DELIVERABLE 5.4 PROCEDURES FOR GOVERNANCE AND MANAGEMENT OF COMPETENCE CENTRE NETWORK AND CRITERIA

WP 5

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
WP	Work package
RC	Regional Cluster
CC	Competence centre
DIH	Digital Innovation Hub
ESQ	Expected service quality
IE	Innovation Experiment
FIE	Flagship Innovation Experiment
FIE CC	Competence Centres collaborated with FIE
ICT	Information and communication technology
PSQ	Perceived service quality
SAH	SmartAgriHubs
SME	Small and medium-sized enterprise

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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 DIHs and numerous 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 organisations 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 start-ups, 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 overall aim of this deliverable was to establish procedures that serve to contribute to the good governance and management of the network of CCs in SmartAgriHubs. These procedures were supposed to enable CCs and CC candidates to join SmartAgriHubs, manage themselves as network partners, and cooperate permanently or ad-hoc with SAH stakeholders in developing digital innovations. In the first iteration of this Deliverable, the authors outlined a roadmap and a preliminary framework, mostly based on literature review, on which this work could have successfully been performed.

As the project progressed, however, a new approach started to gradually evolve, identifying DIHs as responsible actors for the relationship between DIH and CC within their respective DIHs. This shift in the narrative of the project has given DIHs a greater role in ecosystem building and, more importantly, for some of the WP5 tasks, has made it clear that CCs can use their own internal procedures to enter into service agreements with other entities. To do it otherwise would have been a very complex task, given the diversity of the CCs' community and their twofold embedding in the network of DIHs and the Regional Clusters. At this point in the development of the SmartAgriHubs digital ecosystem, this would have not just been beyond the scope of this task, but there would have not been any justification to establish these procedures. Regarding the tasks on CCs' network governance and management, the groundwork for this work started in the first iteration. The resulting literature reviews and some preliminary suggestions remain part of this deliverable for possible future use.

Nevertheless, it is crucially important to underline what has been achieved within this task:

- The empirical evidence supplied by this Deliverable has strengthened the definition of CCs, hence enhancing our comprehension of these actors.
- According to the definition of CCs, CCs are either accepted or rejected after registering on the Innovation Portal.
- We acquired knowledge about the presence of CCs on the Innovation Portal, which is believed to be the primary entry for the SAH digital ecosystem.
- We compiled a number of best practises and helpful hints from genuine CCs regarding their activities in the field of cooperation agreements and service delivery. This work was supported by a comprehensive literature review.
- We gained a clear understanding of how CCs perceived their collaborations with Flagship Innovation Experiments.

To the extent that SAH is kept going and is sustainable, there will be an overall "*lite weight organisation*" governance procedures put in place. This approach is expected to come out of the Sustainability of SAH Committee. As part of the Sustainability of SAH, there will be a Memorandum of Understanding between certain partners who plan to pursue a common course of action after the project's duration. Although the details and content of the Memorandum are not yet known, this deliverable contains several useful components that can be utilised when working it out.

INTRODUCTION

SmartAgriHubs is dedicated to accelerating the digital transformation of the European agrifood sector, building a strong, multi-layered network of agricultural Digital Innovation Hubs (DIHs) and Competence Centres (CCs). DIHs and CCs have different roles, although the CCs often form part of DIHs. The CCs provide R&D, technical expertise, laboratory and demonstration facilities, testing and validation, and ICT skills to users. No single CC can be excellent in all fields, therefore, it is necessary to build strong linkage between CCs. In order to promote cross-fertilisation and to stimulate even more knowledge exchange, SmartAgriHubs aims at expanding the network of CCs within and outside the agricultural sector.

The aim of WP5 is to help the establishment of the network of digital Competence Centres (CCs). This Deliverable 5.4 focuses on procedures that help to create and maintain the network of CCs in SmartAgriHubs. It has a strong synergy with Deliverable 5.5 aims at the capacity building of CCs, developing training and demonstration materials in order to help CCs to become an active, visible and receptive part of a digital ecosystem.

There is a strong synergy also with WP1, responsible for developing the web-based interactive Innovation Portal. The portal will manage the whole SmartAgriHubs ecosystem and will offer several services for the day-to-day operation of CCs also. This deliverable was a "living document", as it was supposed to be updated and expanded throughout the lifespan of the project. The first iteration of this Deliverable came out in June 2020.

1. DEFINITION OF COMPETENCE CENTRES

1.1. REVIEW OF CC DEFINITIONS IN OTHER PROJECTS AND INDUSTRIES

The development of CC definition has been largely drawn from the experience of initiatives with similar objectives to SmartAgriHubs, although examples from other industries have been reviewed as well. A short summary of the relevant projects demonstrates that there is no one standard definition for CCs. Even the names can be slightly different, as 'centre of competence' and 'technology centre' are also used as synonyms. However, the common characteristics in the definitions are the specific digital technological knowledge, the research and transfer activities, demonstration and collaboration.

Based on the paper of the AIOTI (Alliance for Internet of Things Innovation) CCs may be considered as the forefathers of DIHs, as they existed before the concept of DIHs was defined by the Digitising European Industry (DEI) initiative, and they partially served the same role. They consider CCs as collaborative entities, which aim to **help companies towards their digital transformation**, by improving their digital competences and facilitate technology transfer towards them. This is achieved by e.g. providing access to infrastructure, digital tools and services, guidance on the adoption of digital tools (and the digitisation of the companies in general), demonstration of new digital technologies and highlighting their potential benefits, providing support for the development of new products etc (Protonotarios, de Oliveira, and Perez-Freire 2017).

The DIATOMIC project (Quintas 2017) emphasises that CCs are **R&D entities** that operate in some particular area of focus such as a technology, skill or discipline. CCs connect partners from the industry and research sector in order to strengthen the capacity to advance and exploit new technologies in new products, processes and services. They have an important role in **helping SMEs** address the challenges that digitisation poses. Services that CCs offer can range from providing access to technology infrastructure and expertise, to supporting the creation of new product prototypes.

ICT Innovation for Manufacturing SMEs[1] supports SMEs active in the manufacturing sector. According to their definition, a CC can be **any organisation** (university institute, technology and research organisation) **offering technological infrastructure and accompanying skills and competencies** that support the scale-up and valorisation of a technology. They are usually at the core of Digital Innovation Hubs and have an (semi) open approach and provide high-end technological solutions or infrastructure to SMEs in order to translate the I4MS research/technologies into opportunities for business.

HORSE – Smart integrated Robotics system for SMEs[2] is an implementation of the second phase of I4MS, focusing on advanced robotics for manufacturing. CCs in the HORSE are **physical locations and act as a one-stop shops providing information, expertise, equipment, advice, and support services**. CCs offer expert advising assistance on

[1] *https://i4ms.eu*
[2] *http://horse-project.eu*

deployment and quick assessment of robotics solutions in manufacturing especially for first-time users from SMEs.

Enterprise Ireland is the government organisation responsible for the development and growth of Irish enterprises in world markets. According to their definition, CCs (or Technology Centres) are **collaborative entities established and led by the industry** and resourced by highly qualified researchers associated with research institutions who are empowered to undertake market focussed strategic research for the benefit of the industry. Any group of companies with common research interests that are active R&D performers or that have committed to increase their performance in R&D or that has a clear strategic plan to engage in R&D should consider becoming part of a CC[3].

In the CREST (Comité de la recherche scientifique et technique) Report on "Industry-led Competence Centres" (EC 2009) the **following definition was agreed** by the working group:

- They are engaged in collaborative research, typically focused on medium/long term issues.
- The research is conducted on areas of direct industrial relevance.
- The areas of research are focused on gaining competence in areas of technology or innovation which are relevant to the industry stakeholders.
- They are formal organisations, which have a long term but typically finite duration.

They also stated that **there is no ideal type of Competence Centre**, and the organisational setup, mandate, size and resources of CCs vary considerably and therefore there is no one single blueprint that can be designed to assess their impact or define their effective operation. The flexibility of the CC model allows for adaptability to suit the needs of the industrial and academic partners.

TAFTIE is the European Association of leading national innovation agencies. Based on their report (TAFTIE 2016) CCs can be defined as structured, long-term research and innovation (R&I) collaborations in strategically important areas between academia and the industry/public sector. They focus on strategic research agendas, support strong interactions between science and industry and provide truly collaborative research with a medium to long-term perspective. CCs **may also play an active role in developing international standards**. In many industries, standards need to be widely adopted for the research to become industry relevant and therefore internationalisation is a key pre-requisite. They found that the average size of CCs is significantly different amongst the Competence Centre Programmes observed. It seems that larger CCs are typically organised as independent entities. CCs can also be differentiated by their intended duration and continuity.

According to TAFTIE, CCs perform **several activities** separate from the operation of the R&D programme and focus to varying extent on:

- Exploitation of research results by means of IPR and Spin-Offs
- Training of PhDs and master students
- Dissemination of research results via publications, conferences etc.
- Stimulation of networking and knowledge transfer
- Acquisition of third-party funding (incl. EU sources)

[3] *https://www.enterprise-ireland.com/en/research-innovation/companies/r-d-funding/competence-center-faqs*

- Provision of research infrastructures
- Provision of market intelligence.

In accordance to the different definitions, a study prepared for the Digitising European Industry round table(EC 2016) found that **several types of** CCs exist in Europe, e.g.:

- High tech organisations / research institutes (universities, RTOs – research technology organisations, private consultants, design houses, private research organisations) that are specialised in applying certain innovative technologies to solve challenging problems of enterprises.
- Demonstration factories/show cases that show advanced technologies integrated in manufacturing processes.
- Testbed facilities (e.g. a factory, hospital, farm, urban area, test-house, power plant), opening its facility to the technologists for solving their problems and accompanying them during the whole process, from requirement to testing phases.
- Pilot lines, offering production facilities for companies that have developed new products based on e.g. based on nano-electronics, photonics, new materials.
- Maker labs or fab labs which offer introductory courses to understand new technology and offer services for using specialised equipment.

Some centres may have expertise in a very narrow domain, while others may have competences across a broad range of domains. When certain expertise is necessary which is not available in the centre, it should be possible to find it in another centre. Networking among CCs will ensure excellence and specialisation since not all CCs need to cover all competences. Networking CCs with Digital Innovation Hubs will ensure that a DIH can become a one-stop-shop and can offer all necessary support for companies for their digital transformation (EC 2016). Figure 2. shows how CCs can collaborate with other innovation actors in a digital innovation hub to provide a holistic set of digital transformation services to the industry (DEI 2017).

1.2. DEFINITION OF COMPETENCE CENTRES IN SMARTAGRIHUBS

A carefully developed definition is required for the coherence of, as well as for the daily operation of the project. **Defining characteristic of CCs is that they are engaged in both research and transfer of research**. CCs provide cutting edge knowledge and technologies, which may differ from entities that are technology providers, or provide testing facilities. The definition of CCs as it is on the Portal[4]:

> *"Competence Centres form the cornerstone of the Digital Innovation Hubs in the SmartAgriHubs network. They provide the digital technological infrastructure of the DIH by offering advanced technical expertise, access to the latest knowledge and information on digital technologies, as well as test facilities such as labs, pilot and experimental facilities, and other technological and scientific infrastructure.*
>
> *Within their respective Digital Innovation Hubs, Competence Centres cooperate with all relevant partners in the agri-food innovation value chain to support farmers, businesses and other agri-food entities in their digital transformation. This*

[4] *https://smartagrihubs.eu/competence-centers*

entails establishing connections with a wide range of technology companies, research institutions, and digital solutions providers as well as potential users and customers.

