Deliverable D 700.1

Inventory of long and short term future needs of food chain users for future functions of internet

WP 700

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FUTURE INTERNET PPP

SEVENTH FRAMEWORK PROGRAMME

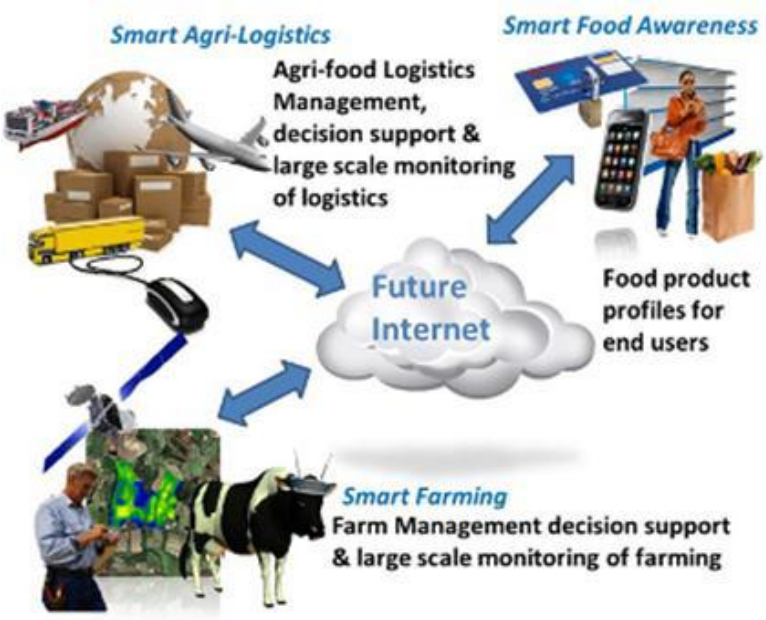
Smart Agri-Food

The SmartAgriFood Project

The SmartAgriFood project is funded in the scope of the Future Internet Public Private Partnership Programme (FI-PPP), as part of the 7th Framework Programme of the European Commission. The key objective is to elaborate requirements that shall be fulfilled by a "Future Internet" to drastically improve the production and delivery of safe & healthy food.

Project Summary

SmartAgriFood aims to boost application & use of Future Internet ICTs in agri-food sector by:



- Identifying and describing technical, functional and non-functional Future Internet specifications for experimentation in smart agri-food production as a whole system and in particular for smart farming, smart agri-logistics & smart food awareness,
- Identifying and developing smart agri-food-specific capabilities and conceptual prototypes, demonstrating critical technological solutions including the feasibility to further develop them in large scale experimentation and validation,
- Identifying and describing existing experimentation structures and start user community building, resulting in an implementation plan for the next phase in the framework of the FI PPP programme.

Project Consortium

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- TNO; Netherlands
- CentMa GmbH; Germany
- ATOS ORIGIN; Spain
- ASI S.L.; Spain
- Huawei; Germany
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Dissemination Level

PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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Document Summary (executive summary)

This document is **Deliverable D.700.1,** which summarizes the total results of questionnaire survey and focus group discussions carried out in work package 700 of SmartAgriFood Project.

The general objective of work package 700 of the SmartAgriFood project is to ensure an effective dialogue between the agri-food chain members representing the "user community" and ICT community representing the "solution providers" for developing such domain-specific capabilities and conceptual prototypes which meet the current and future needs of the different stakeholders of the food chain with innovative solutions provided by the Future Internet.

In the task 710 of the SmartAgriFood project the objective was to screen the users' expectations in a more general, broader scope e.g. to identify their operational problems and their ideas for new (current and future) internet based functions and services. The additional objectives of this task were to collect more information and knowledge about the users' expectations and needs and to collect ideas about possible applications in the future which complement the use case scenario specifications carried out in work packages on Smart Farming (WP200), Smart Agri-Logistics (WP300) and Smart Food Awareness (WP400).

CBHU and the project partners involved in task 710 carried out a questionnaire survey in six countries (Germany, Hungary, Finland, Greece, United Kingdom and Spain). The results of these interviews from each country were summarized in a national report, which was used as an input to develop a focus group discussion guide. After the mutual approval of the focus group discussion guide two or one focus groups per country were carried out in five countries (Hungary, Finland, Germany, Greece and United Kingdom) with food chain members concerning their needs and expectations related to the functions of the Future Internet. Findings were summarized in national reports. These results are provided to other work packages for use in specifications and adjustments of the functions.

A list of functions of the Future Internet was also developed in Task 720 by the ICT expert members of the consortium for creating awareness of the food chain members which was used in the presentation about the possible functions of the Future Internet. This was presented to the respondents before the interviews and was shown to the participants of focus groups.

Functions of the Future Internet

Function 1. The Internet is not limited to self-standing PCs – direct communication is possible between the machines, equipment, sensors, mobile phones, household refrigerators etc. With integrated PCs:

- Services and access to the network do not depend on the location, they are available everywhere
- Direct control and harmonization of machines and equipment for a higher efficiency and saving time
- Integrated services, integrated evaluation of information
- A practically applicable standardization is a prerequisite.

Function 2. There is mobile equipment as data collector, data viewer (display) and information transmitter.

Function 3. Quick and real-time exchange of large amount of data/video/3D information is possible.

- Presentation of information by 3D technology – e.g. labels of a packaging can be readable by rotating in space
- Virtual design facilities, 3D technologies.

Function 4. Content based browsing - intelligent distribution and caching of content – each piece of information and each object gets an individual ID code. We need to specify properly what we want to know, but we don't have to know where to find it.

Function 5. Services of customized information – automatic integration of information on demand

- Users can determine the selection and filtering criteria what type of information should the information pack contain what they receive.

Function 6. It is possible to positioning with higher accuracy for exact identification of objects, and controlling of the (agricultural) machines, equipment.

Function 7. Cloud computing – it is able to handle tasks requiring high data processing, computing capacity. Users do not need to have their own infrastructure; it is available and accessible through the internet at low cost, when it is necessary. Interworking is possible between local subsystems and global system (cloud).

Function 8. Higher privacy which guarantees the protection of personal data.

Function 9. Global data warehousing and management capability is available (application for diseases, pesticides, fertilizers, foreign body, reference samples, etc.).

Function 10. Ability to monitor meeting set technical requirements and initiate automatic corrective actions and/or alarming system operators.

During the focus groups the participants were asked about the importance of the listed functions by ranking them from the most important one to the least important one, where rank 1 marked the most important one.

Then, for the analysis we used Friedman-test to test if there was a significant difference among the given rankings of the Future Internet Functions. The result of the Friedman-test showed that there was statistically significant difference among the functions.

The total test showed that the two most important functions of the Future Internet were **Function 1** (the Internet is not limited to self-standing PC-s) and **Function 8**. (higher privacy - guarantee for the protection of personal data).

It is very clear from the research that the ensuring of safety and security of data and information is the essential element of the Future Internet. Most of the users were worried about the unauthorized use of their data and they require that the expected systems and applications should be safe. Availability of databases should be regulated and controlled to guarantee the data security and protection. The most important requirement of the actors of food chain is reliability and security.

The participants require that the services, the equipment, the devices, etc. should be available everywhere and they can operate their business processes remotely from anywhere. In addition it is necessary that the applications and devices should be integrated and standardized.

Based on the participants' opinion the least important functions of the FI are **Function 6** (positioning with higher accuracy for exact identification of objects, controlling of the machines, equipment) and **Function 7** (cloud computing).

Probably the reason of these results is that the users usually have limited information about the new technologies and devices and cannot imagine and interpret the operation of the new technologies. On the other hand the users are distrustful to store their data on the Internet. The ICT experts should show and explain the new possibilities more spectacularly and more clearly.

Participants of the focus groups also were asked to communicate their first thoughts about the internet and then about the internet of the future – i.e. what was the word which had been associated to the internet first. Compared to the above mentioned functions of the Future Internet the participants mentioned **more simple functions** and features of the Internet – **as information, data storage, unlimited accessibility, awareness for everything, plenty of information for everybody, news, entertainment, communication, mails, downloading, visual experience, connection, comfort and communal life**. A few participants said **negative features as dependency, fear, unreliability, danger and inaccessibility in rural areas**.
It shows that the users have limited experience in internet based solutions and they concentrate on the current limitations and constraints rather than future possibilities.

There are several differences between the expectations and requirements of the participants from different areas, such as agricultural production, trading or logistics. Some functions are very useful and important and some are less important or less typical in the different use case areas.

Based on the results of the implemented questionnaire survey we recognized that there are several advanced **electronic applications** which are used in the area of three sub-use cases. However these applications have several limitations which need to be overcome to make the exchange of information easier, quicker and more efficient. Just a few respondents use really advanced technologies; the majority of the respondents use basic and simple systems and applications such as mailing systems, browsers and websites. The current use of these applications and their limitations are explained in details in the following chapters.

Based on the interviews in the different sub-use cases a set of potential future internet or electronic based solutions and expected applications **were identified, which may be relevant and efficient in the future.**

After the questionnaire survey, focus group discussions were carried out, where the below mentioned expectations and ideas were discussed with the participants as the ones of the main points. The ideas were discussed in order to try to get an explanation why they think that an idea is applicable or not, what the practical benefits of the selected applications are, which application could be developed easily, and what might be the limitations of these ideas.
The participants were asked to divide the ideas into two groups. The first group contained the **applicable ideas**, while the second one contained the ideas which are **not applicable**. The tables with the number of the participants who put the ideas into the applicable or the not applicable group are given in Appendix 4.

The ideas and expectations in the different sub-use cases (first is the most applicable; last is the least applicable by the participants' opinion of focus groups):

Smart Farming:

1. System for selecting the cultivated plants based on a database
2. Monitoring environment for farms and plants – Advisory system
3. Barcode/RFID system -Traceability system facilities
4. Improvement of the daily work of the farmer/breeder
5. Shared infrastructure
6. Yield information system
7. Monitoring environment for animal welfare, sensors in barn/stable
8. Risk assessment
9. System for extraneous and foreign bodies' identification

Smart Agri-logistics:

1. Road monitoring application
2. Dock reservation system
3. Integrated freight and fleet management for vending machines and small retail outlets
4. Secure banking system
5. Flexible parking system for delivery to shops
6. Smart household storage
7. Service-halls" in the basement of apartment buildings
8. Small depots for personalized supply of perishable foods

Smart Food Awareness:

1. Monitoring of food quality
2. Improved awareness information system based on traceability
3. Communication of product-related information towards the consumer
4. Exchange of product-related information between agri-food enterprises
5. Informed decisions of consumers based on tailor made information selected according to their criteria
6. Profile specific newsletters and dissemination of information
7. Virtual shops and virtual visits
8. Connected automatic systems
9. Improved diet and health through personalised nutrition
10. Foreign material identification

In many cases the participants selected an idea or application as being applicable, because:

- use of the selected application have or will have great benefit;
- the selected application is already applied, in some earlier developed format (manual, non-automatic or non-connected), therefore the selected application could be developed with moderate easy or in a cheaper way

In many cases one of the limitations for developing the selected applications was uniformly the high cost of implementing and applying them. However, it was also noted that these operating expenses could be reduced if these applications would be applied widespread as bulk-products.

In Smart Farming area:

The most applicable ideas uniformly were the "System for selecting the cultivated plants based on a database", the "Advisory system", and the "Improvement of the daily work of the farmer/breeder"; beside these the idea of "Barcode/RFID system -Traceability system facilities" also was found important by the participants of focus groups.

The least applicable ideas unanimously were the "System for extraneous and foreign bodies' identification" and the "Risk assessment".

In Smart Agri-logistics area:

The most applicable ideas unanimously were the "Road monitoring application", the "Dock reservation system" and the idea of "Integrated freight and fleet management for vending machines and small retail outlets" in a more general way as "Integrated freight and fleet management in overall". The idea of "secure bank system" also was mentioned as being quite important.

The least applicable ideas were the ideas of "Small depots for personalized supply of perishable foods" and the "Service halls in the basement of apartment buildings".

In Smart Food Awareness area:

The most applicable ideas unanimously were the "Improved traceability system", the "Monitoring of food quality", and the "Communication of product-related information towards the consumer".

The least applicable idea unanimously was the idea of the "Foreign material identification", because this idea was not seen as having the priority of future internet application development at the consumer end.

Conclusions and recommendations

The findings of the interviews and focus groups **showed a large level of consistency among** the surveys carried out in **different countries** – in relation to the functions of the Future Internet, the expectations and ideas or even the current limitations.

Overall, one of the main requirements of the users is that **the Future Internet should be accessible for anybody, anywhere and anytime.**

It was generally agreed that two functions of the Future Internet could be very important:

- Ensuring **a higher privacy** which guarantees for the protection of personal data.
- Ensuring the possibility that the services, equipment, devices, etc. should **be available everywhere** and they can operate their business processes remotely from anywhere - in addition it is necessary that the applications and devices should **be integrated and standardized**.

Based on the results of the interviews and focus groups, **there are also some demands, expectations and limitations which were universally mentioned** by the respondents.

Technical limitations

For achieving the availability of the future internet we should ensure:

- **the** compatibility of the different applied devices, programs and systems **or the integration of systems instead of different connected applications;**
- **longer range** in data exchange/transfer and in communication

Expensive development and the applications

Lower costs for implementing the new or advanced applications is **also a priority,** as currently the price of the technologies required is too high, particularly for smaller businesses.

Lack of experience and knowledge about the applications

By the participants' opinion the **most important precondition and requirement is the training of the users**, as most of them do not have appropriate experience about using the Internet.
User-friendly applications and **interfaces, improved filtering** and **systematic organization** of the received, stored, sent or browsed data - even on demand by a predetermined profile – should also help the users in the future.

In general, we should also state, that in the future, **those applications, functions or systems can be viable and will be implemented, which will have great benefit**, or **which** are already applied even in some other crude format (manual or non-automatic), therefore they **can be developed easily** or in a cheaper way.

In Smart Farming area

Basically, the respondents named the most important functions of the Future Internet as **getting as much information as possible, collecting this information** all **together into a connected database**, and **sharing the information and knowledge** with the neighbouring farmers. **Network of sensors** was also mentioned as being important in the future.

In Smart Agri-logistics area

In general all the selected applications of the Future Internet should have the same **practical benefits as cost reduction, better coordination and better information for decision making. This should be ensured by the real-time exchange of huge amounts of data**, and the proactive control of processes leading to increasing efficiency and effectiveness.

In Smart Food Awareness area

Majority of the participants thought that the **consumers are most certainly interested on knowing what has happened to products on their way to the end user.**

Communication of product-related information towards the consumer will also be an important issue for the companies in food sector.

Last but not least, all the **food awareness applications also require standards** that are accepted within the entire food sector – solving the **problem of missing standardisation is of the highest relevance today**.

It would be useful to compare the findings and results of this project with available consumer studies in the future.

Overall we can state if we consider the mentioned users' demands and we are able to meet these or able to overcome the current limitations, the applications and systems, which will be developed in the project, could be viable and applicable in the future.

