System Dynamics and Innovation in Food Networks 2012

Proceedings of the 6th International European Forum on System Dynamics and Innovation in Food Networks, organized by the International Center for Food Chain and Network Research, University of Bonn, Germany
February 13-17, 2012, Innsbruck-Igls, Austria
officially endorsed by

EAAE(European Association of Agricultural Economists)
IAMA (International Food and Agribusiness Management Association)
AIEA2 (Assoc. Intern. di Economia Alimentare e Agro-Industriale)
INFITA (Intern. Network for IT in Agric., Food and the Environment)

edited by

U. Rickert and G. Schiefer

ISSN 2194-511X

Published by
Universität Bonn-ILB Press, Bonn
(Rheinische Friedrich-Wilhelms-Universität Bonn,
Institut für Lebensmittel- und Ressourcenökonomik)

Order Address:
Department of Food and Resource Economics, University of Bonn
Meckenheimer Allee 174, D-53115 Bonn, Germany
Phone: ++49-228-733500, Fax: ++49-228-733431
e-mail: uf.ilr@uni-bonn.de
Printed by
Universitätsdruckerei der Rheinischen Friedrich-Wilhelms-Universität Bonn

Food Awareness and Transparency: Current Practices and Future Tools

András Sebők, Adrienn Hegyi, Katalin Viola, Istvan Gábor, and Fruzsina Homolka
Campden BRI Magyarország Nonprofit Kft. Haller u. 2, 1096 Budapest, Hungary a.sebok@campdenkht.com; a.hegyi@campdenkht.com; k.viola@campdenkht.com; i.gabor@campdenkht.com; f.homolka@campdenkht.com

Abstract

Within the SmartAgriFood project the envisaged functions of Future Internet (FI) were collected and explained to the business users. 135 in depth interviews in 6 countries, and 8 focus group discussions in 5 countries were carried out for identifications and evaluation of the potential applications in the agri-food chain in the Smart Food Awareness area. Privacy was seen as a key function of the FI. The majority of the potential application ideas were rated as applicable to ensure improved awareness for the food chain members. There is a need for systematic explanation of the new enabling functions of the FI to the potential business users in a user-friendly way to foster the identification of new application opportunities. In some cases there is a difference between the priorities set by them and the behaviour of the consumers.

Keywords: *transparency; food awareness, successful practices; Future Internet functions, Future internet applications*

1 Introduction

Nowadays consumers are in a physical distance from the place of the food production, processing and handling in the food chain in the vast majority of cases. Therefore consumers have less and less direct information and overview about the way how the different food products are produced and supplied to the place of purchase and they have very limited opportunities to get food related information without the assistance of the organisations acting within the supply chain of specific food products. Thus the buying decisions of the consumers are based on the combination of properties measureable directly or perceived through their senses, or based on the information provided with the products, and on trust that the product would comply with those characteristics, which are claimed to be included within the product.

There is an increasing consumer interest in food products, food safety, diet and health, functional foods, sustainability and ethical aspects, besides there is an increasing demand for additional information to facilitate the decision making of consumers e.g. on the product, the process, the food chain members, the production environment, including the cultural background of the geographical area, where the food is produced, processed and handled along the food chain, which prove the validity of claims.

In response to this consumer demand several members of the food chain make more and more efforts to provide the expected information to the consumer. If the consumers are overloaded by a huge amount of information; they are not able to process it, which may result in a loss of interest for all of the information. In addition the amount of information, which can be put on the pack as labelling, is limited by the available space. Therefore it is necessary to prioritise the information which is communicated to the users and to exploit the opportunities in aggregating, integrating the relevant pieces of important information into signals, on which clear, easily understandable messages can be based, which can assist the users in evaluating the credibility of different claims.

