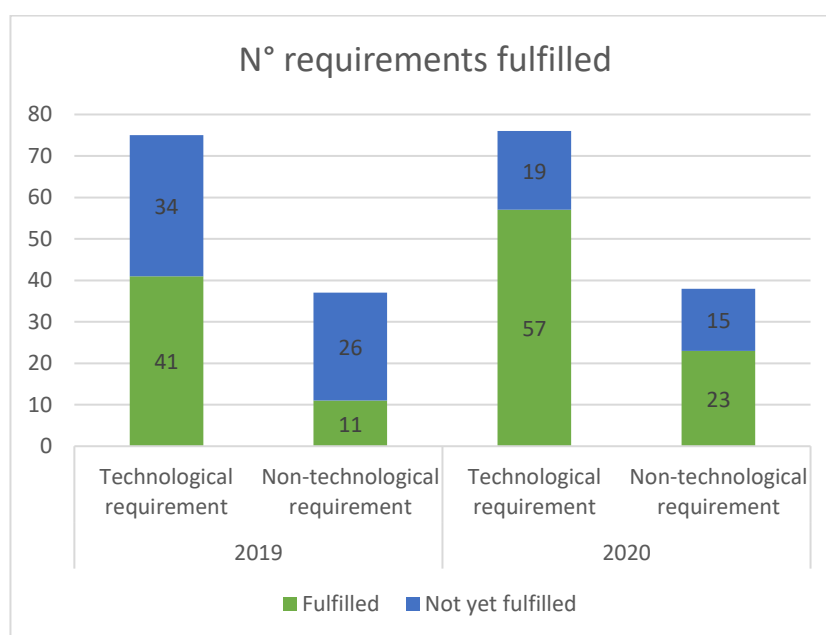
Figure 3: Number of technological and non-technological requirements and their fulfilment over all 28 Flagship Innovation Experiments

Support DIHs and CCs

Support from current CCs and DIHs is present for 68% (n=78) and 58% (n=66) of the requirements, respectively, and was satisfying in 95% and 85% of the cases. Logically technological requirements are more supported by CCs (Table 6) whereas the CC and DIH support for non-technological requirements is equal. More support from CCs and DIHs is requested, mainly for the technological requirements.

Table 6: Support of Competence Centers (CC) and Digital Innovation Hubs (DIH) already received and still requested for each technological and non-technological requirement

	Received		Requested	
	CC support	DIH support	CC support	DIH support
Technological requirement	52	40	10	15
Non-technological requirement	26	26	3	7

The number of supported components slightly increased for CCs and clearly augmented for DIHs for technological requirements, but decreased for non-technological ones in comparison with 2019. Also the request for more support, except for CC support of technological requirements with a slight decrease, raised. The demanded extra help can be covered by current CCs and DIHs, only 2 and 1 requests of new CC and new DIH were counted.

The services currently delivered are summarized in word clouds for the CCs and DIHs separately (Figure 4 and Figure 5).

Figure 4: Competence Centers' services

Only 53 % of the contacts with CCs (44 out of 78) were established through DIHs.

Figure 5:Digital Innovation Hubs' services

Requirements' reusability

The reusability of both the technological and non-technological requirements was estimated by the FIE coordinators and partners. Whether the solution is really reusable as such, is to be validated when it is being used by a number of other systems and users. Very often this will require modifications.

