# FOODINTEGRITY

## Ensuring the Integrity of the European food chain

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# Deliverable 17.5 Position Paper on Hurdles and Solutions

## 1 Description of Deliverable

Deliverable D17.5 is produced, as part of WP 17, to demonstrate the technical possibilities of sharing information without competition issues and the potential of information analytics to identify food integrity issues at an early stage. Secondly, to research the actual feasibility (and willingness) in the food chain of setting up, managing and using a system for the early identification of food integrity issues among food chain stakeholders.

This deliverable (Task 17.1) is a position paper on hurdles and solutions regarding information sharing in the food chain on food integrity issues. It includes some review of interactions in the (food chain) network while executing this work package (meetings, contacts, conferences). Deliverable 17.3 can be considered more as a comprehensive summary of the WP17.

## 2 Achievement of the Deliverable

The deliverable is copied after this page as an integral report.

# Position paper on hurdles and solutions

The purpose of WP17 is to demonstrate (1) the technical possibilities of sharing information without competition issues and (2) the potential of information analytics to identify food integrity issues at an early stage. The actual feasibility relies on two pillars:

- a technical pillar of systems and IT architectures under conditions to support the sharing, and;

- a stakeholder pillar on the willingness and requirements for in-chain data sharing.

However, the type of information shared determines for a large part the success of both of these pillars. The WP17 investigated both pillars including types of information and information analytics. The results have been described in several deliverables. Here we state the most important or striking discussion and conclusion and come to a position on information sharing in the food chain as a way of detecting early signals of food integrity issues.

In the picture below (fig. 1) a relation between information and early signalling is drawn, based on the issue cycle. Crucial factors are type/source of information, interpretation thereof and timing, and the institutionalisation of this in an overall (IT) system or procedure.

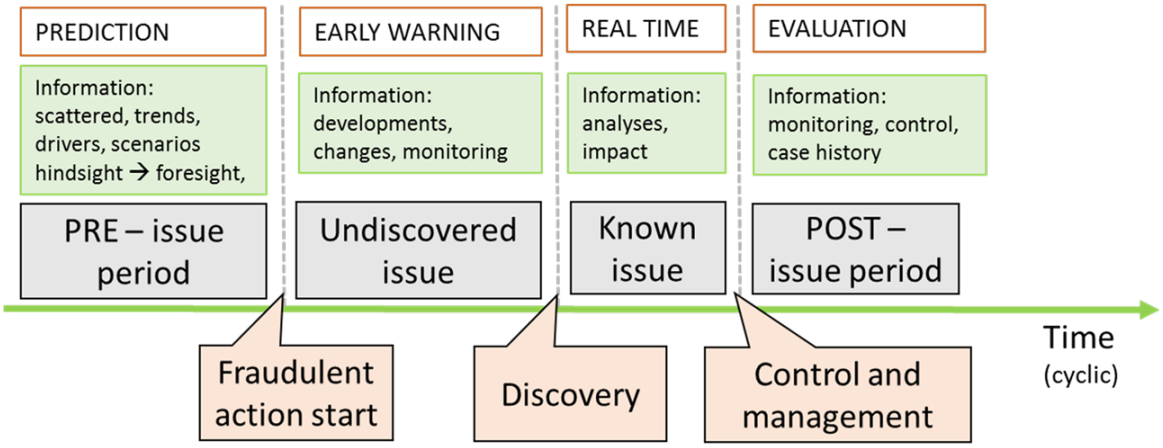


*Figure 1: Issue cycle applied for fraudulent actions in the food chain.*

Sharing information has become one of the most discussed issues of modern times. We all share information willingly or implicitly by using the internet and all its opportunities, our smartphones and its apps, but also more classically in our daily routines by talking, writing or doing. The modern technological infrastructure allows owners of our (willingly or not) inserted information to use it for data analysis and execute new “behaviour” or policy. The more recent discussions have led to better understanding of actual ownership of the data and the explicit use of information for owner’s activities under dedicated permissions. Laws and regulation have entered into force to define this and protect citizen’s interests regarding (personal) information and data.