By providing the test infrastructure and know-how for digital innovation, as well as closely cooperating with Digital Innovation Hubs and Innovation Experiments, Competence Centres help facilitate the realisation of digital solutions for the agri-food sector and form an integral part of the greater SmartAgriHubs innovation ecosystem."

Given that many DIHs offer services that would be expected of CCs, the distinction between CCs and DIHs is functional and role-based rather than organizational. However, two differences are worth being emphasized here. DIHs operate on a local level, whereas CCs can operate on a larger geographic scale and offer services to more DIHs in other regions. Additionally, CCs concentrate on offering competencies, whereas DIHs serve as one-stop shops for the development of digital.

1.3. CRITERIA FOR NEW CCS DESIGNATION

In that sense, criteria for new CCs designation is broad, inclusive and general, whilst having at its core the dual requirement of research and transfer of research.

For example, CCs include universities, applied research and technology organisations (RTO), laboratories and test/demonstration farms and facilities, and other entities with important R&D labs or facilities.
However, CCs are not, for example, tech providers who have products on the market and who do not engage in digital technology research and transfer. These tech companies are an important part of the SAH ecosystem, but they are not CCs. However, in some cases, tech companies or other entities may have a strong digital technologies research and transfer unit (i.e.: department, foundation, etc.), in which case it would qualify as a CC.
These criteria are meant to attract and encourage candidates to join SmartAgriHubs. From the perspective of network development, the central aim is to maximize the number of CCs because this is how a rich and diverse pool of competences can support the creation of digital ecosystem in SmartAgriHubs. When they start their registration, CCs must clearly demonstrate what digital competences they can offer for the agricultural sector. They do so by going through a categorisation process (Deliverable 5.1: Agricultural Technology Navigator). Candidates are responsible for the correctness and accuracy of the information provided.

1.4. NEW DIMENSIONS FOR THE DEFINITION OF CCS BASED ON THEIR SELF-REPORTED ACTIVITIES IN FIE PROJECTS

CCs have played a crucial role in Flagship Innovation Experiments (FIE) and contributed a lot to the success of SmartAgriHubs. However, it sometimes feels challenging to comprehend how and what has been exactly delivered by CCs in SmartAgriHubs without talking about how they operate in their regular business. The definition of CC, as highlighted above, describes their field of activities in a objective, but rather abstract way. Understanding their involvement in SAH and getting a better picture of their regular activities can be enhanced by using their own description of what and how they performed in FIE projects.

In this section, we will analyse CCs' repor**ts to gain a realistic and pragmatic understanding of their work and role**. The reports are CCs' feedback and complements to what the 28 FIEs shared with WP3 as part of their mandatory reporting procedure. Using the CCs' own perspective provides a unique opportunity to better understand the narrative of CCs and to learn more about their participation from their own perspective. **Mapping this primary information adds a new and practice-oriented dimension to the definition of CCs.**

The management of Innovation Experiment Evaluation Reporting is a task which was done done by Work Package 3 throughout the project. The goal of this task is to identify and evaluate the progress of all Innovation Experiments throughout the observed reporting period.

The evaluation report template has specific questions on potential collaboration between FIEs and CCs. These questions highlighted various aspects of CCs' involvement in FIE projects: envisaged and provided support from CCs and the reusability and sustainability of the support provided by CCs. These inputs have already been processed and presented in previous WP3 Deliverables (D3.4-2 Periodic Evaluation of the IEs Performance[5]).

During the reporting process, CCs were given the opportunity to provide feedback on what was reported about them by FIE projects. In that sense, these inputs from CCs uniquely represent their perspectives on their involvement in FIE projects. Feedbacks were requested through open-ended questions of an online survey. This textual data formed the basis of the analysis presented below.

However, the quality of the resulting textual data was highly uneven. One of the main reasons for the unevenness is that not all CCs involved provided a response. Only 16 CCs (24 % of the total number of CCs in FIEs) provided information for reporting despite repeated requests and reminders sent out by WP3. Moreover, in many cases, the responses were very short, even a few words, while in other cases, entire paragraphs were given as responses. In addition, the interpretations of the questions varied between CCs, which made the responses difficult to compare and synthesize.

This analysis followed the methodology of qualitative content analysis. CCs' responses were transcribed in Word and imported into NVivo (Version 12). The software NVivo provided the possibility to store, organise, and coding CCs' textual reports. In qualitative content analysis, the objective of coding is to allow the analyst to interpret the data from his or her own perspective by establishing and organising thematic categories until a new understanding or new narrative of the data emerges. However, due to the data quality issues mentioned earlier, this type of narrative construction was not achievable in this case. **The analysis therefore aimed to highlight the activities of the CCs in order to create a keyword-based inventory map of their activities. Such inventory is believed to be able to contribute significantly to the original CC definition.**

The results will be presented in three sections. In the first session, we will discuss and map the services that the CCs were expected to execute for FIE projects. The description of **these envisaged services** is derived from the FIE coordinators' reports. The second section will demonstrate the service map based on the feedback of the CCs. In addition, we will gather

[5] *https://smartagrihubs.eu/Deliverables/pdfs/D3.4-2-Periodic-Evaluation-of-the-IEs-Performance_final_PU.pdf*

their perspectives on the reusability and sustainability of FIE initiatives. The third section will give an insight into how CCs could provide additional services to help projects like FIEs.

Figure 1 depicts the result of keyword analysis for CC services that FIE coordinators envisaged, while Figure 2 depicts the result of keyword analysis for the CCs' feedback. Both analyses discovered a substantial number of keywords. However, the feedback from CCs was found to be somewhat more diverse, leading to an increase in keywords.

There are three distinct overarching groups in each analysis. Development and service aspects clearly stand out in CCs' work, which is completely consistent with the well-known definition of CCs. The third, however, is the frequently unrecognised and forgotten activity of collaborating with various partners in various contexts. This clearly highlights the fact that CCs are engaged in a variety of forms of collaboration. Given that one of the drivers of innovation processes is knowledge-intensive interactions between various actors, this is not surprising. The majority of CCs described the collaborations in which they participated favourably, which is an important finding for the project.

Figure 1 CCs' envisaged services in FIE projects (n=16)

Figure 2 CCs' actual services in FIE projects (n=16)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement № 818182

1.5. SUGGESTIONS HOW TO BECOME A VALUABLE PART OF SMARTAGRIHUBS

In accordance to the Digital Preservation Europe (DPE) project, CCs should listen and respond to the changing needs of their user communities and reflect to the ongoing achievements of international research and development efforts. They have to be able to demonstrate community building capabilities and effective communication strategies to disseminate guidance, support and resources. CCs could also work more effectively with other CCs to overcome fragmentation and duplication of effort (Lunghi et al. 2007). Referring to Deliverable 5.5, this deliverable highlights the importance of competence demonstration which makes a CC a valuable part of SmartAgriHubs.

1.6. CCS' ADVANTAGE FOR JOINING SMARTAGRIHUBS

The current fragmentation of knowledge and technology expertise in the proximity of farms and the lack of promising business cases for farmers and business models for the technology providers are among the main barriers hindering the spread of digitalisation in agriculture. To overcome these challenges SmartAgriHubs aims to build a digital ecosystem. CCs joining this community can benefit from:

- Showcasing their competences and systems supported by technologies through the Agricultural Technology Navigator on the Innovation Portal.
- Involvement in the development of Innovation Experiments (IEs) in which ideas, concepts and expertise are combined and further developed
- Improving research portfolio by addressing research questions generated by IEs
- Interconnectivity among different actors in the digital ecosystem and increased opportunities for transfer of research and knowledge
- Increased contact with companies and end users who may be interested in the evolution, application and/or commercialisation of products and services related to competences and systems showcased on the Innovation Portal.
- Knowledge sharing with multiple partners and increased possibilities for user feedback, co-creation of solutions, and ability to understand emerging needs of farmers and their businesses.
- Networking possibility that could lead to involvement in EU, state and other R&D initiatives.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement № 818182

2. LESSONS LEARNT ABOUT CCS' PRESENCE AND PERFORMANCE IN FIES

2.1. ANALYSIS OF COMPETENCE CENTRES' PRESENCE IN FLAGSHIP INNOVATION EXPERIMENTS

Introduction

In this section we present a descriptive picture of CCs who participated in FIE projects. We present the number of CCs initially planned to be working within the Flagship Innovation Experiments (FIEs)[6] – which serve as benchmarks for other Innovation Experiments to strive towards – and the number of CCs active throughout the entire project period. We show the location of the CCs' and the number of CCs involved in FIEs. Furthermore, we present the current situation of portal registration and the status of our tool to classify CCs; the Agricultural Technology Navigator (ATN).

CCs can contribute to the success of the FIE by providing their infrastructure and knowledge. Therefore, their presence can significantly influence the outcome of the experiments. It is important to see how they were able to collaborate and how long they supported the project with their competence and tools. It is also important to get a picture of where they are located, which region is overrepresented, and where the latest knowledge, expertise and technology are concentrated. At the project level, it is also important to see how much impact the FIE projects have achieved.

In the following sections we present the methodology used to analyse the lifecycle of the CCs and the sources we worked with, then results will be presented using descriptive statistics.

Methodology

Presence analysis was based on four sources of data:

- the initial FIEs' Execution Plans,
- the Progress report from the second reporting period (Deliverable 3.4-2), and
- an unpublished internal WP3 document to overview the status of CCs' reporting.

We examined the participation of the CCs based on the above-mentioned sources from which we identified their location and gathered the number of FIEs they participated in. We also calculated their registration rate on the portal and for the Agricultural Technology Navigator. After merging these available data sources, we had the opportunity to answer the following questions:

- total number of CCs in FIEs,
- number of FIE involvement per CCs,
- total number of CCs registered on the Innovation Portal,

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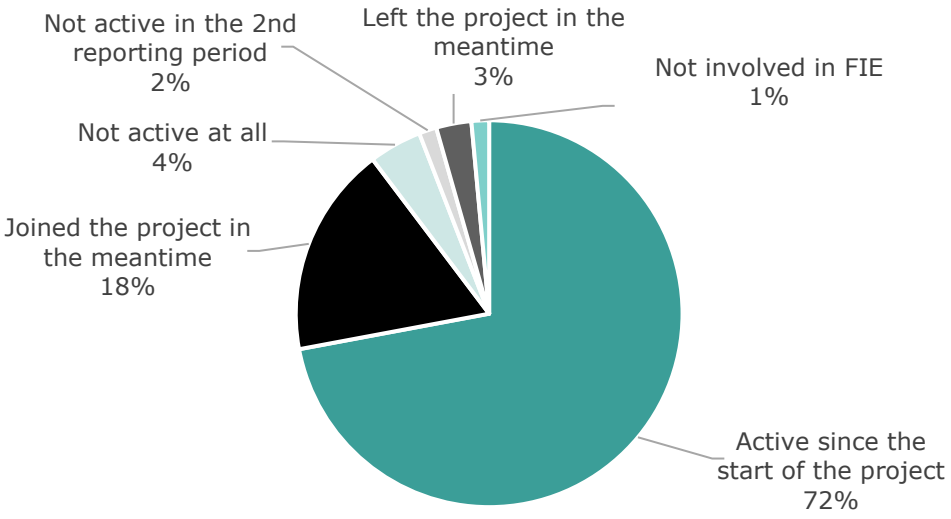
[6] Flagship Innovation Experiments serve as benchmarks for other Innovation Experiments to strive towards. This is where technology solutions are put into practice. Flagship Innovation Experiments are conducted with the help of Digital Innovation Hubs which facilitate access to the latest knowledge and expertise, and technology support provided by Competence Centres.