Organisation of information flow into categories such as information provided routinely with the product, information by demand and exception reporting and designed use of label-based information combined with complementary non-label based information can significantly improve the practicality of use and reduce the technical complexity and cost of provision of transparency and awareness information for different target audiences.
General (routine) delivery means, where the information is delivered with the product. General delivery is made usually, when it serves the interest of the information provider (leads to product differentiation or better image) or used for exchange of information with a user) or when it is enforced by the user. This is the case at legally enforced information or when it is necessary for market access.
A major group of information needs to be delivered by demand. This means that information is delivered only if it is asked for. Information owners need to collect this information and keep it easily and quickly retrievable, but they do not have to transfer this information until it is not requested (Schiefer, G. and Fritz, M., 2010).Negative information is usually not communicated as a part of the general delivery, this is communicated usually by demand – e.g. in the case of a crisis or a major consumer, customer dissatisfaction, when the recipients are interested in the level of risk, failure, the extent of the deviation from the target level, on getting reassurance that the appropriate measures have been taken to reduce the risk or failure and its impact on the consumer, user.
Exception reporting is applied usually, when a deviation from the specified criteria beyond a critical limit is observed in the activity of the information provider, which may have major food safety, quality consequences or which compromise to major extent the value represented by a statement or claim. A typical example is represented by the legal requirement that food business operators have to inform the food control authorities, when they realise that a major food safety risk may emerge related to their products.
Label based information include mandatory information required by the legislation such as list of ingredients, weight, volume, indication of allergens, GMO, user's instructions, etc. and non-mandatory information such as environmental information on carbon foot print, on ethical trading, etc. (Barling, D. and Simpson, D., 2010).
Labelling based on marketing standards can inform consumers for differentiation between product types on quality (standard chicken vs. free range chicken), on meeting composition standards (fat content ice cream vs. premium ice cream), on classification of products (grade A vs. grade B), on a specific production method (Halal, Kosher), on place of origin (TSG, PDO labels), meeting criteria of certification schemes on food safety and quality management, environmental, ethical and social concerns.
Typical non-label based information include visual or written presentation of the production/manufacturing environment, the general location, the processes and practices used, the criteria of the standards applied, audit reports on assessing compliance to criteria, etc. (Barling, D. and Simpson, D., 2010).
Within the increasingly competing global food market more and more claims are made on the specific characteristics of different food products representing a distinguishable attribute, or added value for the consumers. Food safety is taken as pre-requisite supported by the legal requirements for putting food products on sale.
These claims are accepted as valid until the trust of the consumer is strong in the fair operation of the market, in the fair behaviour of food businesses along the supply chain and in the use of appropriate knowledge and practices during the production, processing and handling of the products. In that case, when people trust in the verity of the information

what they have received, or in the processing method of the product, they are not much interested in transparency.

Trust in food is based on several groups of features: product related, company related and geographical area of food production and supply chain transactions related elements (Meixner et al., 2011; Haas et al., 2011).

The food safety scares and food scandals can get a large publicity in the media when a mismatch is detected or suspected between the claims and the reality. Food scares, scandals and even the personal perception that the claims on the properties of a food product purchased may not be valid create the feeling of uncertainty in consumers. These failures can significantly damage consumer trust.

To achieve the increase of trust of consumers it is not enough to provide the appropriate information to the users (consumers, businesses, policy makers) in such format which they can easily understand. In addition their emotional aspects should be considered and their perception of being informed should be achieved.

The damage of trust is not limited to single food products and to specific chain members, who cause the deviation between the anticipated (e.g. the food is safe, etc.) or expressed claim. Failures, poor, unfair practices of any chain members can damage the trust in the whole chain and have a detrimental effect on the image and market of the other food chain members. Therefore all members of the supply chain (e.g. producers, manufacturers, retailers, and wholesalers) make efforts to meet the increased consumer demand for reliable, trustworthy information which their decisions can be based on.

Transparency can increase consumers trust and serves awareness needs in those cases when full trust is not in place and additional information is necessary to verify the credibility of claims and statements representing a value for the users and there are not objective evidences available to underpin it or methods to provide objective evidences quickly, which provide the necessary guarantees.

The notions of awareness and transparency are not distinguished always properly. Awareness is the knowledge and understanding of a subject. It is a state or ability to perceive information. Thus for achieving awareness a broader scope of information should be provided to the users than transparency information (Sebők et al. 2011).

The working definition of transparency is based on the combination of a process based and power balance based approach. “In process based approach transparency means a set of 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 e.g. specific characteristics of products, processes, production environment, activities of actors and the cultural and legal background of the production, having either of a positive enhancement or a negative, risk reduction nature, which can’t be substantiated by the usual quick and simple methods” (Sebők et al. 2011).

