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Quality and integrity in food: a challenge for chain communication and transparency research

Coordination and Support Action – CSA

Food Quality and Safety

D 7.2
The Challenge of Transparency: Focus guide on transparency, tracking, tracing, sustainability, and integrity

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EXECUTIVE SUMMARY

The focus of this report is on the broad subject of transparency. With a broad range of definitions dealing with transparency in literature, this report builds on the understanding that transparency is being reached if everybody with stakes and interest in food production and consumption understands the relevant aspects of products, processes, and process environments and others that allow to making informed decisions.

From this definition as a base, the report moves towards an outline on how to make transparency work considering economic, social/ethical (integrity), or environmental aspects of sustainability for a core group with interest in transparency involving, consumers, policy, and industry. The focus is not on information content which is being dealt with in the project as such but on the integration of information into a transparency scheme. This discussion shows the complexity of issues to consider but also provides a clear sequence of issues that have to be dealt with.

Relevant issues reach from the development of tracking and tracing schemes, to a.o. activation schemes for information delivery, to data ownership, information sources, data carriers, the role of communication technology, or issues of organization and management.

The view is sector oriented, i.e. the discussion is not on the efforts by any individual enterprise but on how to provide support to the sector's enterprises altogether and especially its SMEs to move forward in meeting transparency expectations.

A specific discussion scarcely dealt with in literature elaborates on the concepts of E-readiness and T-readiness as key concepts for reaching acceptance in the sector. E-readiness describes the sector's ability and willingness to provide and utilize necessary information and communication technology, T-readiness the sector's ability and willingness to provide and utilize the necessary information schemes. The analysis of these aspects is a pre-condition for linking transparency concepts with the sector's reality.

The Challenge of Transparency

- Focus guide on transparency, tracking, tracing, sustainability and integrity -

Preface

The focus of this report is on the broad subject of transparency. It is a broad concept which involves issues of content including aspects of sustainability captured traditionally in economic, social/ethical and environmental dimensions and issues of realization including aspects like tracking/tracing and others.

We will not provide details on content which will be provided within the project but elaborate on the various issues that need to be considered to make transparency a reality. As such this report provides a focus guide which identifies the complexities and clarifies the transparency issues the project needs to deal with to reach its goals. It complements the broad framework of the project activities discussed in report D7.1 concentrating on the transparency complexities.

The report integrates issues from a number of different disciplines which are usually separate but provide necessary input for the realization of transparency systems. In addition, it links up with the concept of E-readiness developed for other purposes in country analysis and the concept of T-readiness which evolved only recently.

All concepts together provide a comprehensive guide on what to look at and how to move to reach transparency in the sector.

1. Introduction

It is widely acknowledged that an 'appropriate' transparency within the food sector is of crucial importance and a critical success factor for

a) the ***sustainable development*** of the sector,

b) the ability of food chain actors and policy to ***guarantee food safety and quality***,

d) providing ***consumers*** with the information they need for exercising their preferences in buying behaviour, and for

c) the identification of a suitable ***policy regulatory environment*** that accounts for society's preferences regarding environmental, social, and ethical concerns.

Transparency is one of the most complex and fuzzy issues the sector is facing. The complexities are due to complexities in food products and processes but also due to the dynamically changing open network organization of the food sector with its multitude of SMEs (small and medium sized enterprises), its cultural diversity, its differences in expectations, its differences in the ability to serve transparency needs, and its lack of a consistent appropriate institutional infrastructure that could support coordinated initiatives towards higher levels of transparency throughout the food value chain (Fritz and Schiefer, 2008).

There have been considerable efforts to deal with some of the problems, however usually confined to situations, where enterprises have established exclusive trade relationships between each other. As an example, the development of 'blueprint' solutions for tracking and tracing that are being offered for implementation by a number of providers usually ***fails to address the need of a network*** environment for institutional infrastructures, for open network standardization, for data compatibility, for the protection of data ownership, for appropriate development paths, for integration of trading partners not part of the tracking and tracing scheme or from different tracking and tracing environments, etc.