- number of CCs registered for the ATN,
- CCs' location by country.

Results

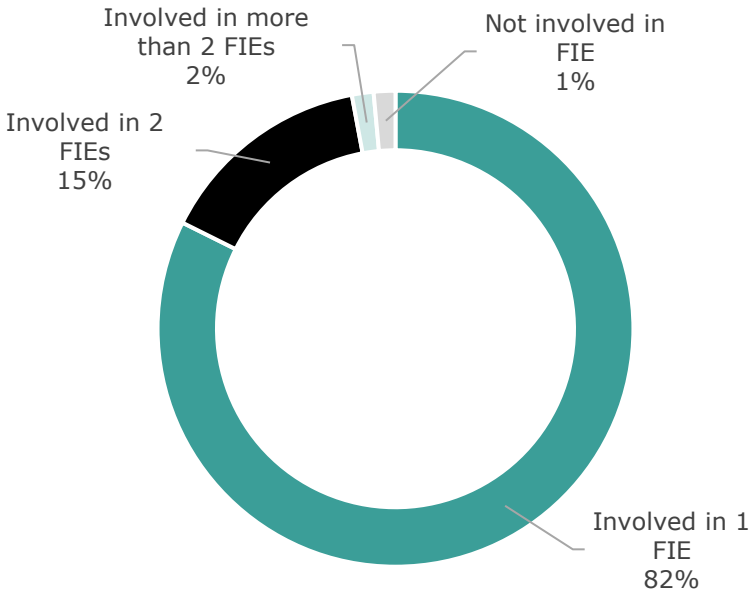
The total number of CCs in FIE projects were 68. Out of these 68 CCs, 48 CCs were active since the start of the project. 18 percent of CCs joined in the meantime and only 4 percent showed no activity in the FIE projects. There was one CC which was not active in the second reporting period and one which was in the Execution Plan but not involved in FIE during the project. Three CCs left the project, and the same number of CCs were not active for the entire lifetime of the project (Figure 3).

Figure 3 Analysis of presence of CCs involved in FIEs (N=68)



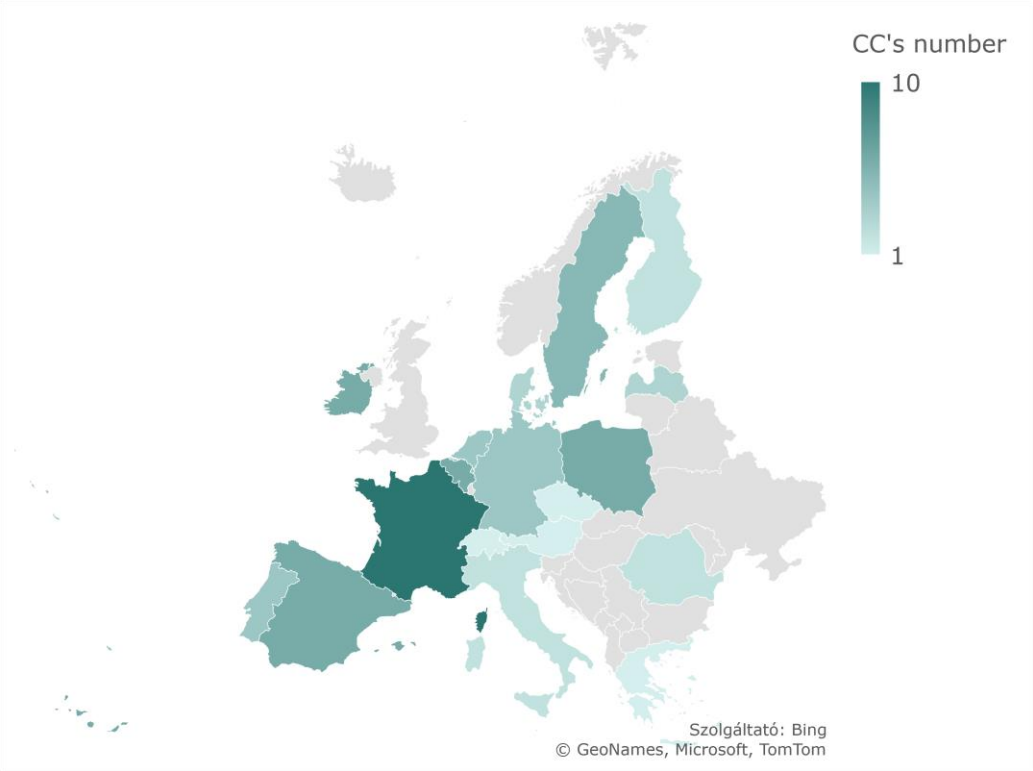
Majority of CCs (82 per cent) were involved in only one FIE, while 15 percent of them participated in two FIEs. One CC worked within more than two FIEs and one was not involved in any of them (Figure 4).

Figure 4 CCs' participation in FIEs (N=68)



Six CCs were located in Ireland, Belgium, Poland, and Spain, while the majority of CCs were in France (Figure 5). Sweden, home to five CCs, came next after them. In the Netherlands, Germany, Portugal, and Latvia, there were four CCs total. In general, we can say that the majority of CCs were found in countries in western and northern Europe.

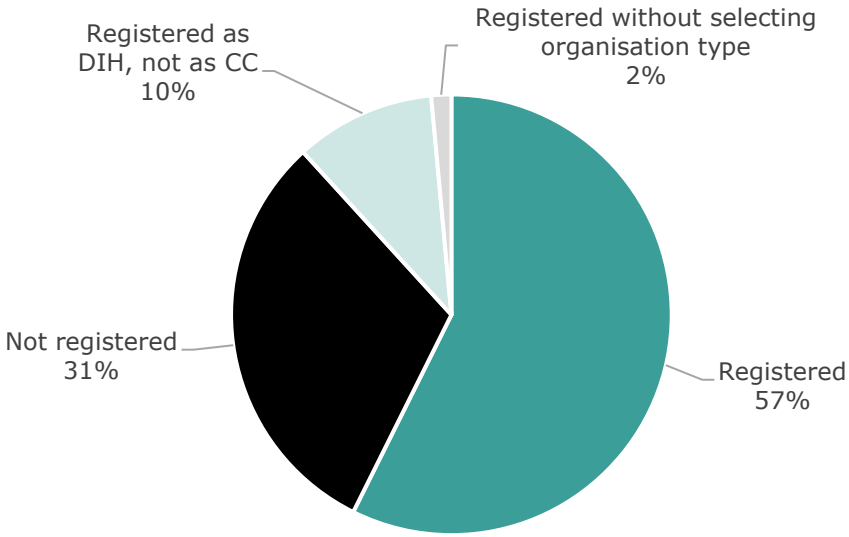
Figure 5 Location of the CCs' (N=68)



One of the major indicators of the success SmartAgriHubs achieved is the number of stakeholders signed up on the Innovation Portal. The Innovation Portal is supposed to promote the digital ecosystem and foster a sense of community among the numerous partners. Therefore, we looked at how many of the CCs involved in FIEs registered on the Portal. When registration statistics were accessed[7], only 60 percent of the CCs registered on the SmartAgriHubs Innovation Portal (Figure 6). It means that one third of CCs who were involved in FIE projects were still not available through the Innovation Portal. We identified seven CCs who registered as Digital Innovation Hubs.

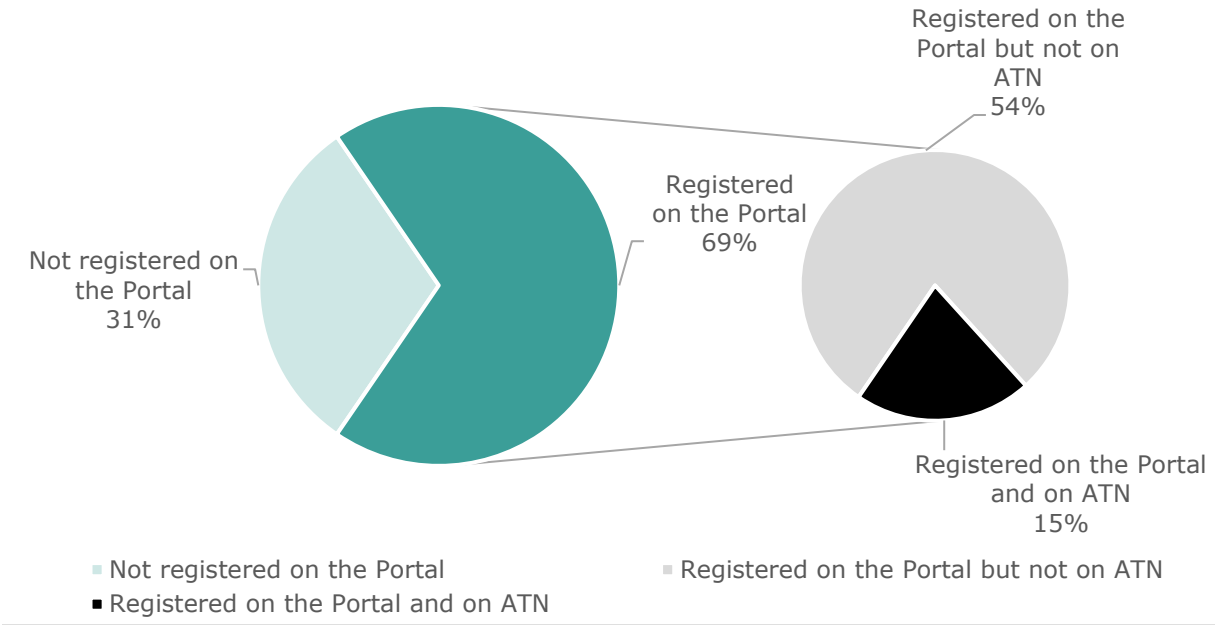
[7] *Registration rate was accessed on 7th of September, 2022.*

Figure 6 Portal registration (N=68)



Another underperforming project impact is revealed by the comparatively low registration rate in what could have served as a powerful tool to connect CCs and their potential beneficiaries. The Agricultural Technology Navigator, along with its classification system for agricultural digital technologies was one of WP5's major deliverables. This system and competence classification tool was created to assist CCs and other ecosystem partners in finding relevant digital technology solutions and systems and presenting themselves when looking for new collaborative partnerships. Despite the ATN's potential benefits, registration rates have been quite low, with only 15% of FIE CCs filling out their competencies (Figure 7). The ATN however, designed and ready to be implemented at M6, was not made available on the Portal until after the FIEs were well underway and ATN registration was not made a condition of participation or funding in the FIEs or IEs in Open Calls to follow. It was not substantially functional on the Portal until the last few months of the project. This untapped potential in the community of CCs could be considered as an asset in the sustainability plan of SmartAgriHubs.