Abbreviations

D	Deliverable
FI-PPP	Future Internet Public Private Partnership
ICT	Information and Communication Technology
RFID	Radio-Frequency Identification
WP	Work Package

Table of Contents

Document Summary (executive summary) 4

1. Introduction 13

1.1 Aim 13

1.2 Scope 13

2. Methodology 14

2.1 Field work and sample details 14

2.1.1 Flow chart to carry out the questionnaire survey 15

2.1.2 Flow chart to carry out the focus group discussion 16

3. Results 20

3.1 Functions of the Future Internet 20

3.2 Ideas and thoughts about the Future Internet 25

3.3 Smart-Farming 28

3.3.1 Results of the questionnaire survey in smart farming application area 28

3.3.2 Results of the focus groups - Refinement of the ideas and expectations in smart farming area 32

3.4 Smart-Logistics 34

3.4.1 Results of the questionnaire survey in smart agri-logistics application area 34

3.4.2 Results of the focus groups - Refinement of the ideas and expectations in smart agri-logistics area 38

3.5 Smart-Food Awareness 41

3.5.1 Results of the questionnaire survey in smart food awareness application area 41

3.5.2 Results of the focus groups - Refinement of the ideas and expectations in smart food awareness area: 46

4. Conclusions, future recommendations 49

5. Appendix 51

1. Introduction

1.1 Aim

The general objective of the work package is to ensure an effective dialogue between the food chain members representing the "user community" and ICT community representing the "solution providers". This dialogue is aimed to support the development such domain specific capabilities and conceptual prototypes which meet the current and future needs of the different stakeholders of the food chain with innovative solutions provided by the future internet.

This activity includes also making the new knowledge on food chain specific internet based capabilities and conceptual prototypes available to a broad community of potential users from all parts of the food chain.

The objective of the task 710 was to screen the users' expectations by involving users from different parts of the food chain who are not participating partners of the project. The aim was to get more information from a broader community and get ideas for a broader scope than the first descriptions of the use cases in WP200, WP300 and WP400, where the participants were limited to the project partners. The aim was to identify the users' operational problems and their ideas for new (current and future) internet based functions and services.

The objective of this document is to develop a summary report based on the findings and results of a questionnaire survey carried out in six countries and followed by the results of the focus groups carried out in four countries. The results of summary report will be provided for WP100-WP500 for use in specifications and adjustments of the functions of Future Internet.

1.2 Scope

The needs and expectations of the food chain members related to the functions of the Future Internet are assessed for three different areas of the agri-food chain:

- Smart Farming
- Smart Agri-Logistics
- Smart Food Awareness

2. Methodology

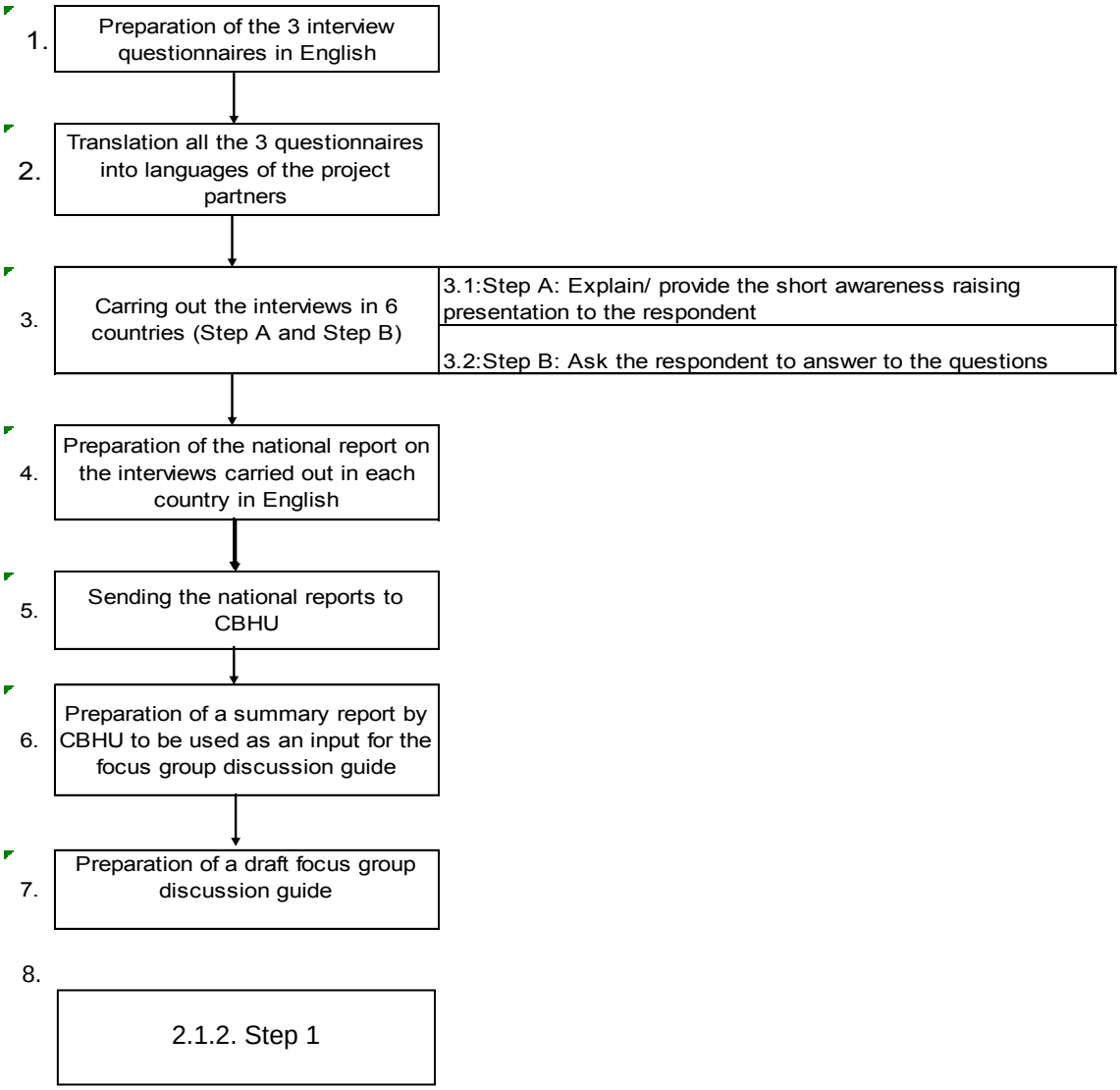
2.1 Field work and sample details

In task 710 a questionnaire survey and one or two focus group discussions per country were carried out.

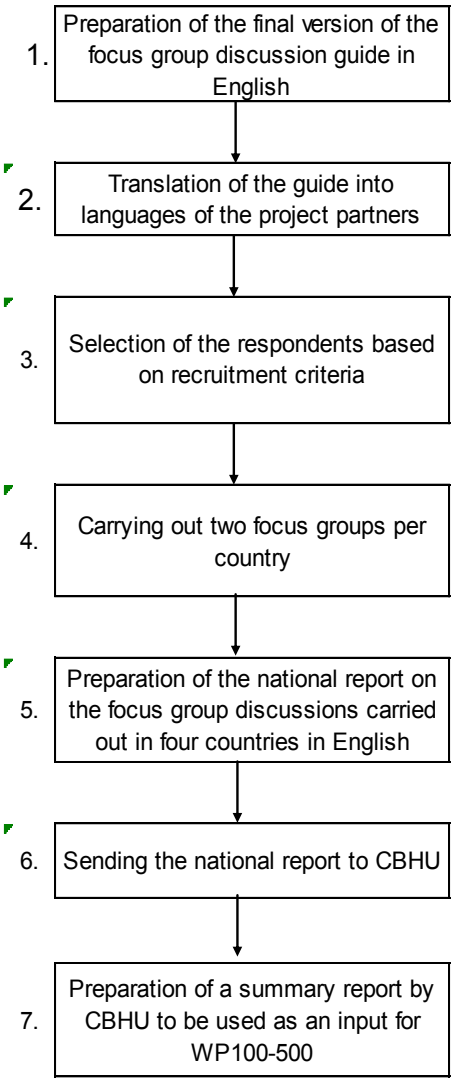
The questionnaire survey and the focus groups were carried out in countries which are participating in the SmartAgriFood project and have agri-food industry and ICT background. The partners were selected:

- to represent the different regions of Europe
  - Finland - Northern Europe
  - Germany, United Kingdom – Western Europe
  - Greece, Spain – Southern and Western Europe, and Mediterranean region
  - Hungary - Central-Eastern Europe and New Member States
- to represent the agri-food industry
- and to represent the ICT community
  - Hungary is one of the members of Future Internet National Technology Platform.

2.1.1 Flow chart to carry out the questionnaire survey



2.1.2 Flow chart to carry out the focus group discussion



Specific questionnaires (Appendix 1) were developed by CBHU for each application area for collecting information on the current use of Internet-based solutions, current and future needs/ expectations of different members of the food chain.

In each questionnaire the main aspects of the questions followed the same logic and sequence:

- Identification of the current use
- Experiences with the current use
- Needs, expectation, ideas for any Future Internet-based new or advanced application.

There were several options of method for carrying out the interviews:

- personnel interview
- phone interview
- self-filling by the respondent with an optional assistance through phone at those parts where he/she needs help or clarification.

Since this survey is made to collect qualitative inputs for a further qualitative research step this freedom in choosing from several options for the methods of the interview was not compromise the results of this step of the survey.

A short presentation was developed in Task 720 by the ICT expert members of the consortium on the envisaged advanced capabilities and functions of Future Internet which was harmonized by CBHU with Hungarian ICT experts. The completed short presentation was used to explain the possible functions of Future Internet to the respondents briefly before the interview.

A list of functions of the Future Internet was developed in Task 720 by the ICT expert members of the consortium for creating awareness of the food chain members which was used in the presentation about the possible functions of the Future Internet which was shown to the respondents before the interviews. After the questionnaire survey the list was discussed between CBHU and Hungarian Future Internet experts and was converted by CBHU for non-ICT professionals in the agri-food chain.

The questionnaire survey was carried out in six countries (Germany, Hungary, Finland, Greece, United Kingdom and Spain, which volunteered to carry out the interviews).

Altogether 135 interviews were carried with respondents representing all stakeholders of the targeted application area of the food chain (Table 1).

Table 1: **Details of interviews**

	Total	Sub-use case Area			Method of the interviews		
		Farming	Logistics	Food Awareness	personal	phone	self-filling
Hungary	47	15	16	16	32	12	3
Finland	18	8	1	9	1	13	4
Germany	32	15	7	10	9	15	8
Greece	15	15	0	0	5	6	4
Spain	17	8	2	7	0	7	10
UK	6	1	2	3	4	0	2
Total	135	62	28	45	51	53	31

The results of these interviews from each country were summarized in a national report, which was used as an input to develop a focus group discussion guide (Appendix 2).

After the mutual approval of the focus group discussion guide two or one focus groups per country were carried out in five countries (Hungary, Finland, Germany, Greece and United Kingdom). The goal of the focus groups was to have a better understanding about the needs and expectations related to the functions of the Future Internet of the food chain members, based on the findings of the interviews.

Qualitative information was collected on the application of the Future Internet in three different areas of the agri-food chain:

- Smart Farming
- Smart Agri-Logistics
- Smart Food Awareness

The focus group discussions had three main parts. First part was the Warm-up of the participants who were asked to communicate their first though about the Internet and the Future Internet and after that they were asked to mention some area where they could use internet based application/s in the future.

The second part was about the evaluation of the applicability of the expected ideas coming from the interviews. The participants were asked to divide the ideas into two groups. The first group contained the most applicable ideas, while the second one contained the ideas which are not applicable. The ideas were discussed in order to try to get an explanation why they think that an idea is applicable or not, what the practical benefits of the selected applications are, which application could be developed easily, and what might be the limitations of these ideas.

At last the functions of the Future Internet were discussed by the participants.

The improved list containing the envisaged advanced capabilities and functions of Future Internet was shown to the participants of focus groups. The participants were asked to deliver their opinions on importance of the listed functions by ranking them from the most important to the least important, where rank 1 marked the most important one.

Then, for the analysis we used a Friedman-test to test if there were significant differences among the given rankings of the Future Internet Functions.

Altogether 8 focus group discussions with 69 participants (table 2) were carried out in five countries (Hungary, Finland, Germany, Greece and United Kingdom).

Table 2: **Details of focus groups**

	Total number of participants	Number of focus groups	Sub-use case Area		
			Farming	Logistics	Food Awareness
Hungary	16	2	12	2	2
Finland	6	1	3	1	2
Germany	20	2	12	2	6
Greece	19	2	19	0	0
UK	8	1	4	2	2
Total	69	8	50	7	12

Table 3: **Type of the areas of focus groups**

	Activities of the respondent	Number of the respondents
1	Producer (plant growing and seed production, animal breeding, rearing, husbandry, production of fish/feed for fish, fish farming, feed production/processing)	24
2	Primary production (flour milling, packaging, slaughtering, etc.) and food processing, and intermediary organizing networks, chain collaboration to meet requirements	25
3	Storage, transport, logistics	5
4	Trading, retailing, wholesaling, catering	8
5	Certification body, policy maker	7

Statistics on participants is given in Appendix 3.

3. Results

3.1 Functions of the Future Internet

A list of functions of the Future Internet (table 4) was developed in Task 720 of SmartAgriFood Project by the ICT expert members of the consortium. The list was discussed between CBHU and Hungarian Future Internet experts and was converted by CBHU for non-ICT professionals in the agri-food chain.

Table 4: **Functions of the Future Internet**

Function 1	The Internet is not limited to self-standing PCs – direct communication between the equipments.
Function 2	There is mobile equipment as data collector, data viewer (display) and information transmitter.
Function 3	Quick and real-time exchange of large amount of data/video/3D information.
Function 4	Content based browsing
Function 5	Services of customized information – automatic integration of information on demand.
Function 6	Positioning with higher accuracy for exact identification of objects, and controlling of the (agricultural) machines, equipment.
Function 7	Cloud computing
Function 8	Higher privacy which is guarantees the protection of personal data.
Function 9	Global data warehousing and management capability.
Function 10	Ability to monitor meeting set technical requirements and initiate automatic corrective actions and/or alarming system operators.

The results of ranking at national level:

Hungary

The result of the Friedman-test showed that there was statistically significant difference among the functions in Hungary.

Table 5 shows the ranks of the functions, the number of the participants, the sum of the ranks and groups.

Table 5: **Comparison (Friedman)-HU**

Ranks	Functions	No. of the participants	Sum of ranks	Groups
1	1	16	60	C
2	8	16	62	C
3	9	16	67	BC
4	2	16	71.5	ABC
5	4	16	87	ABC
6	10	16	95	ABC
7	3	16	96	ABC
8	5	16	97	ABC
9	6	16	119	AB
10	7	16	125.5	A

We can see from the table 5 that **function 1** (the Internet is not limited to self-standing PCs) **and function 8** (higher privacy - guarantee for the protection of personal data) have significant difference from **function 7** (cloud computing) **and function 6** (positioning with higher accuracy for exact identification of objects, controlling of the machines, equipment). It means that the function 1 and 8 are the most important functions of the Future Internet according to the participants. Function 7 and 6 are the least important once to the participants. The other functions of Future Internet have no significant difference.

Finland

The Friedman-test showed that there was not statistically significant difference among the functions in Finland. However it seems from the rankings (table 6) that **function 1** (the Internet is not limited to self-standing PC-s) **and 8** (higher privacy - guarantee for the protection of personal data) were the most important ones and **function 6** (positioning with higher accuracy for exact identification of objects, controlling of the machines, equipment)**, function 7** (cloud computing) **and 9** (global data warehousing and management capability) were the least important functions of the Future Internet in the participants' view.