Transparency builds on appropriate signals which integrate available information and communicate a certain '***message***' to recipients (e.g. 'food is safe'). In the selected domain, signals build primarily on information about products, including their composition and characteristics, on information about processes they were involved in or exposed to, and the production environment incl. its origin etc.. Examples for the generation of information to be useful for signals related to food safety and quality in industry are the participation in monitoring schemes (as e.g. salmonella monitoring schemes) or quality system schemes (as e.g. BRC or IFS certification schemes), examples for consumer related signals involve the 'food miles' or the 'carbon footprint' retail initiatives.

However, transparency signals are not just those that can be formally communicated or that build on information collected through formal information systems. Cultural background of producers, local customs, or the location of production may provide, if known, strong signals to consumers on the quality of products or the reliability of information. As a consequence, the need for ***formal transparency signals*** or their content may differ significantly between regions, cultures, etc. This requires a multi-level view which distinguishes between

a) chains with ***global*** orientation and a universal transparency view and
b) chains with ***regional*** orientations or origins of products which may need to deal with local differences in views.

This involves a ***multitude of complexities*** which reach beyond the identification of suitable signals but require consideration if transparency is to be reached. Examples involve

- the identification of information sources,
- the establishment of links between information generation and transparency signals,
- the role of tracking and tracing schemes,
- the system organization, and
- the integration of transparency clusters already established in the sector.

We will introduce into the further discussion through a specification of our understanding of 'transparency' with its focus and primary recipients. This is followed by chapters which

outline the principle complexities and discuss possible approaches on how to deal with them for reaching transparency through the establishment of transparency systems that best serve expectations considering the scenarios (economic and non-economic) enterprises are in.

2. The transparency issue

2.1 The focus

Transparency is one of the issues which, from the outset, seem to be very easy to understand resulting in proposals abound. Various disciplines reaching from linguistics to macroeconomics or financial and operational management have provided definitions.

The differences are usually due to differences in focus. In industrial marketing, a definition with focus on 'supplier-buyer relationships', understands transparency as an individual's *subjective* perception of *being informed* about the relevant actions and properties of the other party in the interaction (Eggert and Helm, 2003). In Operations Management with a focus on process organization, process transparency is reached if everyone *can see and understand* the necessary aspects and status of an operation at all times (Womack and Jones, 2003).

These views capture the opposite ends in the range of interpretations. The first one expresses a *subjective perception* of being informed, the second one expresses (an objective) *understanding* supported by (visual) guarantees ('can see'). In efforts towards the realization of transparency, both alternatives might be part of developments:

1. The alternatives could be viewed as being part of a development process where transparency requests are first served as expected and subsequently by providing knowledge that supports understanding.

2. The alternatives could be viewed as representing the differing views of providers and recipients of transparency. Providers could minimize efforts by following the first alternative (serving subjective perception) while recipients would be interested in the second one (support of understanding).

The difference between 'subjective perception' and 'understanding' is especially relevant in complex situations where information that is provided meets actual perceptions already in place. In complex environments, expectations towards transparency might mean something different to different actors and individuals. It is one of the challenges to provide information that leads to objectivity irrespective of focus, situation and background of recipients. This is not easy to grasp in a situation where recipients assume to have transparency.

However, irrespective of difficulties, goals towards providing transparency to actors in the value chain will have to eventually focus on reaching a level of understanding which allows 'informed decisions' on an objective basis. This is a crucial prerequisite for reaching a transparency view which is sustainable in the long run. In summary we could specify the transparency challenge in the food sector as follows:

Transparency is being reached if everybody with stakes and interest in food production and consumption understands the relevant aspects of products, processes, and process environments that allow to making informed decisions.

The challenge is to provide the information that enables consumers and other decision makers to reach this status from their present knowledge and perceptions. The provision of information could involve a broad range of alternatives depending on opportunities but also on the ability and willingness of consumers and decision makers to grasp, interpret, and process the information as needed. Common examples involve data (e.g. about the content

of substances), data aggregates (e.g. an index), signals or messages. The delivery of the 'right' information is further aggravated by the food sector's complexity. In this complex environment there is no feasible approach to deliver the perfectly right information to everybody in all possible scenarios.