Awareness has been created but many act in an opportunistic way and may not think twice before entering information or data when the promise or advantage (offer, product, commercial opportunity, service) is considered high enough. So, we send information over the internet to buy or make reservations, not always through certified and secured websites.

It seems we trust our partners to take good care of our data or information and this may even be correct. However, we are mostly not aware of intermediates that handle the transfer of data (still trusted or of good will), or data may be intercepted or hacked.

*How does this all relate to companies?*

First of all, companies are mostly very concerned about the sensitivity of certain information or data relating to their products (recipes, design, patents, sources), processes (patented) and obviously their economics, cost structures and financial state. Secondly, companies rely on some of that same information or data coming from others in the supply chain to be true, transparent and timely. This is a trust that directly relates to your own governance.

Generally, some information (e.g. relating food safety) is often said to be pre- or non-competitive. But, information on issues of any kind with batches or sources is sensitive information as it may influence price and cost immediately, and it may hinder continuous production.

Transparency has been a buzz word in food production chains since the early nineties (at the end of the risk society), mainly as the number one basis for (consumer) trust. However, the information society, or the now evolving post-truth society, has resulted in a sort of divergent trend or balance (like a gymnast doing a split): information **is** transparency (but interpretation is key) and information cannot (always) be trusted anymore.

In most discussions in the food chain with stakeholders, currently, the words trust and transparency still prevail.

*How does this relate to food integrity?*

Food integrity implies food that can be trusted, trusted to be what it is supposed to be (expectations and labelling). Issues on the integrity of food, which include food fraud issues, involve more than any other type of issue a broad type of information and (meta)data (and intelligence..) to be gathered, analysed and interpreted. And this implies that sharing of such information is crucial to detect issues in an early stage, but also to prevent issues or to limit their impact. Early detection is of major importance to all stakeholders, including the consumers. You need a broad overview and several perspectives to be able to analyse and interpret and therefore sharing is essential.

*governance*

Information or data owners have a great responsibility to keep their information clean and clear, and confidential to the extent necessary (be it a company, a consumer, an authority, … ). However, there is an even greater responsibility to protect society and the “system” we all belong to, by sharing the necessary information at the right time and place and with the right entities.

It is the 'right' time, place and entity that needs to be settled together as not one operator or entity can decide this beforehand. Although the sharing of information is probably not the problem, the right time, place and entity are and the conditions applicable are.

The time is now to find a modus operandi for the food chain and other stakeholders to start sharing the necessary information and set the conditions for it. It is clear that a sharing system or procedure can only be efficient and successful if sufficient stakeholders commit and participate and share the "right" information.

Prejudice dictates that commercial stakeholders are in general not willing to share (much) information either on content or in an early stage. Much information is considered of competitive interest. An example is when a company discovers a source of ingredients or raw materials to be potentially frauded the need for immediate re-sourcing is a primary goal, sharing the information at an early stage hinders the search for a new source and might drive price changes. It is often postulated that even in the realm of food safety issues (always said to be pre- or non-competitive) this same reasoning path is sometimes taken by stakeholders.

In our WP we analysed historical cases the establish common features of food fraud cases and to find the typical information and sources that may indicate issues at a certain point in time. This has led to a kind of unified scenario resulting in the description of the type of data needed, the possible indicators and more specifically in-chain and public data sources. Also, some judgement of the indicator's usefulness was given whether it would lead to "no action", monitoring or action. The approach to analyse historical cases is a valid approach to learn (from history), but is strongly influenced by the selection of the cases and, subsequently, the knowledge that can be derived from them by the experts that analyse the cases. The approach here could be typed as "knowledge driven" as opposed to a more "data driven" approach (e.g. Bouzembrak and Marvin, 2016; Marvin et al, 2016). The knowledge driven approach delivers indicators "as far as we know".