The number of reusable components is very high with 103 reusable components out of 114 (90%) (Figure 6). A higher percentage of non-technological requirements is reusable (92% versus 89%) although differences are very small.
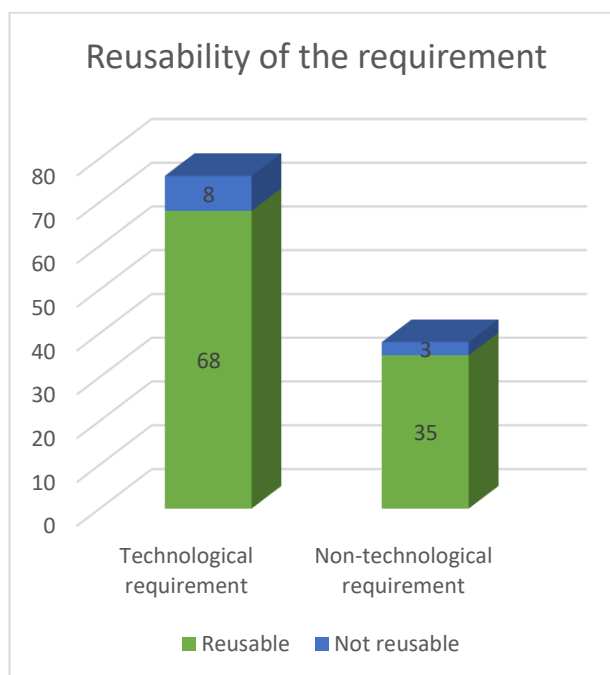
Figure 6:Number of reusable technological and non-technological components over all 28 Flagship Innovation Experiments

Each Flagship Innovation Experiment has 1 up till 9 reusable components with an average of 3 or 4 per FIE.

The majority of reusable components are situated in the arable sector, 26% and 29% for the technological and non-technological requirements respectively, followed by the vegetable, fruit and animal production sector (Figure 7). Seventy-five percent (n=51) of the technological reusable components cover only 1 up till 3 sectors whereas 51% (n=18) of the non-technological ones can be used in 5 or 7 sectors, making them less sector-specific in comparison with the technological requirements.

The current TRL ranges from 3 to 9. Already 21 technological reusable components have a current TRL of 8 or 9 in contrast to the non-technological reusability, with only 7 in that category (not all requirements were assigned a TRL). Thirty-nine and 20 technological and non-technological requirements respectively have a target TRL of 8 or 9, resulting in 59 market-ready, though not all new, reusable components by the end of the project.

Figure 7: The technological (left) and non-technological (right) reusable components' spread across the different agricultural sectors

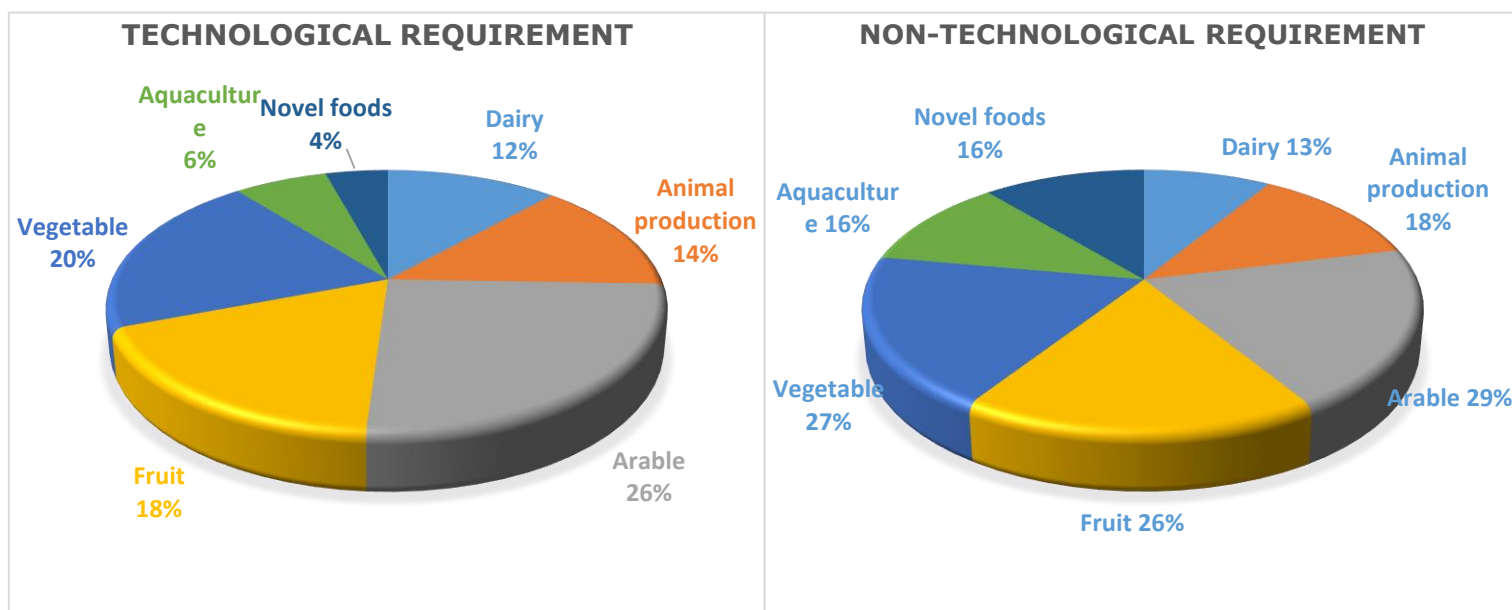Fifty-six reusable components are already available (49%) (September 2020) of which 30 (54%) are against payment whereas payment is requested for 23 out of 47 (49%) non-available reusable components. Ten will become available at the end of 2020, 16 in the first half of 2021, 1 in September 2021 and 11 by the end of the SAH project (November 2022) (9 are unknown). Twenty-eight out of 56 available requirements already existed before the start of the SAH project, resulting in only 28 (27%, 28 out of 103) new available reusable components. Forty-six are validated within the SAH project and 34 (out of 56) further developed.