In addition power balance based aspects mean that “the valid or perceived needs of consumers, customers for facilitating their informed decisions and the sound balance with confidentiality needs of food chain members are considered” (Sebők et al., 2011).

Additional non-label based information can be provided to consumers in-store, through leaflets, by dedicated staff for consumer information, by promotion staff at specific actions, external sources for transparency information which include corporate social responsibility reports, consumer phone lines, websites. The envisaged functions of Future Internet (FI) can

provide new opportunities for serving awareness and transparency needs of consumers. With the foreseen development of the future internet communication of messages and also detailed information meeting the requirements of the consumers, or screened according to their selection criteria will be available on mobile devices quickly, cheaply and real time. Thus a wide range of labels, pictures, videos, and graphics can be made available both in store and outside the store at any requested place. Usual label-based information can be made available paralelly in non-label based, electronic format. This will provide the consumers better legibility on that part of the information in which they are particularly interested.
The objective of this research carried out within the SmartAgriFood FP7 project was to explore the expectations and ideas of the potential users related to the functions of the Future Internet and their potential applications for the food awareness area.

2 Methodology

The results of the Transparent_Food FP7 project, the current best practices and the future research challenges were used as an important input.
Qualitative information was collected on the application of the Future Internet in the area of Smart Food Awareness. A specific questionnaire survey (Resurreccion A., 1998) was carried out for smart food awareness area for collecting information on the current use Internet-based solutions, 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, expectation, ideas for any Future Internet-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) with respondents representing all stakeholders from the whole food chain.
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.
A list of functions of the Future Internet was developed by the ICT expert members of the SmartAgriFood FP7 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 with external Future Internet experts and was converted for non-ICT professionals in the agri-food chain.
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 Future Internet 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 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, a Friedman-test was used to analyse if there were significant differences among the given rankings of the Future Internet Functions. If the Friedman-test's significantly level was higher than 0.05 there was no statistically significant difference among the functions. The functions sharing the same letters are not significantly different.
Altogether 8 focus group discussions with 69 participants were carried out in five countries (Hungary, Finland, Germany, Greece and United Kingdom).

3 Results

3.1 Functions of Future Internet

The functions of FI determined by the project partners and external ICT experts are the followings:

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. The s mobile equipment is used 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 read more easily by rotating in the 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 sub-systems 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.

Some of the functions of FI namely content based browsing (function 4) and services of customized information (function 5) can support the prioritisation of information which is provided to the consumers. The consumers and other users need to specify properly what they want to know and can determine the selection and filtering criteria what type of information should the information pack contain what they receive.
It can be observed that the business users have not paid a specific attention to the significance of the new functions of FI which enable screening and selective searching of information both for business users and consumers.

The following table (Table 1) shows the results of the ranking of the envisaged FI functions.

Table 1.
Ranking of the future internet functions (Friedman)

Ranks	Functions	Sum of ranks	Groups
1	8. Privacy	200	C
2	1. Direct communication of machines, sensors, etc	232.5	BC
3	10. Monitoring system function	241	ABC
4	2. Mobile as data collector	251.5	ABC
5	5. Customized information	266	ABC
6	3. Real-time data/video/3D information	285	ABC
7	9. Global data management	289	ABC
8	4. Content based browsing	295.5	ABC
9	6. More accurate positioning	301.5	AB
10	7. Cloud computing	333	A
The difference between levels with same letter is not significant Difference limit at 5 %: 97.11 Test at the global risk Risk for each comparison: 0.11 % z (normal law) = 3.24			