Figure 7 FIE CCs' Registration rate for the Agriculture Technology Navigator (N=68)



2.2. ANALYSIS OF CCS' PERFORMANCE IN FIES

Introduction

This chapter presents the results of our research on CC's perceptions of their collaboration with FIEs. The key objective was for us to understand how CCs evaluate their participation in the Flagship Innovation Experiments and identify areas where they could operate more efficiently and productively. Receiving feedback, in our opinion, will aid FIEs to accomplish their main goal and, perhaps, motivate participants to take action to improve their initiatives and connections within their network.

To have a clearer insight into how CCs viewed their cooperation in the FIEs, we analysed the questionnaires that Work Package 3 developed to monitor FIEs' progress and CCs' inputs about their collaboration and experiences. At the time of drafting this deliverable, the evaluation period has not ended. However, as the deliverable's due date was approaching, we had to shorten the timeframe of this analysis, thus we only analysed the responses that came in until the 31st of August 2022.

The structure of this section is as follows: we present the methodology of the analysis, proceeded by our result, which we discuss in the same order as the survey questions. The questions and their brief descriptions are listed in the Table 1.

Table 1 Survey questions and their short description to which CCs responded

What is your experience from collaboration with FIE?	Please provide us more information regarding your experience from collaborating with FIE, both positive aspects and drawbacks.
Benefits for CCs	What are some of the benefits you have gained form this corporations and or the SAHs project?
Additional services that could be provided	If participating in SAHs project again, what are additional services that you could provide improve FIE performance or impact?
Services of your CC that you would like to strengthen	Based on the previous experience, are there any particular services that you wish to enhance within your CC to better fit the needs of your end users?
Best practices, success stories	Please share with us any best practices or success stories arising from your involvement in the project.

Source: D3.4-2 Periodic Evaluation of the IEs Performance [8]

Methodology

Within SmartAgriHubs there were 28 Flagship Innovation Experiments including 68 CCs as participants. Our analysis is based on 27 progress reports each from a different CC concerning the collaboration in FIEs. Our evaluation could only process about 40 per cent of the total number of CCs reports due to our constrained timeframe. We analysed the comments that CCs made to the reports, and we opted to evaluate the data using both quantitative and qualitative methodologies as the responses were provided as texts.

The data were processed partly manually and partly automatically using a text analysing software called MonkeyLearn. The application provides a large selection of pre-trained data analysis techniques with a focus on text data analysis. The answers to the first, fourth and fifth questions were analysed using the results of the text analysis program. The answers to the second question were processed manually.

The first question was processed using MonkeyLearn's Sentiment Analysis classifier model, which grouped the responses into positive, negative, and neutral categories. Responses to the second question were divided into four content groups (a "none" label was added as well) and the responses were tagged and quantified based on these. Within a response, multiple tags were indicated and processed in aggregate. The answers to the fourth question were processed similarly as described for the second answer, the only difference being that for the fourth question, we trained a Classifier text analysis in MonkeyLearn to categorise the answers into content groups and tag them for us. The answers to the fifth question were processed using a text condensation method, after which they were sorted into topic groups. Descriptive statistics and graph analysis were employed to illustrate the data and list the basic characteristics of the dataset.

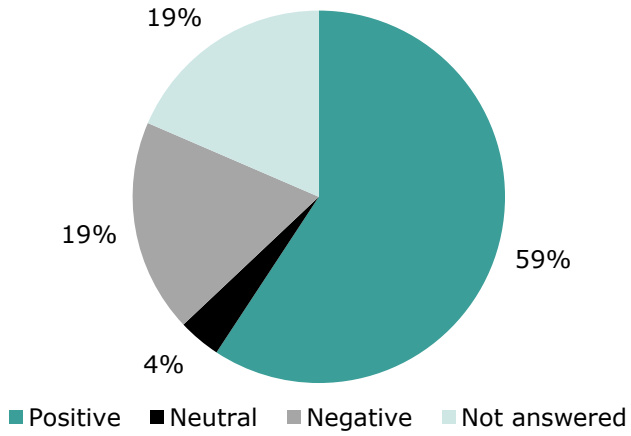
[8] *https://smartagrihubs.eu/Deliverables/pdfs/D3.4-2-Periodic-Evaluation-of-the-IEs-Performance_final_PU.pdf*

Results

In the following section, we present our results from the text analysis of the CCs' answers. In sub-chapter three, we discuss the sentiment analysis of responses, then the benefits of participating in FIEs and aspects of service improvement, and finally, we evaluate best practices and success stories mentioned by CCs.

In the first question, CCs were asked about their opinion of their collaboration with the FIE ("*What is your experience from collaboration with FIE?"*). Because the nature of the question suggested a value-driven, subjective answer we decided to analyse them with a Sentiment analysis tool provided by MonkeyLearn. The software divided responses into good, negative, and neutral. We then added a fourth category: "blank". The model's average confidence level[9] was 0.77 points. Positive responses were easier to categorise and had higher levels of confidence (0.81), while negative responses received 0.67 points and the single neutral response scored 0.554 points, making it the least reliable categorization. Altogether 22 CCs replied to this question, out of which 16 were positive (59 per cent), 5 negative (19 per cent) and 5 CCs did not answer the question. Only one CC's commentary was sorted in the neutral category. The following pie chart serves as a visual aid for the above-mentioned results (Figure 8). Moreover, Table 2 shows some illustrative quotes from CCs' reports.

Figure 8 Sentiment analysis of the responses to the first question shown in percentage (n=27)



Source: Self-edited

[9] *The confidence level is an indicator value which demonstrates the accuracy of the classification. The closer it is to 1 the more reliable the categorisation is.*

Table 2 Representative quotes from CCs responses

Positive statements	Negative statements	Neutral statements
"It was the first time that we have been in a multi-partnership program, so for us it was very rewarding. "	*"The pandemics made testing on field more difficult to accomplish "*	*"As it was said before, [name of CC] was information receiver and knowledge exchange facilitator. It was interesting to hear about the results of the project as [name of CC are implementing EIP project where meteorological stations' data are used, this was good possibility to hear about the other project experience"*
"Great collaboration experience, open communication allowed us to deal with unforeseen challenges. "	*"In our instance, however, I felt that there could have been better organisation of communications, and information gathering. "*	
"We found it very interesting and we were pleased to have the opportunity to collaborate in this FIE. "	*"Issues with Covid restrictions limited possibilities to realization of workshops and physical meetings to improve dissemination impact and direct communication. "*	
"We have had a great experience collaborating with the FIE. "	*"The corona pandemic unfortunately destroyed the timetable for the work in the project. "*	
"Positives: good attitude of the partners, and benefits of regular meetings (especially when there were problems)."	*"A bit hard to get an overview. Not fully transparent in what way our contribution were further developed "*	

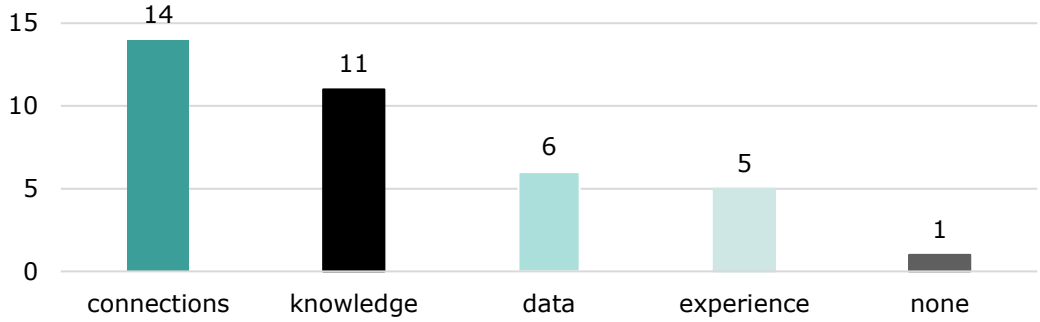
Source: Self-edited

On this basis, we can conclude that the perceptions and experiences of the CCs are favourable with respect to their participation, highlighting an important but difficult-to-measure benefit of SmartAgriHubs.

CCs were asked to evaluate the benefits they received from their collaboration. All 27 respondents answered this question. Overall, 37 tags were indicated for the second question, out of which 18 belong to the same answer. After we became familiar with the responses, we created 4 classification groups which are the following: connections, knowledge, data, and experience. One CC's response indicated no additional benefit. Establishing new connections and partnerships was the greatest benefit of the project according to CCs. This advantage was mentioned 14 times, which accounts for 38 per cent of the answers. CCs used the opportunity of taking part in this project to broaden their network both at national and international levels, and they were able to form connections with parties from practical and theoretical fields as well. These newfound connections help increase CCs' European visibility and provide them access to experience and knowledge. Gaining knowledge is the second highest rated (11 occurrences) benefit among CCs. Knowledge-related benefits varied from personal to an organisational level. CCs could expand their practical and theoretical knowledge and find inspiration to explore further fields as well. The benefit of newly obtained practical knowledge means gaining more data (6 occurrences) and experience (5 occurrences) in their projects as well, thus data and experience became recognised tags too. One CC was not able to identify any benefit, as they were acquaintances with all other participants and they already had a very good collaboration that could not be further

exploited, we indicated this answer with a "none" tag. Figure 9 represents these five groups; the occurrences are shown above each column.

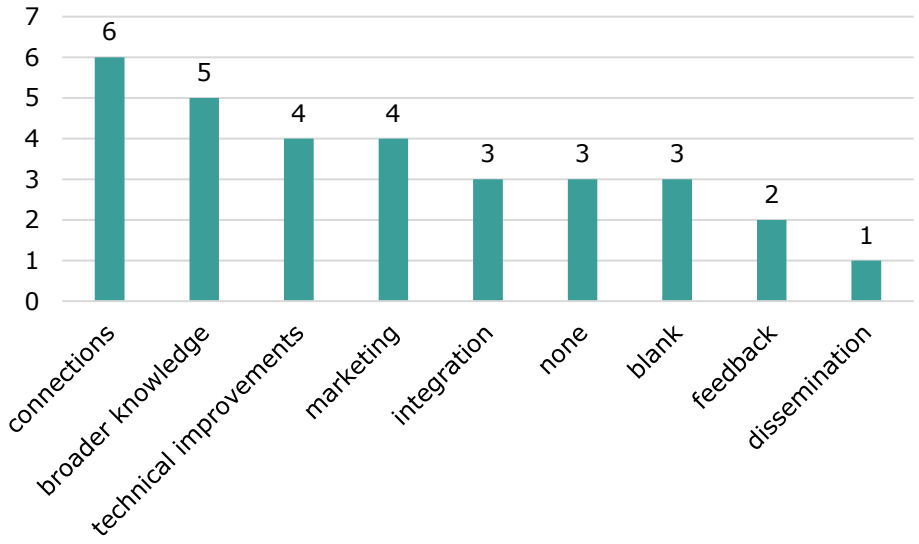
Figure 9 CCs benefits in FIEs categorized into four thematic groups (n=37)



Source: Self-edited

Twenty of the 23 CCs who responded to the fourth question ("*Services of your CC that you would like to strengthen"*) provided information on services that they would like to strengthen. To analyse the responses, we trained a classification module in MonkeyLearn to automatically categorise the answers. The additional services that CCs could provide were covering a wide variety, hence we classified by mentioned topics and not by the actual services. For two answers we had to use manual tagging, but the 24 answers processed by the software reached a 0,809 confidence, which means that the program was able to create quite accurate tagging. Similarly, to the previous questions, we added a "none" and a "blank" group, both containing 3 occurrences, thus the final number of tags was 34. Even with the thematic text analysis, we obtained eight different content groupings that had low element counts; the category ("connections") with the most elements contained only 6 answers. CCs mentioned broadening their knowledge (5 occurrences) and improving their technological assets and methods (4 occurrences) would benefit the services they offer. Another development area that CCs would like to focus on is integration (3 occurrences) within their hubs and connections with farmers. Reaching out to end-users circles back to receiving feedback, which is a very important part of developing one's services, two CCs mentioned that they would like to better their feedback processes. To connect with farmers, five CCs mentioned that they should advance their marketing (4 occurrences) and dissemination (1 occurrence) procedures as well to be able to reach a wider audience and enhance their online presence. Below Figure 3 shows all nine categories that were formed by the responses to the fourth question.