Table 6: **Comparison (Friedman)-FI**

Ranks	Functions	No. of the participants	Sum of ranks	Groups
1	1	6	16	A
2	8	6	24	A
3	4	6	26	A
4	2	6	26	A
5	10	6	26	A
6	5	6	35	A
7	3	6	43	A
8	7	6	44	A
9	6	6	44	A
10	9	6	46	A

Germany

The result of the Friedman-test showed that there was statistically significant difference among the functions in Germany. It seems from the rankings (table 7) that **function 8** (higher privacy - guarantee for the protection of personal data) was the most important and **function 3** (quick and real-time exchange of large amount of data/video/3D information)**, function 2** (mobile equipment) **and function 4** (content based browsing) were the least important functions of the Future Internet in the participants' view.

Table 7: **Comparison (Friedman)-GE**

Ranks	Functions	No. of the participants	Sum of ranks	Groups
1	8	20	8	C
2	10	20	16	BC
3	5	20	26	BC
4	6	20	36	ABC
5	7	20	42	ABC
6	9	20	50	AB
7	1	20	52	AB
8	4	20	66	A
9	2	20	70	A
10	3	20	74	A

Greece

Table 8: **Comparison (Friedman)-GR**

Ranks	Functions	No. of the participants	Sum of ranks
1	3	19	72
2	2	19	84
3	6	19	102.5
4	10	19	104
5	1	19	104.5
6	8	19	106
7	5	19	108
8	4	19	116.5
9	7	19	121.5
10	9	19	126

Table 9: **Friedman test-GR**

Sum of squares of sums of ranks	111593
F	13.7254
corrected F	13.7341
Significance F (Risk)	0.1324
Significance corrected F (Risk)	0.1321

Since the Friedman-test's significant level was higher than 0.05 there was no statistically significant difference among the functions in Greece and the test software did not complete the comparison of the ranks (table 9). However it seems from the rankings (table 8) that **function 3** (quick and real-time exchange of large amount of data/video/3D information) **and function 2** (mobile equipment) were the most important ones and **function 9** (global data warehousing and management capability) **and function 7** (cloud computing) were the least important functions of the Future Internet.

United Kingdom

The result of the Friedman-test showed that there was statistically significant difference among the functions in the United Kingdom. It seems from the rankings (table 10) that **function 1** (the Internet is not limited to self-standing PC-s) was the most important and **function 9** (global data warehousing and management capability)**, 8** (higher privacy - guarantee for the protection of personal data) **and function 10** (ability to monitor meeting set technical requirements and initiate automatic corrective actions and/or alarming system operators) were the least important functions of the Future Internet in the participants' view.

Table 10: **Comparison (Friedman)-UK**

Ranks	Functions	No. of the participants	Sum of ranks	Groups
1	8	8	13	B
2	10	8	20	AB
3	9	8	42	AB
4	3	8	45	AB
5	5	8	49	AB
6	4	8	51	AB
7	6	8	52	AB
8	7	8	53	A
9	2	8	56	A
10	1	8	59	A

Total results of ranking:

Table 11: **Comparison (Friedman)**

Ranks	Functions	No. of the participants	Sum of ranks	Groups
1	8	69	200	C
2	1	69	232.5	BC
3	10	69	241	ABC
4	2	69	251.5	ABC
5	5	69	266	ABC
6	3	69	285	ABC
7	9	69	289	ABC
8	4	69	295.5	ABC
9	6	69	301.5	AB
10	7	69	333	A

It appeared from the results of Friedman-test (table 11) that the **function 8** (higher privacy - guarantee for the protection of personal data) **and function 1** (the Internet is not limited to self-standing PCs) were the most important function of the Future Internet in every participant country.

Table 12: **Summary of the ranks of FI functions**

Functions	Ranks by total	Ranks HU	Ranks FI	Ranks DE	Ranks GR	Ranks UK
8	1	2	2	1	6	9
1	2	1	1	7	5	1
10	3	6	5	2	4	8
2	4	4	4	9	2	2
5	5	8	6	3	7	4
3	6	7	7	10	1	7
9	7	3	10	6	10	10
4	8	5	3	8	8	6
6	9	9	9	4	3	5
7	10	10	8	5	9	3

Function 8:
"Higher privacy - guarantee for the protection of personal data"

Most of the participants of the questionnaire survey and focus group discussions were worried about the unauthorized use of their data and they require that the future systems and applications should be safe. Availability of databases should be regulated and controlled to guarantee the data security and protection. The most important requirements of the actors of food chain were reliability and security.
Opinion of a caterer: *"I think Future Internet should be user-friendly and secure."*
Opinion of a plant grower: *"The safety of information is the most pressing issue in the food sector."*

Function 1:
"The Internet is not limited to self-standing PCs – direct communication is possible between the machines, equipment, sensors, mobile phones, household refrigerators etc. With integrated PCs

- *Services and access to the network do not depend on the location, they are available everywhere*
- *Direct control and harmonization of machines and equipment for a higher efficiency and saving time*
- *Integrated services, integrated evaluation of information*
- *A practically applicable standardization is a prerequisite."*

The participants require that the services, the equipment, the devices, etc. should be available everywhere and they can operate their business processes remotely from anywhere. In addition it is necessary that the applications and devices should be integrated and standardized.
Opinion of a meat processor: *"The Future Internet shouldn't be localized."*
Opinion of a producer: "*I think the Future Internet will be faster, safer and easy to accessible for everybody."*

The results of the Friedman-test show that the least important functions are function 7 and 6.

Function 7:
"Cloud computing – ability to handle tasks requiring high data processing, computing capacity. Users do not need to have their own infrastructure; it is available and accessible through the internet at low cost, when it is necessary. Interworking between local sub-systems and global system (cloud)."

According to the end-user's opinion one of the least important function is the cloud computing. Probably the reason of this result is that the users usually have limited information about the new technologies and devices and cannot imagine and interpret the operation of the new technologies, therefore they cannot recognise the new opportunities enabled by this function. On the other hand the users are distrustful to store their data on the Internet.

Function 6:
"Positioning with higher accuracy for exact identification of objects, controlling of the (agricultural) machines, equipment."

This function was rated as the other less important function of the Future Internet. This may be caused by the differences between the expectations and requirements of the participants from different areas, such as agricultural production, trading or logistics. Respondents from other disciplines have and realised the potential for new, radically improved services based on more precise positioning. It is obvious that this function is important only to the participants from agricultural areas and to this was added, that some agricultural producer mentioned several similar technologies already in existence.

3.2 Ideas and thoughts about the Future Internet

Participants of the focus groups also were asked to communicate their first thoughts about the internet and then about the internet of the future – i.e. what was the word which had been associated to the internet first. Compared to the above mentioned functions of the Future Internet the participants mentioned more simple functions and features of the Internet. It shows that the users have limited experience and overview in internet based solutions and they concentrate on the current limitations and constraints rather than having a vision and creativity about the future possibilities.

The participants of the focus groups mentioned the following features related to the Internet:

- World Wide Web
- Information
- Data storage
- Unlimited accessibility
- Awareness for everything
- Plenty of information for everybody
- News
- Entertainment
- Communication
- Mails
- A huge encyclopaedia

Some participants mentioned browsing related thoughts as downloading, visual experience, connection, comfort, communal life and accessibility.

A few participants said negative features as dependency, fear, unreliability, danger and inaccessibility in rural areas.

The majority of the respondents wrote that the Future Internet will be accessible for anybody, anywhere and anytime. The Future Internet will be faster, safer, easy to access and easy to use.

Opinion of a plant grower: *"I think the Future Internet will be faster, unlimited, accessible anywhere and anytime."*
Opinion of a plant grower: *"Information should be easily accessible independently from one's location, and it must be quick to use."*

As the most important features of FI the proper management of the information with less spam was mentioned. The Future internet shall ensure that all relevant information regarding the requirements is readily available to any person interested.
Opinion of a meat processor: *"I think I will be able to access all relevant information regarding my business with Future Internet."*
Opinion of the member of an Intermediary organizing network: *"A problem with information is that there is lots of it, so the usability of the relevant information is important."*
The participant of a logistic organisation mentioned that in the future information retrieval should be so automated that information is downloaded automatically e.g. when a consumer walks between retail store shelves.

One participant from a caterer organisation mentioned that the Future Internet will be the essential condition for all economic territories.
Opinion of the member of an Intermediary organizing network: *"The future can be anything, so FI should be applicable for many things."*
The participant from a retail organisation said that FI is fragmented, maybe unstable, complex and a central actor in service and information provision.

The answers "awareness for everything" and "plenty of information for everybody" should be considered as well. They represent a false interpretation of optimal information flow – e.g. their vision to have unlimited information instead of structural information by users priorities.

Participants of the focus groups also were asked to answer the following question:
In which area could you use internet based application/s in the future?

Compared to the expected ideas from the questionnaire survey we recognized some similar ideas and demands on the Future Internet.

The participants mentioned the following ideas:

Farming

- Screening of special information and parameters (e.g. in honey and water production).
- Risk assessment
- Information and database of food additives
- Electronic documented spraying
- Information on crop protection agents such as application restrictions, waiting periods, prices.
- Automatic subsidy claims: The Integrated Administration and Control System (IACS)
- Exchange of data related to soil analysis.
- Fast access to relevant governmental requirements such as EU regulations and to other data provided by external sources such as meteorological data and micro-climatic weather forecasts
- Communication of machinery with the farm management information system.
- Greenhouse management
- Common database
- Secure, automated and fast information identification, input and retrieval. Independent of the location of the user.
- Barcode creation through internet
- Application that informs the farmer for the best market for their products inside his country or abroad
- Weather forecast especially for farmers

Logistics

- Using printed code (QR) for monitoring.
- Identification per item
- Common database
- New kind of information identification, input and retrieval.

Food awareness

- Using mobile scanner during the shopping
- Guarantee of traceability

3.3 Smart-Farming

3.3.1 Results of the questionnaire survey in smart farming application area

In the questionnaire survey which was carried out to collect information about the application areas (Smart Farming, Smart Agri-logistics, Smart Food Awareness) the questions followed the same logic and sequence:

- Identification of the current use
- Experiences with the current use
- Needs, expectation, ideas for any Future Internet-based new or advanced application.

Current use

There are several advanced **electronic applications** which are used in the area of Smart Farming. However these applications have several limitations which need to be solved to make the exchange of information easier, quicker and more efficient.

There are several advanced electronic applications which are used and have a specific role in area of farming.

- Using precision soil sampling with GPS and satellite technology for planning fertilization and pest control. The satellite positioning system makes it possible to separate the areas requiring different treatments within the field and to collect exact area data about the patterned field. Due to this the most effective crop production can be performed on the specific field areas.
- Using on-board computer in grain harvesting machines which shows the changing yield and moisture values during work. The change of the suspension volume during fertilization is monitored on the fertilizer spreader's computer.
- Using Pear Technology System to map where pest controls and fertilisers have been used.
- Using 'ISAGRI' system for controlling "herd", estimation of production, yield estimates, recording data of production, organization of breeding in order to achieve better farm management and fulfil their expectations.

Limitations and constrains

The use of new electronic and/or internet-based solutions and application has several problems and limitations. These limitations can be observed in different areas such as quantity and quality of information, communication, data transfer and operation of devices and applications.
Limitations of information and data:

- The information available on the internet is limited, it is not appropriately specific or detailed or the databases are not available and/or expensive.
- In many cases most of the available information is inaccurate and unreliable.

Difficulties of communication and data transfer:

- The communication within a farm or between the partners is too slow. Most of respondents are using paper based communication and manual data recording.
- Large sized files, photos and videos cannot be transmitted.

- In many regions there is no complete network coverage (e.g. the web is not accessible) or the internet services are hobbling because of network congestion.

Limitations of applications and devices:

- There are not appropriate sensors or the existing sensors are inaccurate. This is particularly true for the GPS systems used.
- The current devices and files cannot be combined with each other and are not standardized. The applications are segregated and are not used, or cannot be organised into a system.
- There are no appropriate applications or the applications and solutions are too expensive, in addition the use of these applications is often very complicated.
- Users usually have limited information about new technologies and devices or they cannot use the new application.

Ideas and expected applications

Based on the results of the implemented questionnaire survey we recognized that there are some future internet or electronic based solutions and expected applications of overriding importance, which may be relevant and efficient in the future.

Table 13: **Ideas and expectations in Smart Farming area**

Smart Farming	
1.	System for selecting the cultivated plants based on a database
2.	Monitoring environment for farms and plants – Advisory system
3.	Barcode/RFID system -Traceability system facilities
4.	Improvement of the daily work of the farmer/breeder
5.	Shared infrastructure
6.	Yield information system
7.	Monitoring environment for animal welfare, sensors in barn/stable
8.	Risk assessment
9.	System for extraneous and foreign bodies' identification

1) Advisory system for selecting the cultivated plants based on a database

A large database about different cultivation methods should be available in order to inform every farmer about his cultivated crops or about the ones that he would like to sow in the future. The system will compare the data given by the farmers with the results of soil studies and standards and should make recommendations for plants which could be grown successfully on the specific area and possibly some recommendations, hints about them.

2) Monitoring environment for farms and plants – advisory system

The farmers and specifically the young ones are interested of taking care of their plants' or animals' health by having access to a reliable and regularly updated monitoring / advisory system. The farmer should provide data that may include sensors' data, real and non-real time video, (high definition) pictures, actions taken (e.g. spraying, fertilization) etc. The monitoring system should activate an alarm when some thresholds have been violated; proper recommendations could be sent to the respective farmer in order to take further actions. For example if the temperature is too high and the humidity is too low, a recommendation can find a contractor for spray-

ing, or a fertilizer contractor since those conditions are dangerous for the plants to be infected by a disease.

3) Barcode/RFID system -Traceability system facilities

The farmer has the need to print a basic barcode label for his final product before its storage or shipment. This barcode label should contain information such as the name of the company- farm, the region that it is from, the name of the product, the date of the production, etc. An internet based system could be useful for farmers who have small scale production and they cannot invest a lot of money to have local software for creating and printing the necessary barcode labels. This automation should offer online barcode generator and RFID services, fault tolerant without the burden of managing hardware, deploying patches and upgrades, or monitoring performance.

4) Improvement of the daily work of the farmer/breeder – Task Plan Analyser

A task plan analyser service should organize farmers' daily work with the assistance of a number of specialists. For example, the advisory system has advised the farmer to spray his fields. A spraying contractor could organize his machinery located at a specific point in time in different fields in order to fulfil that contract.

5) Shared infrastructure

A producer, the owner of a small farm can't invest a big amount of money to buy automatic and new sensors for his cultivation. The most crucial information for him is the knowledge of the weather conditions for the specific area. Another issue can be a serious disease that may affect his farms. The agricultural community will be reinforced providing each other inexpensive knowledge and information that are aware of.

6) Yield information system

The professional users explained that the existing yield measurement systems require some development, because the information and results are often inaccurate and unreliable, so organization of production is more difficult. For the same reason there are not reliable and accessible regional and national estimations.
The yield measurement system in the future should ensure appropriate data for the organisation and distribution, should collect information on variation of yield from all points of the area, and should prepare a yield map and a database based on the collected information.
There should be a large database about the information, which is available for all participants. The information collected by different technologies is about:

- the expected yield,
- the development of crops, fruits and vegetables
- the damages of crops
- etc.

This system might be used for planning of the production, for sales forecast, for scheduling harvesting, for irrigation network and for nutrient management.
The collected individual data should be a part of a large national database from which accurate and reliable estimations should be prepared for larger areas (countries, regions, counties). The individual data should be collected through a coding system, summarized into amalgamated data for a major area, without the name of the farmers to ensure their anonymity, privacy and data security.