The result of the analysis showed that there was a statistically significant difference among the functions at 5% level. The two most important functions of Future Internet were Function 1 “The Internet is not limited to self-standing PCs” and 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 the 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."
Based on these comments it can be concluded that the ensuring of the security of data and information is a critically important expected function of the Future Internet.
An other important expectation is that the services, the equipment, the devices, etc. should be available everywhere and they can operate their business processes remotely from anywhere. It is expected also that the applications and devices should be integrated and standardized.
Function 6 "Positioning with higher accuracy for exact identification of objects, controlling of the machines, equipment" and Function 7 "Cloud computing" were classified as the least important functions of FI. This may indicate that the understanding and vision of the users on potential applications is still very limited.
Compared to the above mentioned functions of the FI the participants of the focus groups mentioned as a first thought about the Internet 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 mentioned negative features as dependency, fear, unreliability, danger and inaccessibility in rural areas.
There is a general problem in agri-food sector that the users have limited experience and overview on internet based solutions and they concentrate on the current limitations and constraints rather than having a vision and creativity about the future possibilities, have limited information about the new technologies and devices and cannot imagine and interpret the operation of the new technologies. Therefore the ICT experts should explain and demonstrate the new functions and enabling capabilities more clearly for the possible users.
On the other hand the users are distrustful to store their data on the Internet. Results show the importance of data security and privacy and the need for provision of reassurance of privacy by Future Internet based solution and service providers.

3.2 Potential use case scenarios

During the interviews several potential use case scenarios were identified in the Smart Food Awareness area.

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 can 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.

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.

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.

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**.**

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 legislation can be handled by a system, and personalised information can be purchased, which can accelerate the flow of information.

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.

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.

Virtual shops and virtual visits

Audio-visual solutions such as virtual visits of factories or stores can improve communication to consumers. 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.

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. 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.

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

These use case scenarios were classified by the participants of the focus groups by applicability as follows (Table 2).

Table 2.
Applicable and not applicable ideas – Smart Food Awareness

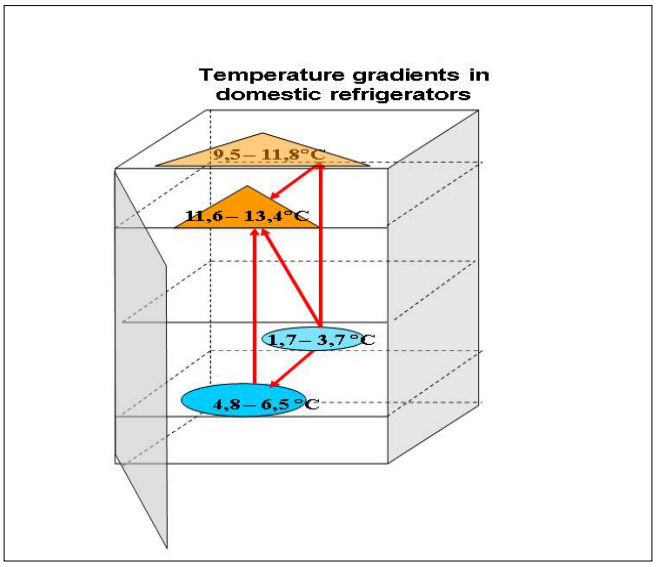
Ideas - Smart Food Awareness	Number of participants Sum total	
	Applicable	Not applicable
1. Monitoring of food quality	31	5
2. Improved awareness information system based on traceability	31	5
3. Communication of product-related information towards the consumers	30	6
4. Exchange of product-related information between agri-food enterprises	28	8
5. Communication of tailor made information selected according to set criteria	27	9
6. Profile specific newsletters and dissemination of information	25	11
7. Virtual shops and visits	24	12
8. Connected automatic systems	23	13
9. Improved diet and health through personalised nutrition	21	15
10. Foreign material identification	14	22

Nearly all of those use cases (7 out of 10) which were related to provision of tailor-made information to consumers trough specified selection criteria were seen as applicable. The concept of ”monitoring of food quality” based on time- temperature history of chilled and frozen products in the cold chain was classified by the representatives of the food businesses as one of the two most applicable uses. However based on the results of our previous research there is an obvious discrepancy between the current practices of the ultimate consumers and the view of professional users.

In a survey of time-temperature regimes and consumer practices of handling of cooked, sliced, packed meat products in the cold chain (Sebők A. et. al., 2006) time – temperature profiles from the whole supply chain (factory storage, retail cabinet, home transport, and home storage) were collected. These data showed that the cold chain is well controlled at factory level, but the weakest points of the cold chain are the handling, storage in retail cabinets, household refrigerators and consumer practices.