Table 7: Number of reusable components (n_{total}=103) with benefits for a specific subcategory, already in use by a specific subcategory and the number of users (N) in that subcategory

Subcategory	Benefit	In use	N[1]
Farmers	83	21	1275
Technological companies	72	15	5
Software developers	55	8	5
Advisors	63	15	222
DIHs	50	8	2
CCs	57	15	9
Retailers	25	4	0
Consumers	16	1	0
Other FIEs	37	1	1
Other	16	7	3

[1]This is an underestimation as in most cases no amounts were given or could be given.

Farmers can benefit from many reusable components (83 out of 103), followed by technological companies (72), advisors (63), CCs (57), software developers (55), and DIHs

(50) (Table 6). Thirty-seven reusable components can also be useful for other FIEs. More than half of the reusable components (54%) can be employed in 5 till 9 sectors.

A promotion plan is not yet developed for 58 out of 103 reusable components (56%) or will be created at the FIEs' end. Dissemination and communication will mainly be in specialized discussion groups, during hackathons, in industry meetings, via webinars, through demonstrations, on fairs, on expositions and on conferences. Social media will also be used often as well as the entire network of the FIEs' partners. Some also mention the DIH network and CCs as helpful factors. Another project can also benefit from the reusable components developed in the SAH project and will add at the promotion.

Support of DIHs for the promotion was given for 22 reusable components: presentations were given, new project proposals were submitted, seminars were organized, social media channels were used as was the entire DIH network. Only for 15 reusable components additional support is requested, both in 2021 and 2022. The need for trainings is mentioned 26 times and these should focus on the (reusability) promotion, exchange of knowledge, data sharing, the FIEs' overall solution and business plans. Also public events should be organized for farmers, advisors and agronomists.

4. CONCLUSIONS

4.1 COMMON CHALLENGES ANALYSIS

The entire SAH project team, DIHs, CCs, regional clusters, FIE coordinators and their partners, and future initiatives can learn from the following take-home-messages to continue or improve services and to circumvent some issues.