Figure 10 Analysis of services aspects that CCs would strengthen, categorized into thematic groups (n=34)



Source: Self-edited

For the last question, we received 25 responses, two of which were "NA" answers, and two CCs did not fill in a response. A sentiment analysis shows that 16 answers (59 per cent) were classified as positive and 9 (33 per cent) as neutral. No responses were grouped as negative. The confidence of the analysis is 0,782 which shows the lowest accuracy out of all the automatically generated queries.

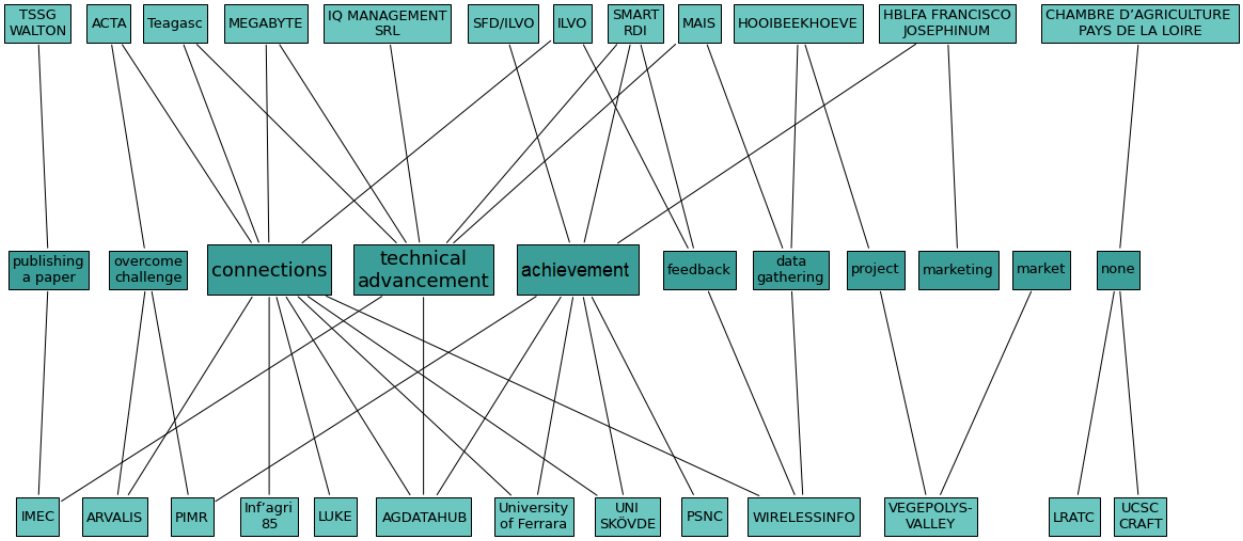
To visualise the answers to this question we decided to process the text with a keyword extracting tool, afterwards, we used these keywords to form a word cloud. The word cloud shows only one highlighted, a clearly outstanding word which is "project". Unfortunately, even with the keyword extraction, there were only a few matches in the text, thus the word cloud cannot serve more purpose than being a visual representation of the descriptions of best practices and success stories (Figure 4).

Figure 4 Word cloud of the best practices and success stories of CCs

Source: Self-edited

However, we processed the replies in an alternative manner. We created a two-step classification method to manually analyse the text, the first step was to simplify, so the text became tags, and we organised the tags into topics. From this model we created a graph, that shows which CCs' best practices and success stories had something in common. Each tag is represented by a single line that connects CCs to a topic group, but some responses contained more than one topic, which means we produced more lines than the number of answers. From our graph (Figure 11) three topics clearly emerge from the other eight. These topics were the most mentioned ones with "connections" receiving 11 tags, "technical advancements" gaining 7 and "achievements" connecting 8 lines. These three groups serve as nodes, they interconnect and bring closer other topics as well. Figure 5 depicts the connections made in this analysis.

Figure 11 Graph diagram of the success stories and best practices mentioned (n=44)



Source: Self-edited

There are also less populated categories, such as publishing an article (2 occurrences), marketing and market access (both having 1 occurrence), these were more single benefits of the project that CCs gained from this collaboration, but nonetheless are worth mentioning.

Overall we can observe that all four questions had similar tags and categories within the responses, which were circling around the importance of making relations and partnerships both with other organisations and end-users, benefiting from knowledge sharing and exploring new ideas to improve and perfect one's processes and achieving technical advancement by the experiences and possibilities presented in the FIEs.

3. CCS' GOOD PRACTICES IN QUALITY SERVICE AND COOPERATION AGREEMENT MANAGEMENT

This section presents good practices collected from CCs in relation to service delivery and cooperation agreements. Moreover, each concept is introduced by a short literature review. One-on-one interviews were used to collect information on best practices. With the assistance of Regional Clusters, recommended CCs were contacted directly and invited to participate in the assessment. Participants who made themselves available were interviewed via video call. Interviews were conducted following an interview guideline (

Annex 2). Prior to the interviews, participants provided consent to participate in the survey. Both the interview guideline and the text of the consent can be found in the Annex 1.

3.1. CCS' GOOD PRACTICES IN THE MANAGEMENT OF SERVICE DELIVERY

Introduction

The primary goal of this section is to contribute to a better understanding of service delivery, hence we present the fundamental definitions, key concepts, and their application in the field of digital innovation. The process of providing a service to a consumer or a client is referred to as **service delivery**. The service concept establishes the means and ways of service design, bridging the gap between customer needs and a company's strategic goals (Ledimo and Martins 2015).

Quality is a highly personal and subjective term, making it difficult to define objectively what constitutes good quality. Researchers (Olshavsky, 1985; Holbrook and Corfman as cited in Parasuraman, Zeithaml and Berry, 1988) concur that subjective quality judgment is similar to attitudes in that both refer to an overall value assessment. **High-quality services,** according to Garvin's definition, are those that satisfy the preferences and expectations of customers (Haywood-Farmer 1988).

Service quality (SQ) and **customer satisfaction** are closely connected terms that have become increasingly more important as the service-providing sector has gained more significance in the economy worldwide. To improve service quality, we must first comprehend the components that make up present service quality, as well as how to measure it, however, due to their intangibility and non-standard character, services are hard to assess (Ramanathan and Karpuzcu 2011). The problem of measuring SQ sparked scientific attention, and several methods were produced. The most popular model is SERVQUAL, a multiple-item scale measuring consumers' perceptions of SQ (Parasuraman, Zeithaml, and Berry 1988). This method compares consumers' expectations for service quality (**expected service quality, ESQ**) with their perceptions of the actual service they receive (**perceived service quality, PSQ**). Consumers' PSQ relies on five dimensions, which are the following:

1) tangibility (the physical facilities, tools, and personnel's appearance),
2) reliability (the capacity to deliver the promised service precisely and consistently),
3) responsiveness (the readiness to assist clients and render speedy service),
4) assurance (workers' expertise, politeness, and capacity to foster confidence and trust),
5) empathy (the level of consideration and individual service the business offers to its clients) (Ladhari 2010).

One of the most important aspects of service delivery is the quality of the service provided, which leads us to the relevance of quality management. Since the early twentieth century, the focus of **quality management** (QM) has evolved from discovering defective items and conducting quality inspections to overall quality assurance of a company's performance (Weckenmann, Akkasoglu, and Werner 2015). On the one hand, quality management became a philosophy: it is a holistic management thinking that supports all organisational functions through continuous improvement and transformation. It is, on the other hand, a practice that, through critical and practical activities, leads to direct or indirect gains in quality performance and competitive advantage (Kim, Kumar, and Kumar 2012). One of the most

well-known and most extensive standards within the QM paradigm is the ISO 9001 (Wen, Sun, and Yan 2022), but the list of QM tools has been growing continuously for the past decade (e.g. Lean, Six Sigma).

The importance and difficulty of **service quality management** can be attributed to several factors. According to Haywood-Farmer (1988), the challenging aspects can be summarized by the following four aspects: Given the **intangibility** of most services, it can be challenging to explain to customers exactly what they will receive, which can result in misinformation and disappointment. Services cannot usually be kept for subsequent quality assessments, which can cause quality management concerns. Secondly, consumers assess the quality of services using **more factors** than they do of products. These characteristics range from the physical surroundings of the service to interpersonal elements, and depending on the client or other variables, their priority frequently changes. Moreover, as the authority of the service provider does not extend to consumers in the same manner that it does to employees and staff, **customers' participation** in the service production process may also present issues. Finally, when we compare industrial manufacturing facilities to service providers, we can see that the former often operate on a smaller scale, giving services a more intimate feel and allowing for **direct interaction between employees and clients**. Services are intangible, so to convey a positive image of the service offered, the staff and physical environment must be client-oriented (e.g., polite, well-trained) and user-friendly (e.g., accessible, clean).

Cody and Hope also emphasise these features, stressing that service intangibility, performance heterogeneity, and the inseparability of customers and producers make it difficult to analyze SQ (Winkler and Moczulska 2014). Consumers' involvement in the service delivery process means that every service is at its core a **co-creation or co-production** between customer and provider (Hilton, Hughes, and Chalcraft 2012).

Since the 1970s, workflows and operations have been subject to ongoing digitization and **digital transformation** (DT). Through the integration of information, computing, communication and connectivity technologies, digital transformation seeks to improve processes as well as to enhance the switch from analogue to digital (Vial 2021). Similar to the principles of digital transformation, **service innovation** also aims to create new, additional value by improving current practices or replacing them with better ones. Service innovation initiatives and new startup companies benefit from the data-rich environment created by digitization thus raising the bar of competitiveness, but to achieve it service providers have to embrace a data-oriented, customer-centric mindset and practice (Soto Setzke et al. 2021).