In this report the focus is therefore on the **delineation of categories** that allow to best serving transparency needs within limits set by available resources. Such categories could relate to products, processes, information, or actors identifying groups that could be dealt with in a homogenous way. It evident that increased divergence in products, processes, information or actors increases the need for differentiation in serving transparency needs.

The identification of the appropriate (optimal) level of differentiation is due to an analysis of costs and benefits. However, this is tricky as the results of the analysis might (and usually do) differ between providers and recipients of transparency. This discrepancy is part of the ongoing discussion on transparency in the food sector. The difficulty is further aggravated as the perception of costs and benefits is not just a monetary issue but involves non-monetary elements whose value to actors might change over time. As an example, consumers' interest in transparency might involve animal welfare or climatic issues which were of less relevance in the past.

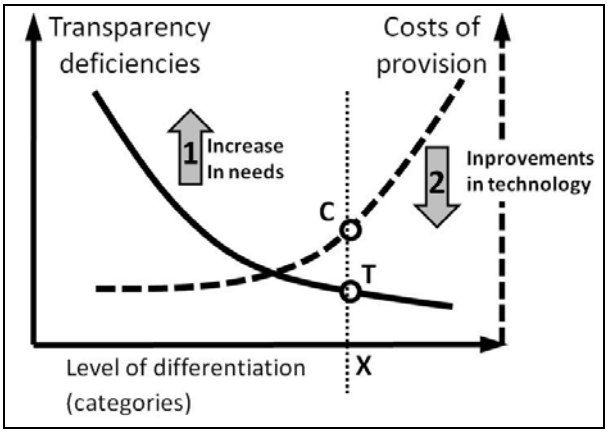

Figure 1: Relationship between costs of provision and transparency quality.

Figure 1 shows the relationship between the costs of provision of information and the transparency quality provided to the recipient. A certain level of differentiation or transparency delivered to recipients (expressed as X on the horizontal axis) builds on a certain level of costs for information provision (C) but still leaves certain deficiencies with recipients (T). It is obvious that an increase in quality (e.g. through a further differentiation of information) is connected with higher costs. However, it is also obvious that developments in technology might lower costs (through e.g. lower network costs which would lower the cost curve as expressed by arrow 2). An increase in transparency needs (e.g. through interest in additional domains which would move the transparency curve upwards as expressed by arrow 1) would increase costs as well (upwards move of cost curve). However, this increase could be offset by new technology which lowered costs (downwards move of cost curve, arrow 2). The triangle between transparency delivery, technology and costs determines the monetary considerations in investment decisions by enterprises.

The developments in technology that are viewed at in this discussion are characterized by
a) improved sensor technology for data collection,
b) improved RFID technology for communication,
c) improved scanner technology for information reception, and
d) improved communication networks for online monitoring of products and their movements.

As is known from the past and supported by discussions on future technology scenarios, such developments combine the provision of improved capability with lower costs.

2.2 The actors

Food networks involve many different actors with interest in transparency activities involving consumers but also employees, institutions for food safety control, communities and many others.

However, in this report we concentrate on core groups, including
a) consumers as the ultimate customers in the chain,
b) policy and related institutions that represent society's interests, and
c) enterprises along the value chain that are responsible for providing the food to consumers.

These actors (as others) are linked with transparency initiatives as recipients but also as providers of information for transparency. The focus in this report is on transparency serving the needs of recipients but also on clarifying the involvement of others within the core group for making transparency a reality.

The prime interest in our discussion is with **consumers** who are the ultimate customers of the food network and the cause for its existence. It is evident that the principal *transparency interest* of consumers is on the products they consume, their safety, quality, availability and affordability (Fritz and Schiefer, 2008). However, beyond these basic requirements consumers may show interest in issues not directly related to products but derived from their (the consumers') value system involving, e.g., requirements on origins, process organization, environmental protection or social responsibility. For the fulfilment of transparency needs, consumers are dependent on industry which could provide the necessary information as well as on policy which could deliver guarantees through its controls.