In time new indicators will be needed as the supply chain will change and crime will adapt to new opportunities and control measures. Also, indicators for potential food integrity issues were identified with their data sources from which they can be derived. So there is potential for a data analytical approach to detect indicators to support the combat of food non-integrity. There is also an urge to catch up with other domains, because criminals may shift their activity from other sectors (such as addictive drugs) to the food domain when "money can be made easier". A recent literature review (Grover and Kar, 2017) indicates that the food supply chain seems to lag behind regarding fraud detection especially when compared to the sectors finance (e.g. businesses financial statement fraud, money laundering, credit card fraud) and healthcare (e.g. insurance claims). There is more potential for the food sector to decrease their vulnerability as more knowledge is gathered on the specific vulnerabilities. Ruth et al (2017) described 31 fraud vulnerability factors in six categories: technical opportunities, opportunities in time and place; economic drivers, culture, technical control measures and managerial control measures. The concept supply chain vulnerability analysis builds further upon the chain and information analysis approach described in the Stakeholders' Guide to assess vulnerabilities in the food chain which was developed in the EU-funded project Sigma Chain (2009).

There is no single approach or solution to detect all types of fraud in time. Given the diversity of food fraud, a single focus on in-chain data as only data source would result in missed signals which is not acceptable. Therefore it is important to be able to detect other types of signals, apply multiple data analytics and use multiple data sources within and outside the supply chain. Signals from textual media and scientific data sources as for example described by Bouzembrak et al (2018) and Van de Brug et al (2014) could here be very useful.

The above way of reasoning may seem clear from a data analytical perspective. However, insight in the technical achievability is just one condition for the business case for data sharing. The benefits of data sharing should outweigh the costs involved. A major benefit from a data analytical point of view is that the pooling of supply chain data enables a wider scope of discovery of signals beyond those derived from a single data set. Secondly, sharing data reduces both the cost of data collection and the cost of data analysis. The usefulness of data sharing needs to be balanced with the industry's barriers for data sharing like privacy and competition (EC report Digital Single Market, 2017).

West and Bhattacharya (2016) argue that given the diversity and dynamics of fraud, it would be useful to have some form of a data analytical framework that could apply to multiple fraud types. This idea could also be applied for the agri-food sector to detect possible food non-integrity. In order to benefit from a similar data analytical framework a potential future IT architecture (to support food fraud detection) should be open so that a variety of analytical algorithms can be used. This also means that a future IT architecture should have access to and be able to process multiple data source types. Stakeholders should be able to access the system via an online dashboard where they can execute queries, run predictive models, set up (email) alerts and can perform other activities.

There are already many commercial and academic systems and architectures that have the potential to enable data sharing for the purposes of ensuring food integrity. It has been widely recognised that greater sharing of data between participants in the food supply chain would make the detection of food fraud, food adulteration and other food incidents easier as well as enabling a more rapid response. We have considered some of the requirements from a technical and business perspective and provided a classification of the different types of systems currently available commercially or proposed in the recent academic literature. We conclude that designing integrated systems that can function effectively both for large organisations and for small ones, that can operate across multiple cultures and legal jurisdictions, that can handle the very large quantities of data present in the food system, remains a substantial challenge.

We could add another, unstated, assumption which is that there are information technologies in place, capturing data of one form or another. This latter assumption is only partially true since much of the agrifood system both in Europe and globally still operates with paper-based records, and/or formats such as PDF which do not enable machine reading.

As is always the case in the adoption of technological solutions, there is complex interplay between the affordances of the technology, and the societal acceptance to adopt that technical solution. While we have briefly touched on the potential of new technologies like blockchains, there are other technical developments which in the longer term may provide more significant technical breakthroughs, irrespective of societal adoption.

We have also noted the social and business cross-currents which push in contrary directions between supporting greater privacy vs. supporting greater transparency in the food system. Greater transparency would inevitably ensure greater food integrity both from the perspective that it would act as a significant deterrent to fraud, it would facilitate predictive analyses, and finally make rapid responses to food crises much more effective. Governments and large enterprises inevitably desire greater "legibility" (Scott, 1998) in their systems but the necessary structures which accompany such visibility are both cost barriers to small companies and provide more complex institutional barriers to innovation and adaptation.