7) Monitoring environment for animal welfare, sensors in barn/stable

The monitoring of different conditions in barn/stable is very important in animal breeding. The different types and different methods of rearing require different housing conditions. Currently there are just few sensors available which can measure the conditions such as temperature and humidity. The farmers would like to measure and monitor every housing condition which is necessary to keep animals in appropriate health, feeding and rearing conditions.
In the expected system several sensors should be located in the barn which can measure the housing conditions (e.g. temperature, humidity, illumination intensity, air velocity, etc.). If the housing conditions reach the maximum permissible value the sensors will make an alarm signal to farmers and/or the system will correct the options automatically.

8) Risk assessment

There will be several large databases about crop protection, irrigation, cultivation and production information in the future. The individual data should be collected through a coding system, summarized into amalgamated data for a major area, without the name of the farmers to ensure their anonymity, privacy and data security. The collected individual data should be a part of a large and national database from which accurate and reliable estimations should be prepared for larger areas (countries, regions, counties).

9) System for extraneous and foreign body identification

Several foreign bodies can occur and cause hazards during the production and processing of arable crops, vegetables and fruits. Foreign material can be: glass, splint, flinders, plastic, metal, stone, etc. The presence of foreign bodies affects the food safety and the quality of the products adversely therefore it is necessary to identify and eliminate the foreign bodies before the food processing. Foreign bodies can cause injuries for customers/consumers and result in complaints. Reliable removal of foreign bodies coming with raw materials is not always possible during the food processing. It is better to prevent foreign body contamination from raw materials. Currently there are not appropriate devices or applications available which can identify the foreign bodies in raw materials in fields.
Identification might be realized with new technologies on the machines, on the fields and around the fields.
When agricultural machines (tractors, harvesting machines, etc.) are working on the field camera systems should be mounted on them, which are connected to a foreign body identification database on the Web to identify the foreign bodies and their location and to provide a map for guiding their subsequently removal. The images found by camera should be compared with the reference standards of formerly found foreign bodies in the database.
Identification should be very exact and the information should be collected in a large database of pictures, videos, images, data and characteristics about formerly identified foreign bodies. The system should communicate with this database (upload and download information).
Benefits of the expected system:

- Rapid and exact identification of foreign bodies.
- Reducing the number of food safety incidents and customer/consumer complaints, compensation costs and negative effects.
- Improving of food safety and quality.
- Increasing cost effectiveness (non-manual separation, remote control of fields).
- Large database about foreign bodies, which can be used in processing and manufacturing too.

3.3.2 Results of the focus groups - Refinement of the ideas and expectations in smart farming area

The focus group participants shared the view that most of the Smart Farming ideas and applications are applicable.

The most applicable ideas uniformly were

- "System for selecting the cultivated plants based on a database"
- "Advisory system"
- "Improvement of the daily work of the farmer/breeder";
- "Barcode/RFID system -Traceability system facilities" also was regarded as applicable.

"Yield information system" and "Shared infrastructure" also were regarded as applicable.

Basically, the respondents named the most important functions as getting more information (weather and ambient conditions, soil conditions etc.), and collecting this all together into a connected database. However, it must be considered that since a huge amount of information can be collected, we should also have the ability to share it.
Getting the right information or sharing the information and knowledge with the neighbouring farmers – via a shared infrastructure - was also important.

Monitoring continuously the health status of the crop and animals or weather and ambient conditions can be ensured by using a large amount of sensors. Sensors could be used more useful, e.g. able to be placed in the middle of grain bins to check temperature/humidity, letting the farmer know if crops are degrading or the likelihood of pest or disease development.
Using a network of sensors or at least connecting more sensors to each other is also a basic criteria for a well-functioning, improved system, which help the daily work of the farmer with automatic corrective actions, alarming or recommendations for an appropriate and quick decision.
Also an advisory system can provide some sort of a market price e.g. for specific plants on a specific area, thus some investment decisions could be made on that basis.
The daily work of the farmer could be also supported by the communication of machinery with the farm management information system, where each machine and each tractor should be able to communicate with the farm, and the high data transmission rates could ensure that data exchange never would cause delays in the field work.

Many of these above mentioned applications or systems are already applied in farms, but not widespread, because of their costs. Uses of such high numbers of sensors or implementing such automatic intervention systems have quite a high cost.

A QR or RFID based system, which can ensure an improved traceability, is also too expensive currently, although it is crucial that this system would not have high costs for the farmer, as otherwise it will not be used.

Beyond the costs, two more limitations were identified in the current practice for a well-functioning, QR/RFID based traceability system. One of them is the lack of a complex, common database, where the data/information can be collected and integrated. The other one is that in farming practice it is quite hard to identify a batch or a smaller unit of crops in the yield.
In additional, in Greece the participants all agreed that farmers could use this kind of systems if the program would be translated in Greek and had a really simple user interface.

If the use of the future internet can ensure the mentioned demands above (existing common database, possibility to improve identification of the yield, or lower costs of QR codes/RFID tags and sensors), the selected applications will be very applicable.

For participants in Greece an additional useful application could be one informs the farmer about the best market for their products inside his country or abroad. As well as an application for purchasing fertilizers, seeds etc, which points out farmers of the same region, in this way they could reduce their costs.

The least applicable ideas unanimously were:

- "System for extraneous and foreign bodies' identification"
- "Risk assessment"

A system for extraneous and foreign bodies' identification was thought to be the least applicable application due to many machines already having some form of detector and that they are not worried what the foreign body is along as it's found and removed. The participants felt the system already in place is at a high efficiency level.

The reason why this idea of "Risk assessment" was regarded overall as being the less applicable was rather related to an ethical issue. Although some of the systems need large amounts of data collected, and the lack of a wider (even world-wide), common database in current practice is a limitation (similarly to ideas No.1 and No.2). It was not believed that appropriately reliable data could be collected into this system anytime in the future.
On the other hand, the idea of an automatic collection of the required data for a risk assessment system, which could solve this problem, was not considered anyway. The participants felt producers would be unwilling to pass on information to their "competitors" and that buyers may have access to the system, so will be able alter market prices.

We have to note that in the UK all primary producer participants found idea No. 9 one of the most useful and applicable applications as they believed that this could be merged with 1, 3, and 5 so that a business forecast can be produced by farmers to let them decided what crop (vegetable and fruit, as well as grain) would be most economically viable according to the yield, there soil/climate type and how they would need to change their management system.

3.4 Smart-Logistics

3.4.1 Results of the questionnaire survey in smart agri-logistics application area

In the questionnaire survey which was carried out to collect information about the application areas (Smart Farming, Smart Agri-logistics, Smart Food Awareness) the questions followed the same logic and sequence:

- Identification of the current use
- Experiences with the current use
- Needs, expectation, ideas for any Future Internet-based new or advanced application.

Current use

In logistics the most developed applications are the electronic ordering system (EDI) and the stockholding system:

- Electronic ordering systems (e.g. EDI – Electronic Data Exchange), which offer the opportunity for the contracted parties to record the details of their orders and the ordered products/services into the common system and to modify the details of their orders (e.g. change the amount of the ordered products, change the delivery time, etc.).
- Stockholding systems, which include:
    - a central database (often after a manual data record);
    - RFIDs – to store the relevant information about the product;
    - mobile devices and scanners (PDA) for recording the data;
    - networks within a site or company to ensure the connection between the database, the RFIDs and the scanners.
- DotMailer to contact suppliers and collect contact information.
- EPoS to record stock movement.

Most of the respondents use simple basic applications:

- Navigation and GPS systems, which help in organizing the delivery routes.
- Simple video control systems are used to monitor the premises, the cargo or the products itself.
- Sensors are also used to measure the conditions (temperature, time, humidity etc.) of the storage and the delivery.
- One of the general logistics software is the SAP system. SAP is an enterprise resource planning software which is used to coordinate all the resources, information, and activities needed to complete business processes such as order fulfilment or billing.

In addition to that very simple basic applications are used in logistics as mailing systems, browsers and web-sites.

Limitations and constrains

Typical difficulties were mentioned by the respondents relating to the speed and access range of information transfer – quick and real time exchange of information cannot be ensured.

- Currently one of the limitations of the data exchange is the range. In the majority of the cases, during the delivery the exchange of the information is ensured by a simple Wi-Fi, and the short range makes the data exchange slow, e.g. a transport vehicle cannot transfer the data to the target location or to the delivery company till it is located beyond the range.

- Another limitation of the quick and efficient information flow is that data recording for the different processes and data exchange between the different processes are not fully automatic. In many cases the data is recorded manually.

Users mentioned that in several cases the lack of compatibility is a limitation.

- The different applications for different processes (invoicing, accounting, stockholding, ordering systems) are not compatible within a company.
- When different partners should exchange data about the completion of a process, their data recording, data processing and data transferring systems are not compatible.

Another highlighted limitation is, that currently the price of the technologies required (RFIDs and satellite based technologies for traceability or monitoring, automated systems) is too high particularly for smaller businesses. If a company handles a smaller stock, the operation of these technologies is not cost-effective.

Users also noted that it is difficult to organize and optimize the deliveries (duration and route) appropriately in advance, since there is not a global or adequately large common database, which could collect all the information together e.g. about real-time traffic conditions or accidents.

Ideas and expected applications

Table 14: **Ideas and expectations in Smart Agri-Logistics area**

Smart Agri-Logistics	
1.	Road monitoring application
2.	Dock reservation system
3.	Integrated freight and fleet management for vending machines and small retail outlets
4.	Secure banking system
5.	Flexible parking system for delivery to shops
6.	Smart household storage
7.	Service-halls" in the basement of apartment buildings
8.	Small depots for personalized supply of perishable foods

1) Road monitoring application

The scope of this example is to share online monitoring information from trucks during the transport of cargo. Current practice allows monitoring trucks during transport with individual software applications and collects the monitoring data with available telematics systems. However, the access to such monitoring data is not organised on standards, which makes the exchange of data a complex task. Due to a divers spectrum of possible events disturbing the transport process (e.g. traffic jams or technical malfunctions) information needs arise from uncertainties about arrival times and complications for further distribution planning as well as warehouse dock organisation.
The example shows an idealistic aggregation of information from different systems (order management system, online monitoring and event management system). This application can be opened for customers contracting a specific logistic service provider and enable a real-time event management in order to support decisions and planning.

2) Dock reservation system

Present organization schemes of cross-docks are focusing on first-come-first-serve principles.
Online applications for dock reservation are just implemented for a short time. These applications allow booking of dock spaces for a specific time in advance, but often require the registration up to 24 hours before transport arrival.
A flexible solution for this is required by the logistic service providers and would enable benefits for all participating enterprises.
The process presented in this example is based on the identification of trucks and their task in a specific geographic area (geo-fence) based on GPS coordinates around the warehouse / cross-dock. The communication between truck and warehouse organisation requires the exchange of information on the truck (identification information based on license plate) and its task (loading cargo, unloading cargo) as well as the registration and communication of a dock space and time windows for the truck driver approaching the warehouse.

3) Integrated freight and fleet management for vending machines and small retail outlets

Users expect an integrated management system which can help them to optimize the use of logistics resources and to improve the stock control and production planning.
A software and/or internet supported stockholding and storage system - which helps the company to optimize its stock, and the stock recording and the stocktaking are automatic - is a common demand by the users, however, it is used already at some companies. Moreover this system should handle the necessary interactions (alarming, re-ordering etc.) automatically as well.

- In the case of small sales units where there are not larger reserves in stock (vending machines, containers and tanks of liquids/gases in manufacturing, independent/small retail shops), it is expected that at the decrease of the stock to a set level an alarm signal should be sent to the supplier of the products or an automatic re-order should be generated and sent to the supplier. Since in the case of vending machines the problem is that the supplier has to deliver smaller amounts of different products to several locations, the automatic orders contain as much information as possible (what type of product is needed, in what amount and how many portions can be served from the remained stock). Thus the delivery route can be programmed after collecting and processing the information from the different vending machines.
  Improving the stock control is an expectation of the producers, retailers and logistic service providers as well, since they could benefit
  - by the better forecast and prediction (production plan, delivery routes),
  - by the reduction of delivery and production costs.

  For this, beyond a GPS system, the system requires a direct, real-time and long-range communication and data transfer among the single units, the supplier and the single vehicles of the supplier. A single vending machine should have the ability to broadcast its information.
- This automatic alarming and re-ordering system may be used in smart households for improving the stock control in the larder or in the refrigerator, and for providing input for the preparation of the actual shopping list.

4) Secure banking system

More secure network systems especially for banking systems are necessary to provide people with more confidence to undertake transactions exclusively through internet based technologies. A more secure and easier system would allow there buyers to purchase goods online reducing the work load.

5) Flexible parking system for delivery to shops

In larger cities (e.g. in Budapest) to find a legal parking place near to the shops for loading/reloading is a basic and common problem – parking on a prohibited place often results in fines. Some of the businesses deliver relatively smaller amount of food to smaller urban shops which do not have a designated parking place for food deliveries. The proposed system should organize possible emergency parking for loading for a short period for an increased extra charge at a prohibited place when a free legal parking place is not available. The parking company and the logistics service provider sign an agreement in advance, where the extra charge rate, the maximum duration of the emergency parking described together with the identification of the authorized user and the method and channels, details of desired communication between the two partners and the police. If there is not any free place near to the target, and the vehicle stops and parks to reload on a prohibited place, the driver of the /vehicle could inform (e.g. via SMS) the parking company. The parking company – based on the previously signed agreement - could make a surcharge automatically for short term emergency parking. The employees of the parking company or the policeman, working on the streets get the information about this specific payment via mobile devices, thus the transport company can avoid to pay fines. Instead of that they pay surcharges.

6) Smart household storage

Food storage is both a traditional domestic skill and is also important industrially. Food storage is becoming more important as we see how much waste originates in food industry and in households. The different kinds of food require different conditions of storage (temperature, humidity, etc.). Foods remain longer consumable in appropriate conditions. Fruits and vegetables are often harvested unripe or green. In this case maturation is a necessary step.
Food storage system should contain a storage device with different and separated boxes and control software. The system ensures appropriate conditions for different kinds of food; the users can select the kind of food (e.g. tomato) and the system determines the present condition of food with sensors and after that determines the storage parameters (temperature, humidity, etc.) of the separated box. The system communicates with a large database of storage standards. According to standards the system ensures the appropriate conditions or starts the post-maturation. There are different conditions and processes in all separated boxes in accordance with storage standards and settings. In the separated boxes several sensors are located which can measure the storage conditions (e.g. temperature, humidity, etc.). If the conditions reach the maximum permissible value the sensors will make an alarm signal to users. The system continuously monitors the processes and signals the condition of stored food and forecasts the date of maturing and spoilage.

7) "Service-halls" in the basement of apartment buildings

These halls should be used in logistics as the pick-up point for consumers. In these halls the company can monitor if the product is cool enough and picked up soon enough (monitoring with sensor technology). With an internet food shop, they have no need to store food: they transfer the ordered food straight away from the farm to these „service-halls". This makes it possible to avoid the use additives.

8) Small depots for personalized supply of perishable foods

Consumers, producers and also retailers raised the idea of an improved access to food supply. Access to quality fresh foods, particularly fruits and vegetables needs more frequent shopping then the weekly shopping. Properly ripen fresh fruits and some of the vegetables have to be eaten within a few days after harvesting. The consumers could buy the selected fresh products daily and collect them on the way home, if a better logistic service is established.
Benefits of the expected system:

- Combination the benefits of the traditional markets and the planned and organized food supply,
- Large choice and flexibility of time of shopping,
- Ensuring of the superior sensorial quality.