Digitization and the **information and communication technology** (ICT) industry has been given a significant boost since 2019 with the Coronavirus epidemic, becoming even more dominant, taking over sectors that were previously offline-based. The service industry was seriously affected by the nationwide lockdowns, which forced businesses to transfer services partially or entirely online (Agostino, Arnaboldi, and Lema 2021). This external event accelerated the speed of service digitization worldwide. Ladhari (2010) summarizes the main differences between traditional retail service and its online counterpart as the following:

1) Online services benefit users with convenience and efficiency.

2) Users' privacy, safety, and secrecy are all issues that arise as a result of their participation in the online environment.

3) Elimination of personal contact between customer and provider.

4) Customers' role in SQ is more important online than offline.

CCs' good practices

Based on the introduction section on management of service delivery we evaluated the results from CCs' service delivery good practices. Our findings are presented in table 3.

On-farm demonstrations are a great way to show services to users in an environment that is familiar to them, and they can see, how the service performs which can fill potential gaps between expected service quality and perceived service quality. It is also crucial to communicate in a common language. There are existing challenges to overcome while offering a service, such as the intangibility of services and the subjective judgments of users. Providers should try to eliminate all additional challenges, such as speaking a language that is unfamiliar to one of the parties, which hinders clarity between partners. To further clarify processes, CCs' may find it useful to create a service roadmap, which helps users to have an overall understanding of the service and its outcomes. This good practice also brings ESQ and PSQ closer to each other and serves as a guide for both the user and provider.

Striving to know more about the target group is very important to improve one's service collecting valid knowledge beforehand is crucial in designing a service, but it is also important to gather feedback while the service is provided. This can help CCs in quality management, while feedback is also a source of inspiration. Finally, involving an outsider in QM can also be a good idea, thus CCs have an impartial third party, who observes the service unbiasedly and brings in new ideas.

Table 3. Results from the "service delivery" good practice collection

Good practice	Why is it a good practice?
Organising farm demonstrations	Organising farm demonstrations is useful because it allows you to address producers in their own environment. They are more likely to open up not just about their business, but more on personal and social matters as well.
Organising farm demonstrations	For planning farm demonstrations, the NEFERTITI project offers a variety of helpful resources.
Developing staff members' facilitation skills	When the goal is to maximise interactions among a group of stakeholders, facilitation becomes extremely important.
Utilizing survey tools after workshops	Using survey tools after workshops/farm visits proved to be beneficial in obtaining feedback on the provided services. These pieces of information were later used to evaluate and better their services.
Creating (digitalization) roadmap for farmers	For achieving farmers' goals, it might be useful to create a roadmap of the service and its impacts, thus the process will be clear and if there are bottlenecks then these roadmaps could become focal in coming up with a solution.

Good practice	Why is it a good practice?
Collecting needs of target groups	Good knowledge of target groups' needs is always essential
Knowledge transfer in common language	There are many methods for transferring knowledge but having a common language among the participants is probably the most crucial criterion in such activity. Finding ways to communicate any content to end users will greatly increase the quality of service
Dedicated person for quality management	Think about the possibility of asking someone outside the project, but in-house, to act as an external observer and witness.
Making video testimonies during events	A creative and exciting way to gather feedback from participants during event. Such videos can later be used for demonstration purposes

3.2. CCS GOOD PRACTICES IN COOPERATION AGREEMENTS

Introduction

The main objective of this chapter is to improve knowledge of cooperation and cooperation agreement; as a result, we provide their core definitions, objectives, types and importance. Inter-organisational relationships (IORs), such as alliances, buyer-supplier partnerships, and cross-sector collaborations, are fundamentally based on collaboration, coordination, and cooperation (Castañer and Oliveira 2020).

According to Wikiwand, "*cooperation […] is the process of groups of organisms working or acting together for common, mutual, or some underlying benefit, as opposed to working in competition for selfish benefit* [10]. Depending on another business-related definition of the term cooperation, cooperation is known as collaboration between two or more businesses with a specific goal in mind, but retain a major portion of their financial and legal independence. Cooperation is frequently used interchangeably with the terms "strategic alliance" and "strategic network" (Possel-Doelken, Zheng, and Tang 2002)(Possel-Doelken et al., 2002).

Cooperation objectives / targets (of production companies)

The main purpose of creating strategic networks is to reduce uncertainty and boost competitiveness. Cutting-edge businesses have to cope with a business environment that is quickly becoming more complicated. Companies attempt to maintain or strengthen their current market position by concentrating on and improving their core competencies and outsource their non-core competencies, which increases the company's dependence on other

[10] https://www.wikiwand.com/en/Cooperation

companies. Cooperation networks are established to ensure that key partners on whom the firm is heavily dependent keep their word. The network's partners make an effort to integrate their business operations, paying close attention to the interfaces of the organisations. Therefore, it is possible to improve the effectiveness and speed of product creation, operations planning, manufacturing, and product distribution and finally they can achieve greater competitiveness which reduces uncertainty. From the economic side, further goals of the cooperation are risk reduction and economy of speed, scope and scale. On the other hand cooperation has socio-emotional aims and is established to influencing competition and transfer know-how (Possel-Doelken et al., 2002). According to Encyclopedia.com, five types of cooperation may be distinguished: automatic, traditional, contractual, directed and spontaneous"[11].

The importance of cooperation has statistically proven by many experts. According to Stejskal et al. (2016) the cooperation of enterprises on innovation activities has a positive effect on their overall performance. Collaboration between universities and businesses also has a positive impact on the performance of companies. Freel and Harrison (2006) identified positive associations between product innovation success and cooperation with customers and the public sector, and between process innovation success and cooperation with suppliers and universities.

Regarding factors affecting cooperation, there are four core clusters of factors that influence the cooperation in networks, in particular, innovation and learning networks: personal characteristics, diversity, effective cooperation and managerial aspects.. Effective cooperation is a core activity in cooperation networks such as in interfirm alliances. The capability to manage cooperation is key to successful cooperation (Sie et al. 2014).

Cooperation agreements

A cooperation agreement is a contract between two parties seeking to collaborate on a project. Therefore, a partnership and cooperation agreement will frequently go hand in hand. The contract specifies the circumstances of the upcoming professional relationship, as well as the aims and goals. Several types of entities can enter into cooperation agreements: it could be required between two parties, such as two people or companies, or it might be required between two nations. [12] In some cases, contracting is obligatory, for instance, well-considered strategies and contractual bases in accordance with the relevant stakeholder communication are required for public-private partnerships. Before creating public-private partnerships formally, it is important to pay close attention to 'competing values' These must be covered by a contract that includes clear control and punishment provisions. By doing this, it is possible to successfully avert distrust that arises from conflicting interests (such as those involving intellectual property rights) (Meissner 2019).

According to ContractBook, cooperation agreements are recommended to contain the following elements: the objective of the cooperation, details of the parties, details of the cooperation, payment structure, term and termination, confidentiality clause, and jurisdiction[13]. By defining the content of the cooperation in details such as tasks, milestones

[11] *https://www.encyclopedia.com/social-sciences-and-law/sociology-and-social-reform/sociology-general-terms-and-concepts/cooperation#A*

[12] *https://contractbook.com/dictionary/cooperation-agreement*
[13] *https://contractbook.com/templates/cooperation-agreement*

and deadlines, as well as by defining the payment structure and the responsibilities and obligations of the partners, the cooperation can be successful. However, sometimes the right content of the agreement is not enough, there are other key success factors, such as trust, that affect the success of the cooperation. Success of the cooperation agreement is also influenced by previous cooperation experiences and the reputation of the partner (Sanchez de Pablo Gonzalez del Campo, Peña García Pardo, and Hernández Perlines 2014).

Table 4. Results from the "cooperation agreements" good practice collection

Good practice	Why is it a good practice?
Agreements are essential in cooperations	No single actor has all the competences needed to do a "project job", so cooperation agreements are essential parts of project life.
Shared documents for agreement templates	Thanks to cloud services, shared documents are now easily accessible at any time and anywhere.
Clarifying roles	Partners should come to a clear understanding of each other's roles and duties; thus they are able to formulate realistic and achievable expectations.
Flexibility in cooperation agreement	The cooperation agreement should be very clear and detailed on each task and duty, but if partners realise that they differ from the original plan, then there should be room to flexibly differ from the original plan, and then there should be room to flexibly change the agreement terms.
Realistic targets	In cooperation agreements, it is essential that the expectations, tasks, deadlines, and delivery methods are not only transparent to all parties, but also designed in a realisable way.
Legal assistance	Participants in the creation of a cooperation agreement should also include individuals with legal experience to ensure that the finalised agreement conforms with legal requirements.
Revisiting agreements	Innovation business often requires the willingness to revisit agreements in the light of changing ideas, opinion, or circumstances.
Frank and open conversation	The sooner you communicate any deviations from the agreement, the quicker they can be addressed collectively."

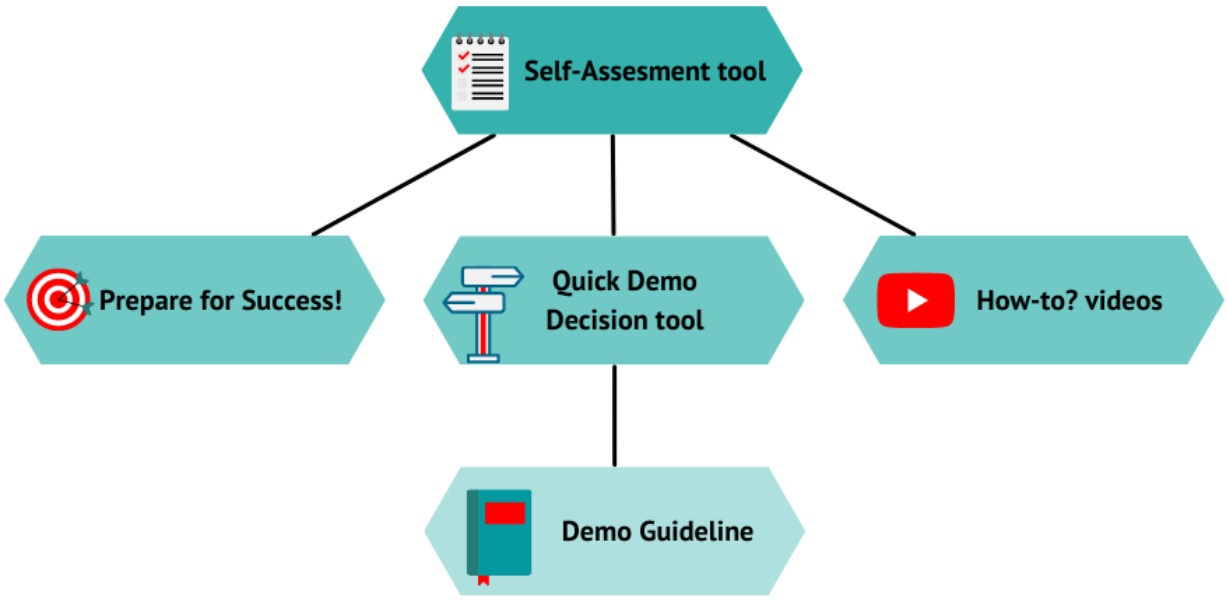
4. PROCEDURES FOR DISSEMINATION AND REPORTING

This section is based on reference to the Demonstration Toolkit from Deliverable 5.5. The Toolkit's main goal was to help CCs become active, visible, and receptive parts of SmartAgriHubs digital ecosystem through their online and offline materials by creating self-training materials. The Demonstration Toolkit offers knowledge and guidance for CCs to go beyond scientific publications with their dissemination activities.