Designing integrated systems that can function effectively both for large organisations and for small ones, that can operate across multiple cultures and legal jurisdictions, that can handle the very large quantities of data present in the food system, remains a substantial challenge. Furthermore, such systems must enable a flow of data in a manner that it can be integrated with "off chain" data (as noted above) so as to provide the necessary insights for a comprehensive approach to the use of data in food integrity.

Integrity challenges along the food supply chain have received increasing attention by food safety authorities, industry and media over the last years. Ellis, Muhamadali, Haughey, Elliott, and Goodacre (2015) stressed that the ever expanding portfolio of analytical methods, techniques and technologies and future pervasive and predictive computation will together take on the role of a technology-based capable guardian for food systems. Simultaneously, more than ever before, experts recognise that food integrity is a challenge that requires a joint strategy and coordinated efforts involving all stakeholders, and that a strengthening of the collaboration between industry and governments is necessary (Brooks, Elliott, Spence, Walsh, & Dean, 2017). The development of an integrated private-public strategy requires clearly defined roles for each participating stakeholder and clarity and shared agreement on the specific purpose (Spink, Moyer, & Whelan, 2016).

The Elliott review following the horsemeat incident introduced eight pillars of food integrity: consumers first, zero tolerance, intelligence gathering, laboratory services, audits, government support, leadership and crisis management (Elliott, 2014). The recommendations that are formulated for these eight pillars refer multiple times to the need for data, information and intelligence sharing between stakeholders. Information and data that could be relevant to identify potential issues of integrity in food supply chains are often firstly and only available to industry experts operating at a specific level of the agrifood supply chain. Ideally, this information and data would be shared, integrated and analysed, in order to help reveal issues faster and more accurately, and help prevent them.

Our study shows that the large majority of stakeholders support the idea of a food integrity information sharing system (FI-ISS). Their support can be seen as a combination of their concern about food integrity issues and their belief that information sharing has the potential to help prevent and detect food integrity issues. However, in spite of this enthusiasm, most stakeholders are sceptical about the ways in which information could be shared.

The majority of stakeholders consider an FI-ISS only promising if the data confidentiality is guaranteed by the data infrastructure. Another fear of industry stakeholders is the added administrative layer that

this information sharing could create. They are mainly worried about the work load and the cost of joining a FI-ISS.

A data and information sharing system would be fed by data from a large number of actors, which do not necessarily know and trust each other. Stakeholders are concerned about the output or communication other actors might receive, such as food safety authorities, consumers and retailers.

The output of an FI-ISS, such as alerts or weak points can also be accessed by food safety authorities, which could decide to take action. A number of stakeholders considered anonymity of actors in the system an important condition, protecting them against actions in case an issue occurs. A reoccurring question from stakeholders regards the moment that food safety authorities would be informed and the level of access they would have to the data.

Although doubts exist, the overall consensus is that an FI-ISS could play an important role in the larger strategy against food integrity issues. The purpose of an FI-ISS should be to protect both consumers and food businesses against food integrity issues. The complexity of information sharing and the possible implications of joining an FI-ISS are still uncertain for many stakeholders and could cause lack of trust. Responding to these worries and doubts will be key to create trust and interest in joining a system.

Is an overarching framework to integrate these results in an approach which takes into account the constraints on data sharing expressed by the community so as to inform architectural choices while considering how on-chain and off-chain data can be used effectively to provide the analytics intelligence needed by the food production sector.

This work is not and cannot be definitive because multiple aspects are in constant change. The challenges faced by the agrifood sector is affected by a multitude of factors making food fraud or adulteration more or less likely under different circumstances. There are economic factors such as the price of food products and ingredients as well as chemical substitutes; there are regulatory factors such as changes in rules concerning permissible feedstock; there climatic factors which may make a food crop scarce or plentiful, etc.

The above described business case for data sharing for the prevention and early detection of food fraud will be influenced by societal demands. Off-chain stakeholders like special interest groups, consumers and regulators are (increasingly) trying to influence or even prescribe supply chain transparency. It may be expected that societal demands will without any doubt have an effect on the agri-food sector’s willingness to share in-chain data.

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