- The most frequently described and ranked challenges concern the execution of the FIE, management, participants or are general issues.
- Fifty-eight percent of the problems are already solved, especially challenges about participants, technology, data collection and privacy, FIE execution, communication and general issues.
- Future initiatives might benefit from the use of more smart aims, a clear planning, and clear objectives and definitions from the start of the project.
- New experiments should start in time to be prepared for seasonal data collection. The current Covid-19 crisis is amplifying the seasonal effects.
- Potential delays should be taken into account when developing deliverables and milestones.
- Native speaking colleagues should be involved in EU projects as the lack of them is hampering cooperation with FIEs from other regions.
- A better view on expected tasks and deadlines is requested.
- A close collaboration results often in dependency from partners and should be taken into account when planning a new project.
- Support is requested, from RCs and others, as the sustainability of the developed solutions is questioned, e.g. searching for new projects and new financial partners, organizing techno-commercial interventions and surveys.
- Experiments should have a longer life-span as the agricultural productivity is variable.
- Technological issues are very FIE- and sector-specific, but are mainly solved (86%).
- Support is demanded for trainings, clearly showing the benefits from digital solutions.
- An Innovation Portal guide and some common standards for functionality of DIHs are requested.
- More guidance is asked to create a Data Management Plan.
- The project would benefit from a simple information collection tool or form and a clear planning of future tasks.
- An exchange of experience and sectorial sessions include advantages for all participants of the SAH project.
- Trainings and clear definitions of DIHs and CCs are asked.

4.2 TECHNOLOGY REUSABILITY EXPLOITATION

The following conclusions and lessons learnt can be drawn from all collected (non-)technological requirements and reusability data.

- In total, 76 technological and 38 non-technological requirements were collected.
- The percentage of fulfilment increased, 75% and 61% of the technological and non-technological requirements, respectively, are already fulfilled.
- Support from current CCs and DIHs is present for 68% and 58% of the requirements and was satisfying in 95% and 85%.
- Only 53 % of the contacts with CCs were established through DIHs.
- More support from CCs and DIHs is requested, mainly for technological requirements, but can be mainly covered by current CCs and DIHs.
- A high number of reusable components are available: 103 out of 114 requirements, with a higher % of non-technological components being reusable (92% versus 89%).

- The majority of reusable components are situated in the arable sector. Half of the non-technological requirements can be used in 5 or 7 sectors, making them less sector-specific.
- Twenty-eight out of 56 already available reusable components already existed before, resulting in 28 new available tools.
- Especially farmers can benefit from many reusable components and effort should be taken to inform them.
- Half of the reusable components lack a promotion plan.
- Additional support from DIHs for the promotion is requested.
- Also a large need for trainings is observed with topics: (reusability) promotion, exchange of knowledge, data sharing, the FIEs' overall solution and business plans. Also public events should be organized for farmers, advisors and agronomists.

In the next iteration of deliverable D3.5 "Technology requirement identification" the reusable components will again be analyzed and the progress of reusability and exploitation will be validated.

4.3 REACHING OVERALL OBJECTIVES

Up till now, 103 reusable components are used by the current 28 FIEs with a range from 1 to 9 and an average of 3 or 4 per FIE. Twenty-eight new tools are already available to the market. The current TRL ranges from 3 to 9. FIEs should be supported to increase the target TRL of new components and to reach these goals.

Especially farmers can benefit from the developed and used tools with 83 out of 103 reusable components useful for farmers. The requested support for promotion should focus on this target audience to increase the number of farmers involved in the project and working with the delivered digital solutions. Onboarding and motivating farmers can be challenging, but working with farmers' cooperatives, having a close contact between farmers and local contact persons and clearly showing the benefits of technologies, e.g. via (in field) demonstrations, can help to circumvent this issue.

Only half of the contacts with CCs are established through DIHs. More support is demanded but can be covered by current CCs (and DIHs) according to the FIE coordinators. Several challenges concerning DIHs and CCs are still pending. First of all, clear definition of DIHs and CCs should be spread again. Also, new DIHs should be supported in their developmental phase and to gain maturity. This can be reached through a close collaboration of WP 3, WP 4 and WP 5.