After a personalized web-based ordering, the ordered products would be delivered to a selected retail outlet point which is located closely to the route which is used by the consumer giving this order. On the way home the consumer can collect the pack of food prepared for him. Alternatively the personalized food pack can be delivered to his home.
This system could help to reduce costs and time of delivery.
For this, beyond the collecting-trucks or collecting-depots, the users need:

- a central database which collects, organizes and synchronizes the inputs, including data about details of the orders, consumers, target locations, fleets, optional delivery routes,
- simple access and availability to the data,
    - for consumers to personalize the orders
    - for retailers or transport companies to get the details of orders
- a direct, real-time connection between the parties,
- and a system of the future internet which helps.

3.4.2 Results of the focus groups - Refinement of the ideas and expectations in smart agri-logistics area

The most applicable ideas unanimously were:

- "Road monitoring application",
- "Dock reservation system",
- "Secure banking system"
- "Integrated freight and fleet management for vending machines and small retail outlets",

The idea of "Flexible parking system for delivery shops" also was mentioned as being quite important.

In general all the selected applications have the same practical benefits as cost reduction, better coordination and better information for decision making, and the proactive control of processes leading to increasing efficiency and effectiveness.

Ideas of a road monitoring application and the dock reservation system actually belongs to the idea of fleet management – all these together seemed to be quite applicable because of two main reasons. First, several application already exist and are applied, as GPS based navigation system, telematics systems or dock reservation systems. On the other hand, most of the companies considers necessary in having these applications or systems for the easier organization and more successful achievement of the transportation processes.

However, there are some limitations in current practice: the range of transferring the data is not too long, and the different applications and systems are not connected appropriately; therefore the exchange of the information within the dock reservation system and fleet management process is delayed, not real-time.
None of these applications can be developed easily, because it requires standards that are accepted in the logistics and food sector - missing standardisation is the most important aspect that is leading to deficiencies today. Logistic service providers are working closely with their customers in the food sector, so any solution has to be fitting for both.
If the systems of the future can give solutions for the problem of compatibility and standardization, and can provide a greater range for data transfer, thereby ensure the real-time operation, these ideas will be really applicable.

One part of the integrated freight management is more-or-less known in the current practice – several companies have automatic systems for monitoring their stocks. In most cases, for monitoring the durability of the products there is a separate system- in several cases based on paper works. This idea would be applicable if companies could integrate these monitoring systems with each other, or could integrate the freight and stock management with a fleet management and road mapping system.

The secure banking system also was mentioned as a quite important application, since the security of the data exchange processes in general is a basic requirement, the more secure banking always helps "build confidence in the system" and encourage more people to shop online amongst other things. However, it was also mentioned that nothing ever is fully safe and secure in the internet – so this is a fundamental issue concerning the existence of the internet at large. This idea was regarded as well applicable that the required identification processes should be simpler and less complex than currently.
However, the secure banking system, among other items, already exist today, the more secure banking system of the future could promote the automatic proceeding of the ordering and invoicing processes which would became quicker and the amount of manual/paper work could also be reduced.

In Finland and the UK a Smart household storage system could be interesting for consumers and not for the logistic service providers. Small household storage was liked by the participants as this would encourage customers to use smaller producers who cannot afford to use life extending procedures. However, smart warehouses with integrated dock management also would be of interest.

The least applicable ideas were:

- "Small depots for personalized supply of perishable foods",
- "Service halls in the basement of apartment buildings".

In general it was seen that IT-systems and smart logistics could provide possibilities to adapt operations to fragment consumer demand, needs and wishes in applications such as small household storages and small depots for personalized supplies of perishable foods. Also, this kind of Smart logistics should help in reducing food waste.
However, these ideas were selected as being less applicable, since these systems seemed to have quite high costs. Delivering the required products to the predetermined depot in predetermined - even small – amounts may not worth it for the producer or the logistic service provider.
In UK these two ideas felt to be not applicable to the participants as in the UK there would not be suitable storage areas (most UK houses do not have an accessible secure area) and that the cost of the sensors compared to the cost of the shopping would not be financially viable.
The idea of Small depots would be similar to the online shopping and veg box system which are already running in the UK.

In addition, the idea of a Flexible parking system was also thought not to be applicable as many of the participants felt this would "serve larger businesses to dodge the law, as they can afford it and would abuse the system", Instead a system that gives information on high/low peak parking times, so the delivery schedules can be organised to send drivers at low times would be useful.

3.5 Smart-Food Awareness

3.5.1 Results of the questionnaire survey in smart food awareness application area

In the questionnaire survey which was carried out to collect information about the application areas (Smart Farming, Smart Agri-logistics, Smart Food Awareness) the questions followed the same logic and sequence:

- Identification of the current use
- Experiences with the current use
- Needs, expectation, ideas for any Future Internet-based new or advanced application.

Current use

Regards to food awareness and food processing methods along the supply chain, there are several systems and applications which are used and have specific role:

- Using semi-automatic business management software and system (e.g. SAP, ROOL) for helping companies to get the most out of their IT investments, by maximizing their business performance with control of production (e.g. production monitoring, production management, trade coordination, transport scheduling, invoice handling, etc.). The database is based on an internal system, which is isolated and manually operated.
- Using detectors for identifying and for visualising the physical contamination in the products during food processing (e.g. colour sorters, metal detector, X-ray detector, image analyser, etc.). Some of these detectors are calibrated by standards or image identification is made by comparison of the actual images with those which are available in the local library of the machine.
- EPoS provides businesses a fast and convenient way of transacting sales, while at the same time recording vital business information.
- DotMailer is an email marketing tool with an intuitive, easy to use email marketing platform.
- Online accounts for members “through a web service”.

In addition within the supply chain electronic applications exist which are used along the supply chain to increase food safety.

- Sensors are used for monitoring environment conditions of products e.g. the temperature, the humidity, etc. Sensors record data and they can transfer this data to local systems with fixed internal connection. Mobile devices are used for recording data manually. These devices help collect information for an internal database. The transfer of this information operated through a fixed connection.

Simple basic applications are also used with regards to food awareness. These applications are: business indicators which are used for benchmarking and newsletters.
Business indicators are used by companies to inform their partners, shareholders and customers to improve their image. These indicators are published usually on the websites of the companies. They update these indicators e.g. profitability, turnover, liquidity, productivity, social responsible report, etc. periodically.
Newsletters are spread to companies on the internet via emails.

Limitations and constrains

The currently used applications have several limitations and barriers. The limitations of the applications are associated to different areas in a similar trend to the previous chapters.

Limitations of information and database:

- Automatic processes, systems and applications are limited in data recording, transferring and exchanging.
- Manually operated systems exist within companies.
- Lack of ensuring the appropriate privacy and accessibility, which increases the distrust between the partners.
- Information is not updated continuously on the internet within websites.

Limitations of the communication and information flow:

- Information flow is not adequate and slow between and within the companies.
- Systems within each company are not integrated and compatible to other systems, thus the communication between these systems and the transfer of information is difficult and inaccurate both internally and externally.
- A significant part of the information is not accessible easily for the consumers/customers, and the use of existing technologies (e.g. smarter mobile devices, identifier chips and a common, global database) is not widespread among the manufacturers, authorities or even the consumers.

Limitations of the electronic applications and equipment:

- Sensors are not connected to local systems via Internet
- Companies use fixed installations and stationary equipment.
- In current time companies disseminate mostly pictures or specification of the products on their websites, however videos illustrate the processing of products better. These applications are not or rarely used during the processes.
- Several applications and devices are not able to transmit large sized photos and videos.
- Lack of financial resources: current systems and mobile devices (e.g. SAP, RFID, EPC, etc.) are too expensive. A common problem of companies is that they cannot invest in the development, and initiate advanced technologies or use marketing tools. One of the findings of the interviews was that several companies were concerned that at the implementation of the “Smart shopping” concept which guides the route of the consumers within the shop. It will make it more difficult for smaller companies or other companies, which spend relatively small amount of money on marketing and advertising to get new customers in the shops, even it is a time-efficient for the consumers.

Ideas and expected applications

Table 15: **Ideas and expectations in Smart Food awareness area**

Smart Food Awareness	
1.	Monitoring of food quality
2.	Improved awareness information system based on traceability
3.	Communication of product-related information towards the consumer
4.	Exchange of product-related information between agri-food enterprises
5.	Informed decisions of consumers based on tailor made information selected according to their criteria
6.	Profile specific newsletters and dissemination of information
7.	Virtual shops and virtual visits
8.	Connected automatic systems
9.	Improved diet and health through personalised nutrition
10.	Foreign material identification

1) Connected automatic system

If systems and devices in different companies and households are connected to each other via the Internet the information flow between them may work automatically, thus the transfer of information will be accurate, quick, and efficient. The electronic devices such as RFID or EPC might transfer information to smart refrigerators in households. This system can handle ordering/reordering functions e.g. monitor the stocks internally and externally too.
Smart refrigerators can collect information about the consumer habits of the specific user (including usual amount, brands, price, preferred shop or a diet), can record the information of product labels e.g. the relevant ingredients (allergenic), the Guideline Daily Amounts (GDA), the nutritional content of the products by sensors inside the refrigerator. Through communication between the smart refrigerator and the smart phones consumers can make informed decisions. With the ability of broadcasting or transferring information the refrigerator can send specific orders directly.

2) Monitoring of food quality

Monitoring of the time-temperature conditions during storage and delivery of perishable foods is an important requirement by the respondents. The most important requirements of this monitoring were to have identification for the smallest packaging unit of the products as possible, and to know the actual (real-time) position with the highest accuracy. By monitoring time-temperature history of the product in the cold chain, items which were out of the control can be identified- e.g. those which may result in a food safety problem. This can also to reduce the cost of a possible recall.

The currently available data loggers and RFIDs have a relatively high price; therefore they can be applied at feasible costs only for larger volumes of products, such as pallets, boxes containing several retail packs. If low cost data loggers, long range RFIDs and accurate GPS systems are available, and long-range and real-time communication between the product (the RFID) and the stock record of the retail shop are available the expired individual retail packs on the shelves of the retail shops can be identified and collected back. Thus consumer complaints and fines from food control authorities can be avoided and the labour costs to achieve full recovery of expired products can be reduced. Home refrigerators can send warnings to the users if some of the foods stored in them are getting out of their use by date and should be consumed urgently.

3) Improved awareness information system based on traceability

Future traceability system may work with sensors and application of RFID (Radio Frequency Identification) or EPC (Electronic Product Code). This system delivers tailor made information (including content, physiological and health aspects, origin etc.) following individually determined selection criteria set by the consumers. Traceability data can be provided to the customer by a code which can be seen on the products. Consumers can obtain information about these products based on their code.

4) Foreign material identification

When a detector finds a foreign body object, which is not similar to any other foreign body which has been identified by it formerly, it communicates with the 'Cloud' - which is a network of thousands of servers - by sending the characteristics and the picture of the foreign material. The 'Cloud' identifies the material and if it hasn't appeared before in any system, the data about the unidentified object are stored automatically in the 'Cloud' database. Thus the 'Cloud' works as a database, which always updates itself**.**

5) Profile specific newsletters and dissemination of information

The information can be more specific or profile specific, and companies should get only relevant information, which fits in their profile. The news about the changes of the regulations or legislations can be handled by a system, and personalised information can be purchased, which can accelerate the flow of information.
The indicators used for benchmarking might be calculated automatically if the data are collected also automatically, the system might transfer information to the calculator, and update it, thus the dissemination of the indicators can be continuous and up-to-date.

6) Informed decisions of consumers based on tailor made information selected according to their criteria

Informed decisions of consumers can be supported by screening of information if customers can set their individual profile in advance by giving their criteria and individual preferences. Many criteria in a profile like price, preferences can be set, and then offers, recommendations given by the system could help their quick decisions in real shopping situations. This way, consumers can get a route plan for purchasing in the store based on the shopping list, or they can also receive some special offers of products which fit their profile. This information can reach the consumers through their smart phones or through an intelligent shopping trolley.

When consumers enter the food store, give their profile ID to the system, which recognizes the ID and the personal profile. Then the intelligent trolley or smart phone communicates with the shelf sides (radio frequency interaction with the tags on the products), which food match best to the profile requirements, and by accepting and sending information through the screen of trolley or smart phone the customer can choose. This system also provides information on the real-time accumulated price of the content of the shopping trolley, making also paying at the counter faster and easier.

7) Improved diet and health through personalised nutrition

Consumers should pay regular attention to their health and weight. However a large proportion of the population has a tendency of neglecting diet, health and weight management issues and not taking preventative measures unless the first signs of overweight and/ or diseases are not visible. If the food consumption of the individual is properly recorded, monitored and compared to the recommended daily allowance significant improvements may be achieved. Typical examples include the monitoring of energy intake, for elderly people the amount of specific nutrients they need on their diet, for allergic patients the avoidance of specific products which contain ingredients for which they are sensitive, etc.
The system can monitor consumers' purchasing and the quantity of the reduction of stocks in the households, the needed specific nutrients, dietary advice, and provide the amount of the consumed food and compare it to the Guideline Daily Amounts (GDA). When the food is used the energy, nutrient content etc. is recorded (corrected by the number of portions and persons) and the daily consumption is calculated and compared to the targeted, recommended value. It will warn the consumer if the product is getting close to or is going beyond the indicated shelf-life date. The system can provide advice with different levels of stringency from recommendations through gentle warning till strong warning.

This system is important because in this rapid life prevention has increasing significance. That is why this system can help our life.

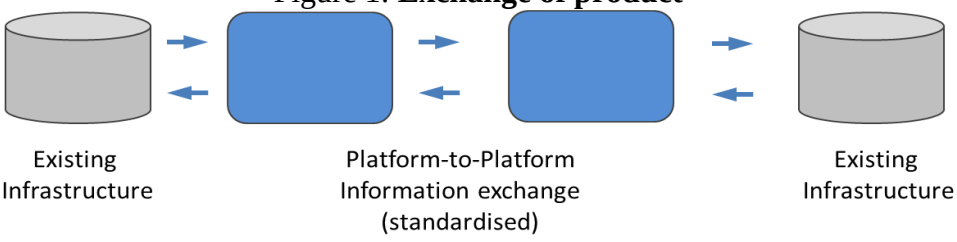
8) Virtual shops and virtual visits

The consumers require more information about the products e.g. about the origin or about the production process. Therefore communication of product-related information towards the consumer is an important issue for the companies in food sector, and achieving this well-functioning communication, audio-visual solutions should be used more, as virtual visits of factories or stores. Companies can increase the consumers' confidence in their products if they have videos on their web-sites, where consumers can look into some production processes or can see the ambient parameters of the processes.

9) Exchange of product-related information between agri-food enterprises

The exchange of product-related information is often organized individually via specific software interfaces between agri-food enterprises. The expected system is a Future Internet Platform, which would allow a decentralized organization scheme that can be easily adapted according to current business relationships without spending funds for developing individual interfaces as it is common today.