Since CCs' main roles are research and technology transfer in digital innovation hubs, it is essential for them to perform dissemination activities. On the one hand, the importance of dissemination is a fundamental component of research anyway. On the other hand, innovation cooperations are usually based on knowledge-intensive interactions between parties with different background. Therefore, there is no guarantee that parties in innovation cooperations have the access and skills to use scientific publications. Consequently, dissemination formats that are accessible to a larger audience may be required for innovation cooperations.

Today ICT resources offer vast opportunities for online demonstration and distribution, while a wealth of resources and knowledge are available for organising physical events and in-person demonstrations. The Demonstration Toolkit for CCs include five stand-alone tools that provide knowledge and guidance for CCs to perform online and offline demonstrations. These tools are designed to be self-training materials and support CCs in the first steps of their demonstration activities. As it was outlined in Deliverable 5.5. the entry point for the Toolkit is the Self-Assessment tool. This tool shows what demonstration competences might need to be improved and strengthened and it recommends other tools to be used. The Quick Demo Decision Tool is designed to help the decision-making process of CCs regarding demonstration activities. Then the three knowledge reservoirs, (Demonstration Guideline, Prepare for Success! and How-to Videos) offer information preliminary selected for CCs presenting knowledge items (videos, success stories, tips and hints) in a free-to-search and browsable design that makes them well-functioning sources of inspiration for CCs.

Figure 12 Ideal user journey of the Demonstration Toolkit



Source: Deliverable 5.5.3. Development of materials for trainings and interregional demonstrations of CCs.

5. PROCEDURES FOR CCS' NETWORK GOVERNANCE AND MANAGEMENT

This section was aimed to establish a common understanding of concepts, definitions and terms related to governance and management of networks by reviewing academic and grey literature. Due to changing priorities in the project, it was not possible to take the network of CCs further in the implementation thereof. However, we used the literature reviews for coming up with some preliminary suggestions for possible future use.

LITERATURE REVIEW ON NETWORK GOVERNANCE

This section will review the literature on network governance to present the terminology having been used in this deliverable. Autonomous firms often work together with other stakeholders in networks for the realization of beneficial knowledge or resource exchange. Network partners benefit from these partnerships by becoming jointly able to adapt, coordinate and safeguard these exchanges (Jones, Hesterly, and Borgatti 1997).

According to Provan and Kenis (2007), one of the most important advantages of networks over hierarchies is their flexibility. It allows their members to respond quickly to competition, other challenges or opportunities. At the same time, however, some level of stability is also required in order to maintain legitimacy (for which the most obvious mechanism is a kind of formal hierarchy). The goal is to find the balance and develop a governance structure that is flexible and stable at the same time.

Network governance can be categorized along two different dimensions: first, the level of brokerage: a network can be governed by the organisations that comprise the network, in a decentralized form (shared governance) or a network can be highly brokered in a centralized

way. The second dimension is the source of governance (external / internal). Along these dimensions, Provan and Kenis (2007) differentiate three forms of network governance:

- Participant-governed networks: the network is governed by the network members themselves with no separate governance entity.
- Lead organisation-governed networks: there is one (usually large/powerful/resourceful/legitimate) participant within the network who takes the lead.
- Network administrative organisations: although the network members interact with one another, a separate (external) administrative entity is set up to govern the network and its activities.

Provan and Kennis (2007) claim that the effectiveness of network governance depends upon some key features of networks. They studied four features such as trust, number of participants, goal consensus and the need for network level competencies. Table 1 presents the relationships between these four features and the governance forms.

Table 3 Key Predictors of Effectiveness of Network Governance forms (Provan and Kenis 2007)

Governance forms	Trust	Number of participants	Goal consensus	Need for network level competencies
Shared governance	High density	Few	High	Low
Lead organisation	Low density, highly centralised	Moderate number	Moderately low	Moderate
Network administrative organisation	Moderate density, NAO monitored by members	Moderate to many	Moderately high	High

According to Provan and Kenis (2007), one of the most important advantages of networks over hierarchies is their flexibility. It allows their members to respond quickly to competition, other challenges, or opportunities. At the same time, however, some level of stability is also required in order to maintain legitimacy (for which the most obvious mechanism is a kind of formal hierarchy). The goal is to **find the balance and develop a governance structure that is flexible and stable at the same time.**

SmartAgriHubs, in its future final design, will be operating on the basis of the paradigm of open innovation network. Open innovation networks have been conceptualized more specifically comparing to traditional networks. According to Chesbrough, open innovation is "*the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively*" (Chesbrough 2006, 1).

From the perspective of SmartAgriHubs, CCs create and maintain partnerships, then contribute to joint innovation activities and Innovation Experiments using multi-layered networks of stakeholders (RCs, DIHs, other CCs). These activities are only able to produce the desired outputs if these networks are governed and managed in a deliberate and adequate way.

Although, cooperation with a diverse group of partners (such as customers, end-users, suppliers, competitors, universities, government bodies, etc.) offers great opportunity, additional challenges may arise and cross the road to the desired success. In the paper of Tepic et al (2010), these challenges are split into two groups: challenges in relation to uncertainty and heterogeneity.

Innovation uncertainty "*is determined by the extent of (in)ability to determine what to pursue, how to pursue and whether the pursuit is likely to be profitable"* (Tepic et al. 2010, 4). Uncertainty arise from the difference between what information we already have and the information we may further need to solve a task. Innovation heterogeneity comes from the special nature of open innovation networks in which network partners may represent a great diversity that often increase the coordination cost of maintaining a network. Partners can be heterogeneous in several comparison such as in their knowledge, capabilities, expectations, interests, views and commitment.

Since such challenges may arise in SmartAgriHubs, therefore, it is worth considering what Tepic et al. (2010) offers with regards to governance mechanism. What they claim is that there are two kinds of governance mechanism. The core element in structural perspective is the self-interested and opportunistic behaviour of human beings which is explained by transaction cost and contact theory. In contrast, relational perspective sees the social context in which human beings are embedded and emphasize their ability to trust and be trusted. Regarding governance strategies, opportunistic behaviour can be managed through specified task and resource allocation in the form of contracts, agreements and decision-making hierarchy. This might be an effective strategy if the number of network partners is high. Relational perspective highlights the importance of trust that develops if the level of shared information about reliability and competencies among partners is high. In other words, if the innovation uncertainty is low. Such condition usually results in a decentralized type of governance with informal group coordination. In case of high network heterogeneity, this type of governance can be constraining. However, under real life circumstances, conditions regarding uncertainty and heterogeneity can be combined which means that structural and relational governance mechanisms are better used in combination too (Tepic et al. 2010).

Claus and Spieth's (2017) study has further examined the impacts of governance mechanisms on innovation networks. They claim that the role of governance is twofold: *control* of partners aims to keep risks of opportunism low, while coordination of partners contributes to "*orchestrated activities*". They identify three different governance mechanisms: transactional governance, relational governance and institutionalized governance. Transactional governance "*significantly enhances joint innovation generation and therefore emphasizes the requirement for formalized processes, activities and roles, defined responsibilities and justified consequences in case of disputes*". Relational governance has impacts on "*joint innovation generation which stresses the need for inherent and moral control, governing exchanges through consistent goals and cooperative atmospheres*". Institutionalized governance relies "*on an active network management dealing with orchestrating of network relationships*" (Clauss and Spieth 2017, 80).

One can easily admit that there is a significant relationship between network governance mechanism and the effectiveness of a network. Moreover, the characterization of a network largely determines what type of governance mechanisms can be applied in a network setup. SmartAgriHubs aims to build the network of networks for the digital transition of European Agriculture. Therefore, careful consideration of the potential uncertainty and heterogeneity is crucial before placing the network of CCs on the continuum of different types of governance mechanisms to realize the ambition of the project.

PRELIMINARY SUGGESTION FOR GOVERNANCE STRUCTURE OF CC NETWORK – LIGHT TOUCH APPROACH

The overall aim of SmartAgriHubs is to build a healthy innovation ecosystem that bridges the gaps between needs, interests and expectations of the policy, research and the farming communities and enables stakeholders to freely establish ad-hoc or permanent partnerships, collaboration and networks for adoption and development of new technologies, services and products. SmartAgriHubs follows the paradigm of open innovation network.

Considering overall aim of SmartAgriHubs and what has been learnt from the literature review, this deliverable suggests adopting a so-called "light touch approach" as a governance and management mechanism. The phrase "light touch approach" has been borrowed from a study made by DEI Working Group 1 on Digital Innovation Hubs (DEI 2017); however, it has been also widely used in research on subjects of regulation. A previous version of the mentioned study (EC 2016) raises the question of what form of coordination and governance a European network' of digital innovation hubs would require and seeks answers for the following questions:

- What would be the criteria for admission/recognition? (E.g. Provision of specific services, meeting specific conditions)
- Would any certification mechanism be necessary (if so by whom)?
- What profile should it have within the marketplace (a brand in its own right or remain in the background)?
- How would issues of competition between members be addressed?
- What governance structures, if any, would the network require?

Another European example for light touch governance is the EIT (European Institute of Innovation & Technology). Within the EIT framework, the individual KICs (Knowledge and Innovation Communities) were given a large degree of autonomy (e.g. agenda and working methods), allowing them to choose the best suited approach to meet their objectives. While the EIT coordinates them with a flexible framework, supports and advises them in administrative matters, and disseminates their best governance and funding models. According to an EU Decision "*The EIT should act as a role model across Europe by showing effective and light touch governance*" (EP 2013).

In the following year (June 2017) an updated final version emphasises **flexibility** as the touchstone of the network structure and governance. The services offered for example should be relevant to the clients. When talking about the required organisational forms of the members, the network would be guided by practicality and not rules and regulations that may restrict the scope to act. A formal certification process (with an accreditation structure, and an awarding body) would be too rigid for a network which aims at being responsive to research needs, knowledge and transfer demands, and market requirements. In order to create a dynamic network, the barriers to entry must be kept low while maintaining service and the quality of the network members. **The development of governance structures, in line with the 'light touch' approach would include a useful guidance discussing a list of potential issues that CCs might need to address.**

Based upon these, the features of light touch approach have been defined:

- **Minimal central (top-down) coordination**: instead of a hierarchical, centralised coordination, a bottom-up way is encouraged where communication, joint decision-

making, negotiation and adaptation among CCs are in place – facilitated through the SAH Portal and DIHs. The DIHs are expected to play an important role in the communication between CCs within the DIHs.

- **Minimal formalization:** instead of focusing on positions, and regulations and explicitly prescribed governance processes, the light-touch approach allows the members to adapt to the quickly changing, diverse environment by providing them non-compulsory guidelines and supporting materials through the Portal (and the DIHs)
- **Decentralization**: decisions regarding the way of operation are made "locally" by the CCs and their partners, supported by non-compulsory guidelines and materials through the Portal (and the DIHs).
- **Horizontal connectedness:** members of the CC network are encouraged to connect one another based on their interests and informed decisions both locally and outside the locality.
- **Self-supporting (self-governance):** within the network, CCs can exercise their power to achieve their goals without an unwanted intervention from a central network body. The SAH community will serve to empower CCs with opportunities and tools to increase their presence, activity and impact.