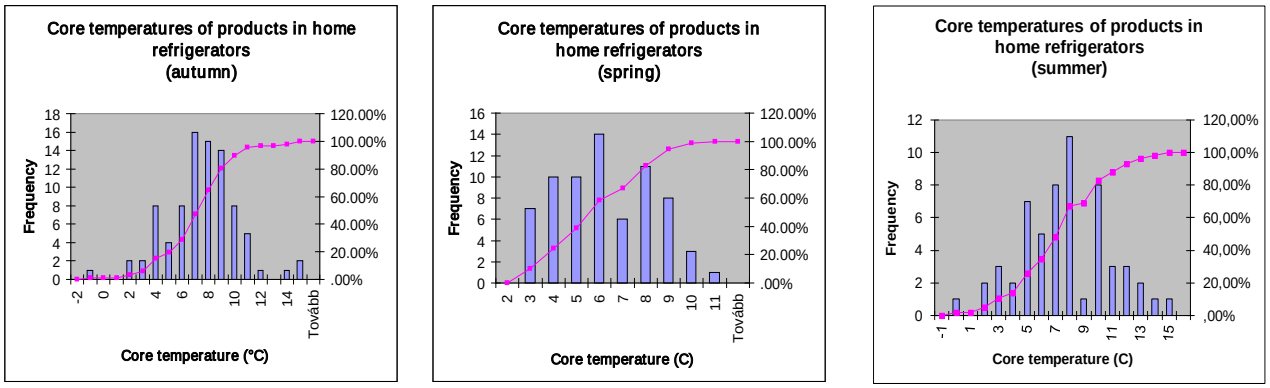
A relatively large proportion of consumers do not pay proper attention to following the users' instructions on time – temperature requirements during handling of chilled foods. False practices are frequent in the Hungarian households due to the low awareness of consumers of the potential growth of pathogens in chilled cold pre-packed meat products. Typical temperature profiles in domestic refrigerators are shown on Figure 1.

Consumers are not aware of the fact that in nearly all domestic refrigerators high temperature differences can be observed. Consumers rarely check the temperature of their domestic refrigerators. It was established that a large proportion of the processed meat products were stored at households at higher core temperature than the standard temperature limit (maximum +5°C) recommended by the manufacturers (Figure 2).



Source: Sebok et al. (2006)

Figure 1. Temperature gradients in domestic refrigerators



Source: Sebok et al (2006)

Figure 2. Time-temperature fluctuation in the cold chain (Home refrigerators)

At the decision about the edibility of products 53.5% of the respondents (n=107) considered the best before date and the sensory evaluation including the visual observation of the colour, mould free status. 29.3% considered only the best before date. However most of the responding consumers failed to control the temperature, only 50-61.4% of them consumed the products before the expiry date.

The potential discrepancy between the opinions of the professional business users and consumers can be demonstrated by another case as well. In a survey of importance of the key quality/sensory attributes of praline (Table 3) differences were found between the opinion of the ultimate consumers and professional users. The table shows the number of respondents who ranked the certain attributes on 1st, 2nd, 3rd, etc. places. Consumers evaluated the chocolate flavour, while industry personnel the gloss as being the most important sensory attribute. (Kuti et al., 2011).

Table 3.
Comparison of the opinions between the consumer and professional users (industry people) in terms of importance of the key quality/sensory attributes of praline

	CONSUMERS (N=80)				INDUSTRIAL PEOPLE (N=81)			
	1st	2nd	3rd	4th-12th	1st	2nd	3rd	4th-12th
Gloss	0	4	3	*73*	32	15	15	*19*
Colour	12	11	3	*54*	3	3	5	*70*
Choco aroma	12	5	6	*57*	3	3	7	*68*
Sweet aroma	2	1	5	*72*	1	0	0	*80*
Filling aroma	2	5	6	*67*	4	7	6	*64*
Hardness	3	4	10	*63*	1	4	6	*70*
Greasiness	0	1	2	*77*	1	5	4	*71*
Snap	4	8	17	*51*	8	13	10	*50*
Choco flavour	25	17	8	*30*	18	15	13	*35*
Sweet flavour	4	2	10	*64*	0	1	1	*79*
Filling flavour	15	22	9	*34*	7	14	13	*47*
Other	1	0	1	*78*	3	1	1	*76*

Source: Kuti et al., 2011

All the participants of the focus groups on FI 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.