Figure 1: **Exchange of product**



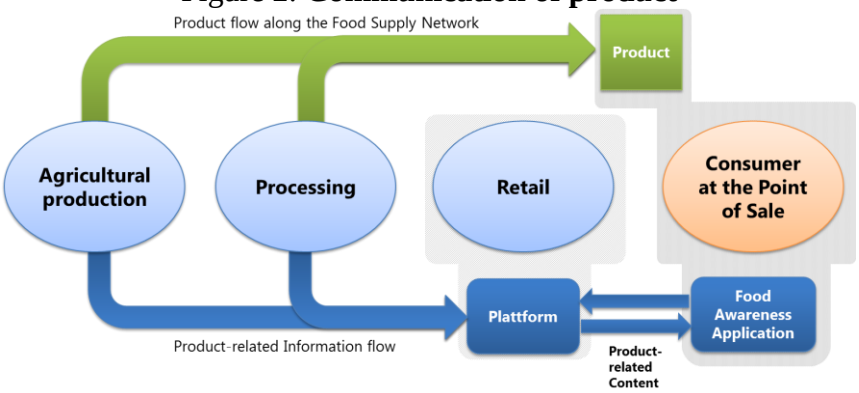
Due to the highly individual character of systems in place, a platform infrastructure is required for establishing standardized information exchange between the enterprises. Between these platform information can be exchanged in a standardized way including standardized interfaces and

data description standards. The integration of these platforms requires the transformation of data to comply with the provided standards. This reduces the number of complexities, because all enterprises can adapt to these standards and don't have to adapt to each and every system the partner offers for information exchange.

10) Communication of product-related information towards the consumer

A standardized communication infrastructure based on information standards describing product characteristic is established. At the point of sale products and product-related information can be accessed by the consumer via a networked device either brought by the consumer himself or provided by the store e.g. at the shopping cart or a terminal in the store.

Figure 2: **Communication of product**



The system includes both above mentioned communication schemes. The product-related information e.g. on the origin of a product, product treatment or other social and ecological aspects of the product are provided regularly or on demand from agricultural production or the processing stage to retail and provided to the consumer at the point of sale. Due to the short timeframe consumers spend in retail outlets, the application has to provide information in a way that is directly accessible and useable in order to support the buying decision. Additional features, such as check-in at the supermarket and reception of individualised product offers available in this particular supermarket or upcoming events at the supermarket are ideas stated during the interviews.

3.5.2 Results of the focus groups - Refinement of the ideas and expectations in smart food awareness area:

Smart food awareness as a whole was seen to be important in the future.

The most applicable ideas unanimously were:

- "Improved awareness information system based on traceability",
- "Monitoring of food quality",
- "Communication of product-related information towards the consumer".

The idea of "Exchange of product-related information between agri-food enterprises" and "-informed decisions of consumers based on tailor made information selected according to their criteria" also were regarded as applicable.

All the participants thought that traceability will be important in the future. Consumers are most certainly interested in traceability and knowing what has happened to the products on their way to the end user, as well as the possibility to find products easily from the most nearby location.

However, in UK most of the participants felt that though traceability is good for food safety issues, it is otherwise unneeded as consumer like the idea of traceability but buy their food on price and freshness first.
Participants imagined a scheme, that if we have a connected automatic system, which provides connection between several sub-systems and automatic data/information exchange, we can partly ensure the monitoring of food quality (idea No.2) and the traceability - within a company or even through the entire food supply chain, depending upon this is a local or a wider system.
If we add an application using barcode/RFID tag/QR code (idea No.5 from Smart Farming) to the system, we could ensure an improved traceability system (idea No.3).

In current practice, the major limitations of these integrated systems are: the lack of the appropriate amount of connections and the non-automatic data exchange, which are caused by the incompatibility between the different sub-systems. Moreover in most cases the data transferring is slow and delayed, and this fact hinders the real-time monitoring of the products. In addition, use of the RFID tags/QR codes widespread and in big amounts has a quite high cost.

The improvement of transparency within a supply chain by inter-enterprise information exchange as well as the potential to improve consumers' trust in food products are the most outstanding arguments. Additionally, any system that helps reduce unnecessary public recalls helps agri-food enterprises to improve trust and their food safety mechanisms.

Communication of product-related information towards the consumer was also an important issue for the companies in food sector, and this communication can be achieved e.g. by applying virtual shops and virtual visits of factories or stores (idea No.8). The idea of the virtual visits was seen as an affordable idea, if guaranteed to be objective and reliable in a marketing sense.

Another possibility of this communication is using the mentioned RFID/QR codes, which can contain all the relevant information about the product. To achieve this, we have to consider two limitations: the application of RFID tags/QR codes has currently too high a cost, and the fact that most of the common consumers do not have smart mobile device, which is necessary to get the applicable information (as a scanner).

Improvements of customer services by product centric information provision is considered as a field of research that can generate advantages for consumer, as well as enterprises in the sector by communicating hidden product characteristics that are of interest to consumers when selecting their food purchases.

Last but not least, all these Food Awareness applications also require standards that are accepted within the entire food sector – solving the problem of missing standardisation is of the highest relevance today.

The least applicable idea unanimously was:

- "Foreign material identification".

First, this idea was not seen as having the priority of future internet application development at the consumer end.
The idea of a system for extraneous and foreign bodies' identification was also criticized because the planned functionality was seen as too expensive due to its technological complexity and more like a function performed by machine automation.

In additional, though exchange of the information is a key-word within this topic, idea of "Exchange of product-related information between agri-food enterprises" thought to be non-applicable as they do not see how this would work. Most participants felt that they would not want other organisations knowing what they are doing and would therefore, not wish to have a compatible system, even if it could make exchange of information easier. The exchange of product related information was thought to be a nice idea but would not work as again, people like to keep their own information on what works or does not.

4. Conclusions, future recommendations

The findings of the interviews and focus groups **showed a large level of consistency among** the surveys carried out in **different countries** – in relation to the functions of the Future Internet, the expectations and ideas and even the current limitations.

It was generally agreed that two functions of the Future Internet could be very important:

- ensuring **a higher privacy** which guarantees for the protection of personal data, and
- the possibility that the services, equipment, devices, etc. should **be available everywhere** and they can operate their business processes remotely from anywhere - in addition it is necessary that the applications and devices should **be integrated and standardized**.

An example to show the importance of these two mentioned functions: one of the most important expectations is a common and large database of information regarding the different areas of food industry. The databases should be easily accessible to those users who have been given permission to access the database and they can monitor and control this permission.

Overall, one of the main expectations of the users is that **the Future Internet should be accessible for anybody, anywhere and anytime.**

Based on the results of the interviews and focus groups, **there are also some demands, expectations and limitations which were universally mentioned** by the respondents.

Technical limitations

For achieving the availability of the future internet we should ensure:

- **the** compatibility of the different applied devices, programs and systems **or the integration of systems instead of different connected applications;**
- **longer range** in data exchange/transfer and in communication

Expensive development and the applications

Lower costs for implementing the new or advanced applications is **also a priority,** as currently the price of the technologies required is too high particularly for smaller businesses.

Lack of experience and knowledge about the applications

By the participants' opinion the **most important precondition and requirement is the training of the users**, as most of them do not have appropriate experience about using the Internet.
User-friendly applications and **interfaces, improved filtering** and **systematic organization** of the received, stored, sent or browsed data - even on demand by a predetermined profile –should also help the users in the future.

The managing and screening of the information is an important issue, too. Currently there is a huge amount of spam on the Internet, and on the other hand a lot of relevant information, which cannot be found easily.

In general, we should also state, that in the future, **those applications, functions or systems can be viable and will be implemented, which will have great benefit**, or **which** are already applied even in some other crude format (manual or non-automatic), therefore they **can be developed easily** or in a cheaper way.

In Smart Farming area

Basically, the respondents named the most important functions of the Future Internet as **getting as much information as possible, collecting this information** all **together into a connected database**, and **sharing the information and knowledge** with the neighbouring farmers. **Network of sensors** was also mentioned as being important in the future.

In Smart Agri-logistics area

In general all the selected applications of the Future Internet should have the same **practical benefits as cost reduction, better coordination and better information for decision making by ensuring the real-time exchange of huge amounts of data**, and the proactive control of processes leading to increasing efficiency and effectiveness. However, the **current problems of compatibility and standardization of the different systems need to be solved**.

In Smart Food Awareness area

Majority of the participants thought that the **consumers are most certainly interested on knowing what has happened to products on their way to the end user.**

Communication of product-related information towards the consumer will also be an important issue for the companies in food sector.

Last but not least, all the **food awareness applications also require standards** that are accepted within the entire food sector – solving the **problem of missing standardisation if of the highest relevance today**.

Overall we can state if we consider the mentioned users' demands and we are able to meet these or able to overcome the current limitations, the applications and systems, which will be developed in the project, could be viable and applicable in the future.

5. Appendix

Appendix 1.

General instructions for the questionnaire survey in Task 710 of the SmartAgri-Food project

Objective:
The objective of the questionnaire survey to provide an input for the development of the focus group discussion guide for the focus group carried out in the next stage of this task. Qualitative information will be collected on application of the Future Internet in three different areas of the agri-food chain such as:

- Smart Farming
- Smart Agri-Logistics
- Smart Food Awareness

For each application area a specific questionnaire will be used for collecting information on the current use Internet-based solutions, current and future needs, expectations of different members of the food chain.

In each questionnaire at each main-aspects the questions follow the same logic and sequence:

- Identification of the current use
- Experiences with the current use
- Needs, expectation, ideas for any Future Internet-based new or advanced application.

The questionnaire survey will be carried out in six countries (Germany, Hungary, Finland, Greece, UK, Spain). 10-10 interviews will be carried out with each questionnaire in each country (30 in total/country) with respondents representing all stakeholders of the targeted application area of the food chain. In each country all 3 questionnaires have to be used. The questionnaires cover all aspects of the application area along the food chain. Thus some of the questions or a part of them may not be relevant for a specific respondent. To avoid the unnecessary overloading of the respondents with questions, which are not relevant for them, when the interviewer or the respondent decides that a question is not relevant for the respondent please apply scoring with N/A (not applicable).

10-10 respondents relevant for each questionnaire should be selected to cover the main stake-holders of the specific area as uniformly as possible. You should consider the typical nature and members of the agrifood chains in your country.

We provide you some recommendations on distribution of the selected respondents. You can apply some flexibility and deviate from these recommended numbers depending on the availability of the typical food chain members in your country and the availability of your respondents. It is a priority that the key players of the food chain should be included anyway.

	Type of the areas of respondent	Approximate number of the respondents
1	Plant growing and seed production	2-4
2	Animal breeding, rearing, husbandry, production of fish/feed for fish, fish farming	2-4
3	Feed production/processing	1-2
4	Manufacturing and sales of agricultural chemicals/veterinary drugs etc. used in farming/ agricultural machinery	0-1
5	Primary production (flour milling, packaging, slaughtering, etc.) and food processing	0-2
6	Storage, transport, logistics, trading, retailing, wholesaling	1-2

Please translate the questionnaires to the national language of your country.

A short presentation will be developed in Task 720 by the ICT expert members of the consortium on the envisaged advanced capabilities and functions of Future Internet for creating awareness of the food chain members. Please explain these functions using the short presentation to the respondents briefly before the interview.

For carrying out the interview you may choose from several options selecting the most appropriate method for a specific respondent

- personnel interview
- phone interview
- self-filling by the respondent with an optional assistance through phone at those parts where he/she needs help or clarification.

Since this survey is made to collect qualitative inputs for a further qualitative research step this freedom in choosing from several options for the methods of the interview will not compromise the results of this step of the survey.

Further useful information can be collected on the top of the 30 interviews carried out by the above described methodology through the optional use of an Internet survey methodology. Therefore we propose that the questionnaire should be put on your home page with the user's instruction and a letter should be sent out for your user's network to trigger responses. The information received this way can be used as an additional source of ideas for the focus group discussion guide.

Questionnaire "A" for Smart Farming

Please follow the attached general instructions for carrying out the interviews!

Background information:
Envisaged capabilities and function of the Future Internet

Future internet will provide opportunities, for:

- "Cloud-computing" (The "cloud" is like a precise functionality of a 24h fully scalable data centre. The "cloud-computing" approach to infrastructure services, where large scale data centres provide virtual execution environments as Internet services with the same functionalities to physical machines but far greater flexibility and scalability)

- The use of sensors and monitoring, decision support systems and precise input application so as to make the use of resources more efficient in food production, and secondly concerns ways to improve traceability and the flow of data along the food supply chain.
- Greater mobility in use with using wireless communicating devices and remote control
- Handling of higher quantity of data
- Quicker information flow
- More trustworthiness
- User friendly system
- More compatibility of devices in use
- More security of data
- More safety of information flow
- Cost efficiency
- More accurate use of incoming data
- More efficient use of resources required for production

Please indicate in which activities are you involved (you may choose several options):

- □ **Plant growing and seed production**
- □ **Animal breeding, rearing, husbandry**
- □ **Feed production/processing**
- □ **Production of fish/ feed for fish, fish farming**
- □ **Manufacturing and sales of agricultural chemicals/ veterinary drugs etc. used in farming**
- □ **Manufacturing and sales of agricultural machinery**
- □ **Primary production (flour milling, packaging, slaughtering, etc.)**
- □ **Food processing**
- □ **Storage, transport and logistics**
- □ **Trading**
- □ **Retailing, wholesaling**
- □ **Other (please specify):**

……
……

Questionnaire

Do you use internet and/or internet based, electronic applications during the purchase of the agricultural inputs with particular focus on precision farming:

Please tick the appropriate □ box.

A. Seed □
B. Plant protection product and biocides □
C. Organic or inorganic manure □
D. Breeding animal/ sire □
E. Feed □
F. Litter □
G. Equipment and cleaning products □
H. Wide-spectrum biotics, feed additives and veterinary medicinal products □
I. Other (please specify):…… □

If you use such applications please describe:

□ Which applications do you use? (please specify)

……...
……...

- □ For which purpose?(please specify)
  ……...
  ……...
- □ Does this solution meet your expectations (please describe):
  ……...
  ……...
- □ Are there any limitations, constrains of the current application(s) with particular focus on precision farming? (If yes, please specify!)
  ……...
  ……...
- □ If you do not use internet or any internet based solutions please describe its reason or problems you have found.
  ……...
  ……...

Please describe your needs, expectations for any new or advanced future internet based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!

……
……
Any comments: ……..

Do you use internet and/or internet based, electronic applications during the preparation of the processes of crop production and breeding with particular focus on precision farming:

Please tick the appropriate □ box.

A. Soil preparation □
B. Barn preparation for receiving livestock □
C. Lake preparation for fish farming □
D. Other (please specify): …….. □

If you use such applications please describe:

- □ Which applications do you use? (please specify)
  ……...
- □ For which purpose?(please specify)
  ……...
- □ Does this solution meet your expectations (please describe):
  ……...
- □ Are there any limitations, constrains of the current application(s) with particular focus on precision farming? (If yes, please specify!)
- □ If you do not use internet or any internet based solutions please describe its reason or problems you have found.
  ……...

Please describe your needs, expectations for any new or advanced future internet- based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!

……...

Any comments: ……....

Do you use internet and/or internet based, electronic applications during the cultivation and nutritional requirement procedures and sowing, breeding procedures, rearing and animal husbandry with particular focus on precision farming:

Please tick the appropriate □ box.

