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Innovative Solutions of the Future Internet: Needs of the Food Chain Users

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Abstract

Within the SmartAgriFood project 135 in depth interviews in 6 countries, and 8 focus group discussions in 5 countries were carried out for identification and evaluation of the potential applications of the Future Internet (FI) in the agri-food area. Several innovative ideas were described by the participants and there were also some demands, expectations and limitations which were universally mentioned by them. One of the main expectations is that FI should be accessible for anybody, anywhere and anytime. In addition the followings should be ensured: higher privacy; compatibility; integration of systems; longer range in communication; lower implementation costs; and user-friendly interfaces. The most important prerequisite is making aware and training of the users, as most of them do not have appropriate experience about using the Internet. For enhancing the application of the ICT solutions in the agri-food sector the above mentioned needs of the users should be considered and met by the ICT community.

Key words: *Future Internet, innovative applications, agri-food sector, needs of users*

1. Introduction

Nowadays there are not segments of the economy where the information technology, the ICT tools and solutions are not necessary, and the agriculture is neither an exception.

All over the world the agricultural faces many challenges such as variable demand, decreasing of the cultivated agricultural land, decreasing of the agricultural productivity, or the increasing of the international competitiveness. The sector could provide solutions to these challenges by improving agricultural productivity, and by developing of market techniques and technologies (dr. Vajdáné et al., 2001).

In the 21st century the basic ICT applications and tools - computers, Internet access, e-mail system - are essential conditions for proper business processes, even at the smallest primary producers too, however there are several actors who are not taking advantage of these opportunities.

The majority of the farmers due to their age and habit cannot, or do not want to use the applications, while the other side the modern information and communication tools are usually expensive and the agricultural actors cannot finance without help (Infotér, 2011)

There is a need to collaborate with other disciplines, to use methods, knowledge of the high-tech sectors and to adapt solutions existing in other disciplines, sectors. In addition to basic ICT tools, relatively complex ICT solutions could be used in order to improve operational efficiency, save time, reduce costs, increase revenue, or improve the overall competitiveness of the agri-food area.

Applications of ICT in support of agricultural and rural development fall into five main areas, as outlined by Don Richardson (1996). These are:

- economic development of agricultural producers;
- community development;
- research and education;
- small and medium enterprises development; and
- Media networks.

ICT in the agri-food sector is a new concept that has arisen following the rapid development in ICT and the internet. Agricultural informatics is an emerging field which combines the advances in informatics, agricultural development and entrepreneurship to provide better agricultural services, enhanced technology dissemination, and information delivery through the advances in ICT and the internet. This concept is aimed to improve communication and learning processes among relevant actors in agribusiness at different levels i.e. locally, regionally and globally (Gakuru et al., 2009).

On this basis in order to stimulate the development of innovative solutions provided by the FI it is necessary to ensure an effective dialogue between the agri-food chain members representing the "user community" and the ICT community representing the "solution providers". First of all the demands, expectations and ideas of the potential users related to the FI should be studied.

This was the objective of the research carried out within the SmartAgriFood FP7 project in which the potential agri-food members were examined in three different areas, such as Smart Farming, Smart Agri-logistics and Smart Food Awareness.

2 Methodology

Qualitative information was collected on the application of the FI in the area of Smart Faming, Smart Agri-logistics and Smart Food Awareness. A specific questionnaire survey (Resurreccion A., 1998) was carried out for the above mentioned areas for collecting information on the current used Internet-based solutions, and on the current and future needs/expectations of different members of the food chain.

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

- Identification of the current use
- Experiences with the current use
- Needs, expectations, ideas for any FI-based new or advanced application.

Altogether 135 interviews were carried out in the questionnaire survey in six countries (Hungary, Finland, Germany, Greece, Spain and United Kingdom) (Table 1.) with respondents representing all stakeholders from the whole food chain. The partners were selected to represent the different regions of Europe, the agri-food industry and the ICT community.