Policy interests deal with both, interests of consumers (assuring, e.g., the safety of food) and society (assuring, e.g., that social standards are being kept). It provides the legislative space in which industry can act and provides guidance (e.g. through its tax and subsidy policy) on the direction of developments. Its *transparency needs* derive from the domains it is active in. In principle, policy is in a comfortable position regarding the fulfilment of its transparency needs. It can enforce the fulfilment by industry and other actors through reporting requirements and government controls. In addition, it can support the fulfilment of transparency needs of consumers or industry through legislative or guiding initiatives.

Industry follows its objectives within the boundaries set by legislation and the value system of society, enforced by market reactions on its activities. In general, the long-term focus of enterprises is on improving market position and internal strengths (). In this regard, core *transparency needs* refer to suppliers and their products (input), to customers including consumers with their attitudes (taking up outputs), and to the market environment (legal, cultural, natural, social, political, etc.) the enterprise is in or intends to be. Industry depends on the provision of information through its suppliers, its customers (e.g. through retail on market requirements), and through research regarding consumer attitudes and market environment (strategic view).

Table 1

Primary interactions for transparency among the core interest group

	Receiving		
Providing	Consumers	Policy	Industry
Consumers			
Policy	X		
Industry	X	X	X
Research			X
X	Strong interaction		
X	Weak interaction		

The principle interaction between the core group members is summarized in table 1. For reaching transparency, the major interaction is within industry (for communication along the value chain) and between industry (as suppliers of products) and consumers.

3. Serving transparency needs

3.1 Transparency domains

Transparency is served through the provision of information of whatever kind on products, processes and other domains of interest to the user. For linking the collection of information on one side and its use in chain environments with several stages on the other side, the approach of Life Cycle Assessment (LCA, ISO 14040:2006) has gained prominence. Without going into details, it builds on relationships that link

a) inputs and outputs of processes with

b) indicators with

c) impact domains of interest with

d) signals that communicate the relevance of process inputs and outputs for impact domains towards information recipients.

Initially developed for environmental analysis (Mattson and Sonesson, 2003), LCA has been extended to serve all kinds of domains, including e.g. economic (e.g. Kicherer et al., 2007) or social ones (e.g. Geibler et al., 2006). The domains are usually linked to one of the major pillars of sustainability, focussing on economic, social and environmental issues.

The cluster of impact domains that is being discussed in society is quite stable and has even been the focus of standardization efforts. What is subject to changes is

a) the *vector of relative importance* attached to the domains in different scenarios and

b) the vector's adjustment to changes in society's value system over time.

From this point of view, discussions on transparency would have to look at

a) the cluster of domains agreed upon,

b) the vectors of relative importance differentiated according to sectors and cultural environments, and

c) the expected changes of vectors over time.

This analysis provides a picture on transparency priorities and their changes over time.

Impact domains could be served by different indicators and indicators could serve different impact domains. Similarly, effects on impact domains could be expressed by different signals and signals could express effects on different impact domains (figure 2).

The difference between indicators and signals is not always apparent. Indicators serve impact domains, signals serve transparency needs. As an example, CO2 emissions might serve as an indicator for impacts on climatic change, food miles are a signal towards consumers regarding the quantity of CO2 emissions (Pretty et al., 2005, DEFRA, 2005, Blanke et Burdick, 2005) that impact climatic change. On the other hand, information on the origin of products or the retail outlet the product is being sold through might be considered indicators for impacts on quality but could serve as quality signals towards consumers as well.

When looking at indicators and signals one has to consider two lines of variability. First, the clusters of identified indicators and signals that could be linked to impact domains might change. New developments in technology and science or changes in people's perception etc. might bring up new indicators and signals not considered before. Secondly, in situations with a multiple relationship between indicators and domains or between domains and signals the relationships could be captured in vectors of relative importance which, as in the case of domains, might show differences according to e.g. production systems, sectors or cultural environments and be subject to changes over time.

To account for this variability, any system approach for delivering transparency would have to build as much as possible on generic communication approaches (building on categorization approaches) where any specific indicator or signal could be replaced by one from the same category (building on the same generic communication approach) with limited efforts.