The idea of light touch approach fits well in with the general mechanism that SmartAgriHubs is built around. Stakeholders of the digital ecosystem, such as individual farmers, small technology providers and even large technology companies tend to achieve only a limited influence on the digital ecosystem, SmartAgriHubs will strengthen and connect them with DIHs and embed them within the network of CCs.

DIHs will be in the frontline in searching for challenges and funding to generate, advance and combine new or already existing innovations in the agricultural domain. When DIHs have a match, they join these forces, initiate an Innovation Experiment (IE) with the involvement of best qualified CCs.

Therefore, it is crucial to let CCs freely operate, as much as possible, within the network as their involvement in the development of an IE might require quick reactions crossing borders of sectors, regions or even countries. In this free role CC's might also be an active source of inspiration for DIHs to (jointly) develop new IEs.

LITERATURE REVIEW ON NETWORK MANAGEMENT

In SmartAgriHubs, network management is the operational guidelines of those day-to-day tasks that CCs may need to complete in their "network life". According to Wielinga (2018), three main streams of thought can be identified in the process of constructing networks. These imply three different modes of collaboration.

- Transfer:" I know what is good for you"

  Transfers of technology, extension, diffusion of innovations, multiplier effects are typical to this mode. When the message is really good, transfer mode can be effective. The challenge is to convince the partners that the outcome is their interest.

- Exchange: "Can we make a deal?"

  In exchange mode, the initiator has a desired outcome in mind, for which other actors are needed to collaborate. However, the collaborators need something in return, there should be mutual gain in this mode.

- Co-creation: "What can we create by pooling resources?"

  In co-creation mode, actors pool their resources to achieve some common goal. Shared ambition is the driving force here.

Identifying the right partners with complementary competencies can be difficult, as these partners might speak another 'language' due to their very different technical background. The following three steps are essential for a CC to **identify and interact with prospective partners** in setting up (research) collaboration (Abuja et al. 2019):

1. Determine the right partner profile.
2. Create a proposition that fits your target audience or potential partners
3. Reach out to prospective partners.

PRELIMINARY SUGGESTIONS FOR MANAGEMENT OF DAY-TO-DAY OPERATIONS

Day-to-day operation is broken down into interactions that CCs may be engaged in while using the network (e.g. entering the SAH community, networking, collaboration, monitoring / evaluating). These actions might either generate or might be impacted by issues that need to be addressed, although CCs are not necessarily able to handle them. Therefore, this deliverable is planned to provide a non-binding guidance for CCs to help them through these issues. **The guidance is planned to be a collection of recommendations in the form of a checklist**. Certain key actions have already been identified with potential links to activities of other WPs or Deliverables.

- **Initiation / entry:**

When a newcomer CC wants to register in the Portal, they will be asked to create a profile. Upon registering the CCs' profile through the **CC categorisation tool** (Agricultural Technology Navigator) it is required to enter information on their services, competences, systems and technologies in a multi-layered input system.

- **Networking:**

Based on the details provided throughout registration, the Innovation Portal is planned to help users in networking by the '**Matchmaking**' function. Users will be able to look for other users by using a search engine and/or applying filters such as competences, region, country, sector or organisation type. In the future, the classification of systems and competences technologies through the Agricultural Technology Navigator will allow a more sophisticated search function by CCs and also by the whole of the SAH community. The Portal's **discussion forum** will be available on the matchmaking page for users to access and engage in discussion threads dedicated to topics relevant to the SmartAgriHubs community. Deliverable 5.5 will provide guidelines for face-to-face and online demonstrations that help create local networks.

- **Cooperation:**

Among the several kinds of cooperation that SAH will generate, cooperation through lean multi-actor method will likely be the most noticeable. Lean multi-actor approach for Innovation Experiments will play a crucial role in expanding and developing the SAH ecosystem including the network of CCs. This deliverable is planning to provide recommendations for CCs how they can gain the most from their participation in these processes.

- **Monitoring:**

The self-evaluation tool (Deliverable 5.5) is provided to support CCs in self-evaluation concerning demonstration and networking skills. Further evaluation tools assessing performance (evaluation sheets) will be delivered in later phases of the project.

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ANNEXES

ANNEX 1

Interview Consent Information and Form

This consent form is necessary for us to ensure that you understand the purpose and conditions of your participation. Would you therefore read the accompanying information sheet and then sign this form to certify that you approve the following:

This activity is organised in the framework of the SmartAgriHubs research project. This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 818182. The H2020 European project SmartAgriHubs, "*Connecting the dots to unleash the innovation potential for digital transformation of the European agrifood*", is dedicated to accelerate the digital transformation of the European agri-food sector. It will consolidate, activate and extend the current ecosystem by building a network of Digital Innovation Hubs (DIHs) that will boost the uptake of digital solutions by the farming sector. This will be achieved by integrating technology and business support in a local one stop- shop approach involving all regions and all relevant players in Europe. The heart of the project is formed by 28 flagship innovation experiments demonstrating digital innovations in agriculture, facilitated by DIHs from 9 Regional Clusters including all European member states. Concurrently, SmartAgriHubs will improve the maturity of innovation services of DIHs so that digital innovations will be replicated across Europe and widely adopted by European farmers. The SmartAgriHubs consortium is led by Wageningen University & Research (WUR).

The data collected during the lifetime of the SmartAgriHubs project follow the General Data Protection Regulation 2016/679 (GDPR).

PURPOSE FOR PROCESSING INTERVIEW DATA

Within the frame of this project, AKI (Institute of Agricultural Economics, Hungary) is responsible for the development of protocols for quality service and cooperation agreements and the collection of good practices. To complete this task, personal interviews are conducted with representatives of Competence Centres. Your response will be kept strictly confidential. Your name will not be linked with the task materials and will not be identified or identifiable in the report or reports that result from this task. The interview will be recorded, and a transcript will be produced. The transcript of the interview will be analysed.

YOUR RIGHTS AS A PARTICIPANT

Participation in this activity is voluntary. You can stop at any time without giving reasons. The legal basis for the processing of personal data in this interaction is 'consent'. This means that personal data, your interview answers, the results of the discussions and exercises can only be processed if you explicitly give permission for this (i.e. by signing this consent form).

You have the right to withdraw your consent at any time. However, the withdrawal of your consent shall not affect the lawfulness of processing based on your consent before its withdrawal.

At any time, you have the right to:

- Ask for additional information about the processing of your data.
- Request access to the data that is stored about you.
- Request corrections if the data is incorrect or incomplete.
- Ask for information about you in a common form to be transferred to yourself or someone else.
- Ask for data to be erased or removed from you insofar as this does not threaten or threaten to seriously jeopardize the achievement and validity of the scientific research objectives.

CONFIDENTIALITY

The received data files related to the interview will be hosted and stored by AKI (Hungary) in specifically designed online shared space for SmartAgriHubs, protected with a password, accessible only to the SmartAgriHubs project partners. No sensitive personal data is or will be collected in the context of this interview.

We would like to inform you that AKI is the joint controller of your personal data processed in the context of this research. This means that the researchers at AKI decide on the how and why of the processing in the context of the research. Of course, they are bound by the information in this consent form.

Your personal data may possibly be consulted by some of the people working on the SmartAgriHubs project.

Your personal data as a research participant, will be protected and all data will be handled confidentially. Within AKI, all staff members are bound by the 'Generic Code of Conduct for the processing of personal data and personal information.' In the publication(s) of the project you may be quoted. Even though your name will not be used, the quote itself might state your position.

Where to get more information

Website project: www.smartagrihubs.eu

For more information on the research, you can contact:

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kiraly.gabor@aki.gov.hu

If you have any questions, then you can contact Szabolcs Vágó [AKI's Data Protection Officer] via

vago.szabolcs@aki.gov.hu

Consent Form

Please take the time you need to read all the info until the end and answer the survey.

1.What is your name?

2.What is your e-mail address?

Do you acknowledge that you understand all the info in this consent form and that you provide us with your full consent to collect and use your data in the SmartAgriHubs research project as described?

- Yes
- No

ANNEX 2

SmartAgriHubs Work package 5
Interview with Competence Centres
(Interview guide for interviewees)

Within the frame of SmartAgriHubs, AKI (Institute of Agricultural Economics, Hungary) is responsible for the development of protocols for quality service and cooperation agreements and the collection of good practices. To complete this task, personal interviews are conducted with representatives of Competence Centres (CC).

The interview will cover three topics:

- we would like to learn about practices that you consider to be **good practice** and worth sharing with others in the project;
- we would like to know about your experience in **quality management, including service delivery**;
- and finally, we want to know what principles / protocols you follow to organise **how you work, cooperate, collaborate with others**, especially how you come to **agreements** and how you form these agreements.

INTRODUCTORY QUESTIONS

1. How do you define you as a CC?

Definition of Competence Centres: they form the cornerstone of the Digital Innovation Hubs in the SmartAgriHubs network. They provide the digital technological infrastructure of the DIH by offering advanced technical expertise, access to the latest knowledge and information on digital technologies, as well as test facilities such as labs, pilot and experimental facilities, and other technological and scientific infrastructure.

2. Please choose up to 10 keywords which best demonstrate what your CC does!

3. What key services and/or technologies does your CC offer?

4. What is (are) the main area(s) of strengths of your CC?

QUESTIONS ON GOOD PRACTICES

1. Can you provide two examples of good practices that are related to CC service delivery or CC operations?

service delivery is understood as the actual delivery of a service and products to the customer or clients.

QUESTIONS ON QUALITY MANAGEMENT

1. How does your CC manage quality issues in relation to service delivery? Is there a documented process or protocol in use for that purpose?

documented process: written, management-initiated mechanisms that influence the probability that employees or groups will behave in ways that support the stated marketing objectives" or,

ad hoc practices: unwritten, typically worker-initiated mechanisms designed to influence behaviour.

2. What quality practices does your CC follow when interacting, co-creating with customers?

2.1. What guarantees in your CC that the following matters associated with customers' satisfaction are addressed when interacting or co-creating with customers: personal recognition, courtesy, timely service, professionalism, enthusiastic service, empathy, patience?

QUESTIONS ON COOPERATION AGREEMENTS

1. In the last section of this interview, we would like to talk about cooperation agreements. Are cooperation agreements part of your activities in innovation processes?

cooperation agreement for innovation: formal or written, legal or non-legal arrangement between two or more parties, institutions or individuals that provides a framework for jointly pursuing innovation processes (e.g. memorandum of understanding, legal framework, etc),

innovation process: defined as the development and selection of ideas for innovation and the transformation of these ideas into the innovation.

2. What are the key elements that your CC always has in cooperation agreements? Can you name 2 or 3? Why those?

E.g. Legal framework (legally binding or not); scope of cooperation; purpose of agreement; limitations, governance of resource / infrastructure sharing; IPR, timeline of actions; etc.).

3. Please, think about a cooperation agreement that you consider most successful in your CCs! What factors determined the success of that cooperation agreement? Do you pay attention to have these factors covered in new cooperation agreements?

4. If you think about less successful or unsuccessful cooperation agreements, what factors caused these failures? How do you handle these factors today?

Thank you for your cooperation!