The respondents imagined an automatic system, which provides connection between several sub-systems and automatic data/information exchange. Thus the monitoring of food quality and the traceability - within a company or even through the entire food supply chain can be ensured at least partly, depending on whether this system is a local or a wider one.

If barcodes or RFID tags or QR codes are applied the traceability system can be improved.

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. The use of the RFID tags/QR codes is not widespread and even in large volumes 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 to reduce the 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. 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 above mentioned RFID/QR codes, which can contain all the relevant information about the product, but they are too expensive yet.
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.
Al though the exchange of the information is a key objective within this area the idea of "Exchange of product-related information between agri-food enterprises" thought to be non-applicable as the respondents do not see how this would work. Most participants felt that they would not want other organisations to know 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 it is not likely to work caused by the reluctance of people to share information on what works and what does not.

The ability of provision of a large amount and variety of information to consumers is a very important function of the Future Internet by the opinion of the professional users. The Future Internet offers new opportunities to improve the information flow. However special attention should be paid to the importance of finding the sound balance between the valid or perceived needs of consumers and customers for facilitating their informed decisions and the needs of the food chain members for protection of their sensitive, personnel, confidential data and information
Organisation of information flow into categories such as information provided routinely with the product, information by demand and exception reporting and designed use of label-based information combined with complementary non-label based information can significantly improve the practicality of use and reduce the technical complexity and cost of provision of transparency and awareness information for different target audiences.

4 Conclusions, future recommendations

During the development of the Future Internet specific attention has to be paid to ensure data protection and improved privacy. For fostering the identification of new application opportunities and the development of new solutions and services the new enabling functions of the Future Internet should be explained more effectively to the potential business users since the current level of understanding and knowledge in the agri-food chain is very limited. In some cases there is a discrepancy between the view of the professional users on the importance of certain applications for improving consumer awareness and the consumer practices. There is a need to check the consumer interest for these applications with consumer studies.

Acknowledgement

This research was made within SmartAgriFood (Contract No. 285326) and Transparent_Food (Contract No. FP7KBBE-2009-245003) projects co-founded by the FP7 programme of the European Commission).
Propraline project (Contract No. FP7SME-2007-22184232) Project under the European Community Seventh Framework Programme “Research for the benefit of specific groups”

References

Barling, D., Simpson, D. (2010). Report drawn from data collection and review and stakeholder participant workshops on the breath and range of certification systems and labelling schemes signalling information to consumers and the strengths and weaknesses of these systems and signals in the Transparent_Food FP7 project.

Haas, R., Meixner, O., and Ameseder, C. (2011). The creation of trust in e-business cross-border transactions in food supply network in “Food Supply Networks: Trust and E-business”, CABI Publishing

Kuti, T., Hegyi, A., and De Pelsmaeker, S. (2011). Consumer perception and acceptance of product defects of chocolate pralines 9th Euro Fed Lipid Congress, Oil, Fats & Lipids for Healthy and Sustainable World, Rotterdam, The Netherlands, 18-21 September 2011

Meixner, O., Haas, R., and Amseder, C. (2011). Trust-building features in traditional cross-border transactions in food supply networks in “Food Supply Networks: trust and E-businesses”, CABI Publishing

Resurreccion, A.V.A (1998). Consumer sensory testing for product development, Aspen Publishers, Inc.; p.181; p.184

Sebok, A., Percsi, Sz., Horvath, E., and Baar, Cs. (2006). Final report on Development of a procedure for the determination of safe shelf-life of meat products) **(**in Hungarian “Ipari gyakorlatban használható eljárás kidolgozása a húskészítmények biztonságos fogyaszthatósági idejének meghatározására) GVOP – 3.1.1. – 2004-05-0152/3.0 project

Schiefer, G., Fritz, M. (2010). Focus guide on transparency, tracking, tracing, sustainability and integrity. Transparent Food project Internal report

Sebők, A., Berczeli, A., Homolka, F., Molnár, A., Gellynck, X., and Van Lembergen, K. (2011). Best practice guide on food transparency Transparent_Food project www. transparentfood.eu