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

Source: SmartAgriFood, D700.1, 2012

The results of these interviews from each country were used as an input to develop a focus group discussion guide (Resurreccion A., 1998). The goal of the focus groups was to have a better understanding about the needs and expectations related to the functions of the FI of the food chain members, based on the findings of the interviews.
Altogether 8 focus group discussions with 69 participants were carried out in five countries (Hungary, Finland, Germany, Greece and United Kingdom) (Table 2.).

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

Source: SmartAgriFood, D700.1, 2012

The focus group discussions had three main parts. First part was the Warm-up session of the participants who were asked to communicate their first thoughts about the Internet and the FI and after that they were asked to mention some areas where they could use internet based applications in the future.
The second part was about the evaluation of the applicability of the identified 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 applications could be developed easily, and what might be the limitations of these ideas.
At last the functions of the FI were discussed by the participants. The improved list containing the envisaged advanced capabilities and functions of FI 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.

3 Results

3.1 Ideas and thoughts about the Future Internet

Participants of the focus groups 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.
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 encyclopedia

The participants mentioned 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.
However the majority of the respondents had a clear conception how would be the Internet in the future. They wrote that the FI will be accessible for anybody, anywhere and anytime. The FI will be faster, safer, easy to access and easy to use.
Opinion of a plant grower: *"I think the FI 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 FI 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 FI."*
Opinion of the member of an Intermediary organizing network: *"The problem with information is that there is lots of it, so the usability of the relevant information is important."*
One participant from a caterer organisation mentioned that the FI 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 organization said that FI is fragmented, maybe unstable, complex and a central actor in service and information provision.

3.2 Future Internet based solutions

Based on the interviews in the different sub-use cases a set of potential FI or electronic based solutions and expected applications were identified, which may be relevant and efficient in the future. In the focus groups these ideas were discussed in order to try to get an explanation why they think that an idea is applicable or not.
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 Table 3.

Table 3. Applicable and not applicable ideas

Ideas	Number of participants Sum total					
	Smart Farming		Smart Agri-logistics		Smart Food Awareness	
	Applicable	Not applicable	Applicable	Not applicable	Applicable	Not applicable
1.	53	3	26	3	31	5
2.	52	4	22	7	31	5
3.	49	7	22	7	30	6
4.	48	8	21	8	28	8
5.	44	12	17	12	27	9
6.	43	13	17	12	25	11
7.	31	25	12	17	24	12
8.	29	27	11	18	23	13
9.	19	37			21	15
10.					14	22

Source: SmartAgriFood, D700.1, 2012

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):

<u>Smart Farming:</u>

1. Advisory 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 – Task Plan Analyzer
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 personalized nutrition
10. Foreign material identification

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.

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.

Monitoring environment for farms and plants – advisory system

The farmers and specifically the young ones are interested in 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 spraying, or a fertilizer contractor since those conditions are dangerous for the plants to be infected by a disease.

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.

Basically, the respondents named the most important functions of the FI 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 neighboring farmers – via a shared infrastructure - was also important.
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 into the national language and had a really simple user interface.

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.

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 organized 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 organization. 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.

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 organization 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.

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.

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.

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”.

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.

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.

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. 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 individualized product offers available in this particular supermarket or upcoming events at the supermarket are ideas stated during the interviews.

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.
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 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 to the system, we could ensure an improved traceability system.

3.3 Demands and expectations of the food chain users

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.

The use of new electronic and/or internet-based solutions and application has several problems and limitations in **Smart Farming area**. 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 the 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 organized into a sys-tem.
- 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.

In **Smart Agri-logistics area** 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.

Limitations of data exchange

- 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.

Limitation of compatibility

- 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.

The currently used applications have several limitations and barriers in **Smart Food Awareness area**.

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.

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 FI, the expectations and ideas and even the current limitations.

Overall, one of the main expectations of the users is that the FI 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 FI 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 FI as getting as much information as possible, collecting this information all together into a connected database, and sharing the information and knowledge with the neighboring 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 FI 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 standardization 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.

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