A. Cultivation procedures □
B. Organic manure, inorganic manure, ascertain the nutritional requirement of plants □
C. Sowing □
D. Pest control and plant protection (weed control, protection against pests and diseases, preparatory steps for harvesting) □
E. Water utilization, water supply, water requiring □
F. Irrigation □
G. Animal breeding procedures □
H. Nutritional requirements for livestock/ fish stock □
I. Watering, feeding □
J. Fattening □
K. Animal health protection □
L. Disposal of waste and dead animals □
M. Other (please specify):…… □

If you use such applications please describe:

- □ Which applications do you use? (please specify)
  ……...
- □ For which purpose?(please specify)
  ……...
- □ Does this solution meet your expectations (please describe):
  ……...
- □ Are there any limitations, constrains of the current application(s) with particular focus on precision farming? (If yes, please specify!)
  ……...
- □ If you do not use internet or any internet based solutions please describe its reason or problems you have found.
  ……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!

……..

Any comments: ……....

Do you use internet and/or internet based, electronic applications for controlling/measuring /recording during the production/ husbandry/ breeding with particular focus on precision farming:

Please tick the appropriate □ box.

A. Meteorological conditions □
B. Microclimatic conditions(humidity, temperature, air velocity) □
C. Soil inventory (moisture, nutritional indicators, soil packing) □
D. Concentration of detrimental gases □

E. Estimation of the production □
F. Yield estimates □
G. Production supervision (measurement of data on production, sampling, etc.) □
H. Recording data on production □
I. Organization of breeding (pairing plan, breed societies, etc.) □
J. Storage conditions: they are necessary to ensure food safety □
K. Regulatory conditions □
L. Other (please specify):…… □

If you use such applications please describe:

□ Which applications do you use? (please specify)
……...
□ For which purpose?(please specify)
……...
□ Does this solution meet your expectations (please describe):
……...
□ Are there any limitations, constrains of the current application(s) with particular focus on precision farming? (If yes, please specify!)
……...
□ If you do not use internet or any internet based solutions please describe its reason or problems you have found.
……..

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!
……...

Any comments:……

……....

Do you use internet and/or internet based, electronic applications during the following operations with particular focus on precision farming:

Please tick the appropriate □ box.
A. Harvesting/ post-harvest handling □
B. Milk/ egg/ wool/etc. production □
C. Storage □
D. Distribution □
E. Other (please specify): □

If you use such applications please describe:

□ Which applications do you use? (please specify)
……...
□ For which purpose?(please specify)
……...
□ Does this solution meet your expectations (please describe):
……...

- □ Are there any limitations, constrains of the current application(s) with particular focus on precision farming? (If yes, please specify!)
  ……...
- □ If you do not use internet or any internet based solutions please describe its reason or problems you have found.
  ……...

Please describe your needs, expectations for any new or advanced future internet based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!
……...

Any comments: ……....

Do you use internet and/or internet based, electronic applications during monitoring of the market, competitors and the partners:

Please tick the appropriate □ box.

A. Market opportunities	□
B. Market requirements	□
C. Market changes	□
D. Competitors watching	□
E. Communications with partners	□
F. Other (please specify):……..	□

If you use such applications please describe:

- □ Which applications do you use? (please specify)
  ……...
- □ For which purpose?(please specify)
  ……...
- □ Does this solution meet your expectations (please describe):
  ……...
- □ Are there any limitations, constrains of the current application(s) with particular focus on precision farming? (If yes, please specify!)
  ……...
- □ If you do not use internet or any internet based solution please describe its reason or problems you have found.
  ……..

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!
……...
Any comments:……

Do you use any other internet and/or internet based, electronic applications with particular focus on precision farming:

If you use such applications please describe:

- □ Which applications do you use? (please specify)

……..

- ☐ For which purpose?(please specify)

……...

- ☐ Does this solution meet your expectations (please describe):

……...

- ☐ Are there any limitations, constrains of the current application(s) with particular focus on precision farming? (If yes, please specify!)

……...

- ☐ If you do not use internet or any internet based solution please describe its reason or problems you have found.

……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!

……..

Any comments: ……

Questionnaire "A" for Smart Agri-Logistics

Please follow the attached general instructions for carrying out the interviews!

Background information:

Envisaged capabilities and function of the Future Internet

Future internet will provide opportunities, for:

- "Cloud-computing" (The "cloud" is like a precise functionality of a 24h fully scalable data centre. The "cloud-computing" approach to infrastructure services, where large scale data centres provide virtual execution environments as Internet services with the same functionalities to physical machines but far greater flexibility and scalability)
- The use of sensors and monitoring, decision support systems and precise input application so as to make the use of resources more efficient in food production, and secondly concerns ways to improve traceability and the flow of data along the food supply chain.
- Greater mobility in use with using wireless communicating devices and remote control
- Handling of higher quantity of data
- Quicker flow of information
- More trustworthiness
- User friendly system
- More compatibility of devices in use
- More security of data
- More safety for flow of information
- Cost efficiency
- More accurate use of incoming data
- More efficient use of resources required for production
- A reduction in the technological network complexity and this has to be matched by a reduction in information complexity.

Please indicate in which activities are you involved (you may choose several options):

- ☐ Plant growing and seed production
- ☐ Animal breeding, rearing, husbandry
- ☐ Feed production/processing

- ☐ Production of fish/ feed for fish, fish farming
- ☐ Primary production (flour milling, packaging, slaughtering, etc.)
- ☐ Food processing
- ☐ Storage facilities
- ☐ Road transport
- ☐ Air transport
- ☐ Water transport
- ☐ Rail transport
- ☐ Trading
- ☐ Retailing, wholesaling
- ☐ Catering
- ☐ Packaging and ingredient manufacturing
- ☐ Other (please specify):

Questionnaire

Do you use internet and/or internet based, electronic applications during the ordering process:

Please tick the appropriate □ box.

A. Calls for offers	□
B. Determination of buyers' or consigners' demands	□
C. Determination of condition of transport and goods	□
D. Ordering and confirmation	□
E. Signing a contract	□
F. Preparing specifications	□
G. Other (please specify):……	□

If you use such applications please describe:

- ☐ Which applications do you use? (please specify)
  ……...
- ☐ For which purpose?(please specify)
  ……...
- ☐ Does this solution meet your expectations? (please describe):
  ……...
- ☐ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)
  ……...
- ☐ If you do not use internet or any internet based solutions please describe its reason or problems you have found.
  ……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!
……....

Any comments: ……...

Do you use internet and/or internet based, electronic applications during the intake, stowage, and the entry into storage:

Please tick the appropriate □ box.

A. Reduction of the costs of storage and stock-holding □
B. Reduction of direct labour inputs □
C. Improving space utilization □
D. Improving productivity □
E. Improving efficiency of use of capital □
F. Improving partnerships and cooperation □
G. Reduction of environmental impact □
H. Other (please specify): …….. □

If you use such applications please describe:

□ Which applications do you use? (please specify)
……...
□ For which purpose?(please specify)
……...
□ Does this solution meet your expectations (please describe):
……...
□ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)
……...
□ If you do not use internet or any internet based solutions please describe its reason or problems you have found.
……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!
……....

Any comments: ……...

Do you use internet and/or internet based, electronic applications for monitoring and controlling the stock, goods in hand or goods in transportation? For:

Please tick the appropriate □ box.

A. avoiding stock-outs □
B. ordering reconciliation □
C. for measuring shrinkage of products/stocks (out-of-date or damaged products, theft) □
D. Other (please specify): …….. □

If you use any application please describe:

□ Which applications do you use? (please specify)
……...
□ For which purpose?(please specify)
……...
□ Does this solution meet your expectations (please describe):
……...

- ☐ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)
  ……...
- ☐ If you do not use internet or any internet based solutions please describe its reason or problems you have found.
  ……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!
……....

Any comments: ……...

Do you use internet and/or internet based, electronic applications to improve:

Please tick the appropriate □ box.

A. operational efficiency of stock	□
B. handling efficiency	□
C. inventory reduction	□

If you use any application please describe:

- ☐ Which applications do you use? (please specify)
  ……...
- ☐ For which purpose?(please specify)
  ……...
- ☐ Does this solution meet your expectations (please describe):
  ……...
- ☐ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)
  ……...
- ☐ If you do not use internet or any internet based solutions please describe its reason or problems you have found.
  ……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!
……....

Any comments:……

Do you use internet and/or internet based, electronic applications for traceability systems for:

Please tick the appropriate □ box.

A. Reduction of recall incident	□
a) Reduction the amount of recalled products	□
b) Reduction of recall processing costs	□
B. On-going data capturing	□
C. Other (please specify):……..	□

If you use such applications please describe:

- ☐ Which applications do you use? (please specify)
  ……...
- ☐ For which purpose?(please specify)
  ……...
- ☐ Does this solution meet your expectations (please describe):
  ……...
- ☐ Are there any limitations, constrains of the current application(s)?(If yes, please specify!)
  ……...
- ☐ If you do not use internet or any internet based solutions please describe its reason or problems you have found.
  ……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!
……....

Any comments: ……

Do you use internet and/or internet based, electronic applications during the receipt of goods:

Please tick the appropriate □ box.

A.	Intake	□
B.	Monitoring	□
C.	Registration	□
D.	Other (please specify):……	□

If you use such applications please describe:

- ☐ Which applications do you use? (please specify)
  ……...
- ☐ For which purpose?(please specify)
  ……...
- ☐ Does this solution meet your expectations (please describe):
  ……...
- ☐ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)
  ……...
- ☐ If you do not use internet or any internet based solution please describe its reason or problems you have found.
  ……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!

Any comments: ……...

……..…

Do you use internet and/or internet based, electronic applications in the processes of planning the transportation?

Please tick the appropriate □ box.

A. route planning □
B. to estimate the duration of the journey □
C. to estimate and determine the time of the delivery □
D. to select the adequate freight vehicle to meet the consigners' requirements □
E. Other (please specify):…… □

If you use such applications please describe:

- □ Which applications do you use? (please specify)
  ……...
- □ For which purpose?(please specify)
  ……...
- □ Does this solution meet your expectations (please describe):
  ……...
- □ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)
  ……...
- □ If you do not use internet or any internet based solution please describe its reason or problems you have found.
  ……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!
……..…

Any comments: ……

Do you use internet and/or internet based, electronic applications to ensure the required and appropriate transport conditions?:

Please tick the appropriate □ box.

A. in monitoring the proper vehicle fleet □
B. in having the information about renting appropriate freight vehicle □
C. in controlling and monitoring the conditions during loading, the journey and unloading (time, temperature, etc.) □
D. in controlling and monitoring the conditions during the storage □
E. Other (please specify):…… □

If you use such applications please describe:

- □ Which applications do you use? (please specify)
  ……...
- □ For which purpose?(please specify)

……...

- ☐ Does this solution meet your expectations (please describe):

  ……...
- ☐ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)

  ……...
- ☐ If you do not use internet or any internet based solution please describe its reason or problems you have found.

  ……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!

……....

Any comments: ……

Do you use internet and/or internet based, electronic applications to optimize your transport?:

Please tick the appropriate □ box.

A. ensuring greater connectivity and network efficiency □
B. ensuring shorter journey time □
C. ensuring cost efficient transportation □
D. Other (please specify):…… □

If you use such applications please describe:

- ☐ Which applications do you use? (please specify)

  ……...
- ☐ For which purpose?(please specify)

  ……...
- ☐ Does this solution meet your expectations (please describe):

  ……...
- ☐ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)

  ……...
- ☐ If you do not use internet or any internet based solution please describe its reason or problems you have found.

  ……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!

……....

Any comments: ……

……....

Do you use internet and/or internet based, electronic applications to ensure security in your entire transport system?

Please tick the appropriate □ box.

A. to avoid theft of goods from stock □
B. to avoid theft of goods from vehicle □
C. to avoid theft of vehicles □
D. Other (please specify):…… □

If you use such applications please describe:

- □ Which applications do you use? (please specify)
  ……...
- □ For which purpose?(please specify)
  ……...
- □ Does this solution meet your expectations (please describe):
  ……...
- □ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)
  ……...
- □ If you do not use internet or any internet based solution please describe its reason or problems you have found.
  ……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!
……....

Any comments: ……

……....

Do you use internet and/or internet based, electronic applications to became your transport system cleaner, quieter or more energy efficient?:

If you use such applications please describe:

- □ Which applications do you use? (please specify)
  ……...
- □ For which purpose?(please specify)
  ……...
- □ Does this solution meet your expectations (please describe):
  ……...
- □ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)
  ……...
- □ If you do not use internet or any internet based solution please describe its reason or problems you have found.
  ……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!
……..

Any comments: ……

……..

Questionnaire "A" for Smart Food Awareness

Please follow the attached general instructions for carrying out the interviews!

Background information:

Envisaged capabilities and function of the Future Internet

Future internet will provide opportunities, for:

- "Cloud-computing" (The "cloud" is like a precise functionality of a 24h fully scalable data center. The "cloud-computing" approach to infrastructure services, where largescale data centers provide virtual execution environments as Internet services with the same functionalities to physical machines but far greater flexibility and scalability)
- The use of sensors and monitoring, decision support systems and precise input application so as to make the use of resources more efficient in food production, and secondly concerns ways to improve traceability and the flow of data along the food supply chain.
- Greater mobility in use with using wireless communicating devices and remote control
- Handling of higher quantity of data
- Quicker information flow
- More trustworthiness
- User friendly system
- More compatibility of devices in use
- More security of data
- More safety of information flow
- Cost efficiency
- More accurate use of incoming data
- More efficient use of resources required for production
- A reduction in the technological network complexity and this has to be matched by a reduction in information complexity.

Definition of transparency

Transparency is frequently confused with traceability both in practise (by experts) and in scientific literature (by researchers). Traceability is a prerequisite of transparency.
As such, there is a need for clear definition(s) of transparency/traceability.

Process based approach:
Transparency are measures for building up credibility for consumers and customers, through openness and accountability on activities along the food chain, by underpinning the verity of messages and by generating the perception of being informed to allow informed decisions.
This is achieved by making appropriate signals/information available and understandable on the verity of messages (claims, statements) on

- specific characteristics of products, processes, production environment, activities of actors
- which can't be substantiated by the usual quick and simple methods.

Power balance based approach:

- The valid needs of consumers, customers for facilitating their informed decisions and the sound balance with confidentiality needs of food chain members are considered.

Please indicate in which activities are you involved (you may choose several options):

- Plant growing and seed production
- Animal breeding, rearing, husbandry
- Feed production/processing
- Production of fish/ feed for fish, fish farming
- Primary production (flour milling, packaging, slaughtering, etc.)
- Food processing
- Storage, transport and logistics
- Trading
- Retailing, wholesaling
- Catering
- Certification body
- Policy maker
- Intermediary organizing networks, chain collaboration to meet requirements
- Other (please specify):

  ……
  ……

Questionnaire

Do you use internet and/or internet based, electronic applications or mobile devices for transferring data, results of measurements along the food chain related to the claims, statements on products in the following areas:

Please tick the appropriate □ box.

A. Food safety □
  a) Compositional □
    - chemical hazards □
    - including allergens □
    - biological hazards □
      - measures to control contamination arising from: air, soil, water, feed, fertilisers, veterinary medicinal products, plant protection products, biocides, storage, handling, disposal of waste □
      - measures relating to: animal health and welfare, plant health □
    - analytical considerations □
    - Other:…… □
  - Technological (primary production, processing, packaging, transport and distribution, use, abuse) □
  - Traceability □
  - Organizational and discipline (recognition of management practices/systems- relevant for safety) □

B. Food quality □

a) Nutritional composition □
b) Health and nutrition claims (functional food) □
c) Sensory properties-handling □
d) Raw material production (cultivar based, quality categories, genetic modifications, etc.) □
e) Storage conditions (temperature monitoring, etc.): other than safety aspects □
f) Food processing methods (traditional vs. emerging methods) □
g) Food packaging and distribution (active and intelligent packaging, other than safety aspects, product-packaging interactions, etc.) □
h) Authenticity □
i) Traditional foods □

C. Food integrity □
a) Origin based on traceability as a guarantee of origin of food □
b) Environmental impact (data collection, collection of product specific data, carbon footprint, water consumption) □
c) Ethical and Social (ethical and social animal welfare, labour and working conditions, terms of trade, fair trade, etc.) □
d) Economic issues □

D. Other (please specify):…… □

If you use such applications please describe:

□ Which applications do you use? (please specify)
……...
□ For which purpose?(please specify)
……...
□ Does this solution meet your expectations (please describe):
……...
□ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)
……...
□ If you do not use internet or any internet based solutions please describe its reason or problems you have found.
……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!

Any comments: ……..

Do you use internet and/or internet based, electronic applications to collect information by:

Please tick the appropriate □ box.

A. Sensor technology □
B. Data capturing □
C. Audio-visual solutions □
D. Other (please specify): …….. □

If you use such applications please describe:

- □ Which applications do you use? (please specify)
  ……...
- □ For which purpose?(please specify)
  ……...
- □ Does this solution meet your expectations (please describe):
  ……...
- □ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)
  ……...
- □ If you do not use internet or any internet based solutions please describe its reason or problems you have found.
  ……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!

……...

Any comments: ……...

……....

Do you use internet and/or internet based, electronic applications for communication of information for consumer awareness (data carriers, communication networks, information reception, scanner technology, etc.) to:

Please tick the appropriate □ box.

A. Business partners □
B. Consumers □
C. Policy makers □
D. Other (please specify):…… □

If you use such applications please describe:

- □ Which applications do you use? (please specify)
  ……...
- □ For which purpose?(please specify)
  ……...
- □ Does this solution meet your expectations (please describe):
  ……...
- □ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)
  ……...
- □ If you do not use internet or any internet based solutions please describe its reason or problems you have found.
  ……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!

……...

Any comments: ……...

Do you use internet and/or internet based, electronic applications for sharing traceability information with consumers about:

Please tick the appropriate □ box.

A. Chain members involved in the supply □
B. Practices and products □
C. By descriptions, videos, photographs, virtual visits on chain members' sites □
D. Information on the location of chain members' sites, origin of ingredients □
E. Other (please specify):…… □

If you use such applications please describe:

□ Which applications do you use? (please specify)
……...
□ For which purpose?(please specify)
……...
□ Does this solution meet your expectations (please describe):
……...
□ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)
……...
□ If you do not use internet or any internet based solutions please describe its reason or problems you have found.
……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!
……...

Any comments: ……...

……....

Do you use internet and/or internet based, electronic applications for improving consumers' trust through:

Please tick the appropriate □ box.

A. Monitoring of product movements □
B. Virtual open days □
C. Provisions of indicators, benchmarking tools and self-assessment tools on advantages/ disadvantages of different products and systems for informed decisions □
D. Collective web-site for several SMEs for provision of transparency information □
E. Other (please specify):…… □

If you use such applications please describe:

□ Which applications do you use? (please specify)
……...
□ For which purpose?(please specify)

……...

- ☐ Does this solution meet your expectations (please describe):

……...

- ☐ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)

……...

- ☐ If you do not use internet or any internet based solutions please describe its reason or problems you have found.

……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!

……...

Any comments:……

Do you use internet and/or internet based, electronic applications for innovative services:

Please tick the appropriate □ box.

A. Innovative services □
   a) Traceability □
   b) Satellite based delivery tracking □
   c) Interactive shopping lists □
   d) Proposing of recipes □
   e) Demand and supply based inventory management □
   f) Other (please specify):…….. □

B. Other (please specify):…….. □

If you use such applications please describe:

- ☐ Which applications do you use? (please specify)

……...

- ☐ For which purpose?(please specify)

……...

- ☐ Does this solution meet your expectations (please describe):

……...

- ☐ Are there any limitations, constrains of the current application(s)? (If yes, please specify!)

……...

- ☐ If you do not use internet or any internet based solutions please describe its reason or problems you have found.

……...

Please describe your needs, expectations for any new or advanced future internet-based solutions/applications related to the above mentioned areas, which should be realised by the new functions of the future internet. If you identified a need or expectation please describe it briefly!

Any comments: ……

Appendix 2.

Focus group discussion guide (moderator guide)

The focus group discussion will be carried out with the cooperation of a moderator. The role of the moderator is to facilitate the discussion.

The *italics* style highlights the background information then the bullet points are the direct information for the moderator. The guide also contains an estimated timing.

Introduction
(*3 minutes*)

Each participant has a nametag and type of the areas coming from on the table placed in front of them.

- Good afternoon, first, I would like to thank all of you for participating in this focus group. My name is……and I will conduct this group session on behalf of Campden BRI Hungary that is the subsidiary of Campden BRI Food Research Association, UK (different from participant to participant). Beside many other activities the institute carries out market research as well. This focus group research is sponsored by EU project that focus on applications of the Future Internet in three different areas of the agri-food chain such as:
  - Smart Farming
  - Smart Agri-Logistics
  - Smart Food Awareness.

Directions
(*1 minute*)
- The group discussion is going to be recorded, both video and/or audio. This copy can only be used for research purposes; everything said here would be confidential. The information will remain anonymous.
- There is no good or bad, right or wrong answer; we are interested in everybody's own view.
- We would like everyone to be involved in the discussions. You can ask questions from each other and react to each other's opinion.
- We would like to ask express your opinions clearly and please talk one at a time.

WARM up
(*10 minutes*)

- Please, tell us your First Name and where you are from.
- What is your first thought about internet?

An incomplete sentence is written on small cards, which should be distributed to the participants. PR1

- Please ask to finish the sentence. Discuss the ideas with the participants.

- In which area could you use internet based application/s in the future? (*Every participant should say at least one area.)*

The moderator will write down the spontaneous ideas (areas and applications mentioned by the participants in previous question) on the flipchart. Discuss the ideas with the participants.

Topics of the discussion

Ideas and expected applications[1]
(*25-25-25 minutes*)

The ideas and expectations are written on cards PR2. The cards should be handed out to the participants and the ideas and expectations should be explained briefly to the participants. The brief explanation of these ideas you can find in Appendix 4. and more details in national reports on the interviews. After explanation ask the next question.

Smart Farming (PR2/F1-F9)

1. Yield measurement system
2. System for extraneous and foreign bodies' identification
3. Sensors in barn/stable
4. System for selecting the cultivated plants based on a database
5. Barcode/RFID system -Traceability system facilities
6. Advisory system
7. Improvement of the daily work of the farmer/breeder
8. Shared infrastructure
9. Risk assessment

- Have you got any other ideas what you can add the circulated list?

Hand out PR3 to the participants and ask them to complete it.
The participants have to divide the cards into two groups. The first group contains the most applicable ideas, than the second one contains the ideas which are not applicable in their company.

Please tell us what ideas you put in the applicable section and why. The moderator goes through the following questions:

- Which applications could you use in your practice?
- Please, explain why did you choose these applications?
- What are the practical benefits of these applications in your activity?
- Which application can be developed easily?
- What might be the limitations of these/this idea(s)?

Discussion about not applicable ideas:

- What are the limitations and constraints of these ideas?

Repeat for Agri-Logistics.

[1] Based on the findings of interviews carried out in SmartAgriFood project earlier we selected the main ideas and expectations of the respondents in all three areas.

Smart Agri-Logistics (*PR3/*L1-L8)

1. Integrated freight and fleet management for vending machines and small retail outlets
2. Flexible parking system for delivery to shops
3. Smart household storage
4. Small depots for personalized supply of perishable foods
5. Service-halls" in the basement of apartment buildings
6. Secure banking system
7. Road monitoring application
8. Dock reservation system

Repeat for Food Awareness

Smart Food Awareness (*PR3/*A1-A10)

1. Connected automatic systems
2. Monitoring of food quality
3. Improved traceability system
4. Foreign material identification
5. Profile specific newsletters and dissemination of information
6. Informed decisions of consumers based on tailor made information selected according to their criteria
7. Improved diet and health through personalised nutrition
8. Virtual shops and virtual visits
9. Exchange of product-related information between agri-food enterprises
10. Communication of product-related information towards the consumer

Collect the PR3 from the participants.

What can future internet offer[2]
(*20 minutes*)

The functions of Future Internet are written on PR4 which should be sent to the participants before the focus group discussion.
Distribute PR4 to the participants and read all functions to the participants and after I would like to ask to look through the list and add, if not on the list. Please rank the functions from the least important ones to the most important ones, where 1 is the most important one.

Functions of the Future Internet

1. The Internet is not limited to self-standing PC-s – direct communication between the machines, equipment, sensors, mobile phones, household refrigerators etc. With integrated PCs
   - Services and access to the network do not depend on the location, they are available everywhere
   - Direct control and harmonization of machines and equipment for a higher efficiency and saving time
   - Integrated services, integrated evaluation of information

[2] A list of functions of Future Internet will be presented to the participants. This list of functions was compiled by ICT experts and was translated by CBHU for non-ICT users.

- A practically applicable standardization is a prerequisite.

2. Mobile equipment as data collector, data viewer (display) and information transmitter
3. Quick and real-time exchange of large amount of data/video/3D information
   - Presentation of information by 3D technology – e.g. labels of a packaging can be readable by rotating in space
   - Virtual design facilities, 3D technologies
4. Content based browsing - intelligent distribution and caching of content – each piece of information and each object gets an individual ID code. We need to specify properly what we want to know, but we don't have to know where to find it.
5. Services of customized information – automatic integration of information on demand
   - users can determine the selection and filtering criteria what type of information should the information pack contain, what they receive
6. Positioning with higher accuracy for exact identification of objects, controlling of the (agricultural) machines, equipment
7. Cloud computing – ability to handle tasks requiring high data processing, computing capacity. Users do not need to have their own infrastructure; it is available and accessible through the internet at low cost, when it is necessary. Interworking between local subsystems and global system (cloud).
8. Higher privacy - guarantee for the protection of personal data
9. Global data warehousing and management capability (application for diseases, pesticides, fertilizers, foreign body, reference samples, etc.)
10. Requirements ↔ Monitoring → Set alarm in case of deviations
    - Data recording of conditions of food
    - Increased transparency – RFID, "smart shelf", sensor gates
    - Broadband wireless connectivity in remote areas (e.g. farm land)
    - More use of video surveillance at premises to increase security

Discussion:

- Which functions are the most important ones? (or first three)
- Why do you choose this function?

The moderator writes down the notes on the flipchart.

Closing of the discussion

- Is there anything that might be important related to applications of the Future Internet which has not been discussed?
- Now, we have finished the discussion.
- Thank you for your cooperation and answers.

Appendix 3.

Statistics on participants - focus group

	No.	Area			Activities
		Smart - Farm-ing	Smart - Logis-tics	Smart-Aware-ness	
Germany	1.		X		Logistic Service Provider
	2.			X	European Retail Institute
	3.			X	Quality Management System Provider
	4.			X	GS1 Germany
	5.			X	Huawei
	6.			X	Meat processing
	7.			X	Traceability Service Provider
	8.		X	X	Research Institute
	9.	X			Vegetable seedling producer (big, international)
	10.	X			Cropping farm (small (Potatoes)
	11	X			Cropping farm with ecological viticulture
	12	X			Cropping farm (big)
	13	X			Subcontractor
	14	X			Carrots and viticulture (small)
	15	X			Crops and livestock (middle)
	16	X			Vegetables (big)
	17	X			Vegetables (small)
	18	X			Ecological cropping farm and fruit distillery (small)
	19	X			Cropping and livestock farm (small)

	20	X			Cropping and livestock farm (big)
Hungary	21	X			Producer (plant growing and seed production, animal breeding, rearing, husbandry
	22	X			Producer (plant growing and seed production, animal breeding, rearing, husbandry
	23	X			Primary production (flour milling, packaging, slaughtering, etc.) and food processing
	24	X			Primary production (flour milling, packaging, slaughtering, etc.) and food processing
	25	X			Primary production (flour milling, packaging, slaughtering, etc.) and food processing
	26	X			Primary production (flour milling, packaging, slaughtering, etc.) and food processing
	27	X			Primary production (flour milling, packaging, slaughtering, etc.) and food processing
	28			X	Trading, retailing, wholesaling, catering
	29	X			Producer (plant growing and seed production
	30	X			Producer (plant growing and seed production
	31	X			Primary production (flour milling, packaging, slaughtering, etc.) and food processing
	32	X			Primary production (flour milling, packaging, slaughtering, etc.) and food processing
	33	X			Primary production (flour milling, packaging, slaughtering, etc.) and food processing
	34		X		Storage, transport, logistics
	35		X		Trading, retailing, wholesaling, catering
	36			X	Certification body, policy maker
Finland	37	x			Plant growing
	38	x			Plant growing
	39	x			Intermediary organizing network
	40		x		Logistic
	41			x	Retail
	42			x	Certification body

Greece	43	X			Farmer - vegetable growing
	44	X			Civil servants coming from Greek regions
	45	X			Civil servants coming from Greek regions
	46	X			Farmer - plant growing and seed production
	47	X			Representative from a farmer unions in Greece
	48	X			Representative from a farmer unions in Greece
	49	X			Representative from a farmer unions in Greece
	50	X			Representative from a farmer unions in Greece
	51	X			Civil servants coming from Greek regions
	52	X			Civil servants coming from Greek regions
	53	X			Farmers - animal breeding and husbandry
	54	X			Farmer - vegetable growing
	55	X			Farmer - vegetable growing
	56	X			Representative from farmer unions in Greece
	57	X			Representative from farmer unions in Greece
	58	X			Representative from farmer unions in Greece
	59	X			Representative from farmer unions in Greece
	60	X			Representative from farmer unions in Greece
	61	X			Representative from farmer unions in Greece
United Kingdom	62	X			Fruit farmer, mainly soft and top fruits
	63			X	Organiser for the nearby farmers markets
	64			X	Small retailer, sells mainly fresh fruit and veg
	65	X	X	X	Is a primary producer but has interests in all food areas as sells localy
	66		X	X	Large retailer
	67	X	X	X	Organisation promoting farming and farm based technologies

	68	X	X	X	Mainly farmer with interests in technology and does some consultancy
	69		X	X	Meduim retail, buys local

Appendix 4.

The following tables include the total numbers of the expected ideas from Smart Farming, Smart Agri-logistics and Smart Food Awareness areas which were considered "applicable" or "not applicable" by the participants of focus groups carried out in five countries.

Applicable and not applicable ideas – Smart Farming

Ideas - Smart Farming	Number of participants Sum total	
	Applicable	Not applicable
1.	53	3
2.	52	4
3.	49	7
4.	48	8
5.	44	12
6.	43	13
7.	31	25
8.	29	27
9.	19	37

Applicable and not applicable ideas – Smart Agri-logistics

Ideas - Smart Agri-logistics	Number of participants Sum total	
	Applicable	Not applicable
1.	26	3
2.	22	7
3.	22	7
4.	21	8
5.	17	12
6.	17	12
7.	12	17
8.	11	18

Applicable and not applicable ideas – Smart Food Awareness

Ideas - Smart Food Awareness	Number of participants Sum total	
	Applicable	Not applicable
1.	31	5
2.	31	5
3.	30	6
4.	28	8
5.	27	9
6.	25	11
7.	24	12
8.	23	13
9.	21	15
10.	14	22