3.2 Information collection for indicator specification

The collection of information and its communication is the most crucial prerequisite for reaching transparency. For the identification of appropriate information collection schemes, one of the aspects to consider is the stability of information.

1. *Variable information*. This is information that might continuously change (and within a range that might be of relevance for transparency. This type of information is common in production processes where quality characteristics and contamination of products (pesticides, etc.) needs to be **monitored** on a continuous basis. Such monitoring schemes could build on a vertical approach (process monitoring) or on a horizontal approach where enterprises participate in joint monitoring scheme (as e.g. in salmonella monitoring).

2. *Semi-stable information*. This type of information characterizes production scenarios that do not continuously change. Examples involve the implementation of production processes, the establishment of production controls, or the prevalent working conditions etc. Such production conditions can be captured through audits that follow a certain time sequence (e.g. 1 year) as is common in **certification schemes**. Examples include schemes dealing with quality (e.g. ISO 9000, HACCP, IFS or BRC), environmental (e.g. ISO 14001) or social (e.g. fair trade) issues.

3. *Stable information*. This type of information is considered to be valid for any specific production scenario either perfectly or within an accepted variability. Examples include quality characteristics of specified products produced through a specified production process within a specified production environment. Such information could be collected once and be made available in **standard data bases** for use where needed. Actual initiatives involve the specification of 'CO2 emissions' or 'food miles' that could be allocated to product groups (e.g. apples produced in certain regions).

From an economic point of view and in support of the feasibility of transparency efforts, producers and industry as primary information providers would need to move as much information needs as possible to the status of 'stable or semi-stable'. A suitable **categorization** of *information needs* along these lines is a challenge which could greatly facilitate the development of transparency schemes.

Apart from this categorization of information, a transparency system suitable for realization requires a built-in flexibility in the relationships between information, indicators, and signal:

1. The relationships need to involve buffers which assure that variations of an input variable (e.g. indicator) within certain limits do not affect the output variable (e.g. signal). This requires an identification of the variability ranges.

2. The relationships should allow a variation of input variables that could serve output variables. This variation facilitates the systems' adaptation to changing conditions and scenarios.

3.3 Transformation

Considering the many product lines in the food sector, including meat, fish, fruits and vegetables, or cereals the identification of product specific information sources and their linkage with appropriate indicators and signals might involve a tremendous task. However, it is argued that signals that serve transparency needs of consumers and policy do not differ substantially between product lines (e.g. the concept of 'food miles' is product independent), that there is a common base of approaches for information generation (e.g. through certain controls), and that there is a certain overlap in information sources (e.g. certification schemes) utilized in different product lines.

This hypothesis allowed the formulation of signal-information trees that cut across different product lines.

In **linking information with indicators and signals**, there is a great variety of alternatives that guide the transformation of information on its way through the value chain. As examples, information on the consideration of animal welfare at farm level might be communicated without changes and, in effect, could bypass customer enterprises while information on 'food miles' would be dependent on individual enterprise activities all along the chain. Life Cycle Assessment (LCA) and its variations like Social-LCA etc. have been dealing with those issues and provide suggestions for suitable transformation activities.

However, without referring to some of the more complex transformation needs there is already a **multitude of information in the value chain** that might be suitable for the formulation of indicators and signals but is rarely tapped in today's communication schemes.

This is illustrated through two examples. Information about GlobalGAP certification of farms involves, in principle, a lot of detailed information about production processes, environmental concerns etc. that is scarcely utilized at retail stage. Furthermore, chain

focused quality systems like the systems Q&S (DE) or IKB (NL) build on certification of stage specific fulfilments of requirements. Knowledge on the certification of supplier enterprises could provide, in principle, a multitude of information details concerning products, processes, controls, and management of supplier enterprises that is scarcely used but could support end-of-chain transparency signals.

4. Delivering of transparency

4.1 Delivery

In the delivery of information in support of transparency one can distinguish between three generic alternatives (www.cuteloop.org),

a) 'general delivery', where information is delivered with the product (in whatever form),

b) 'on demand', where information is delivered on a case by case basis if asked for, and

c) 'exception reporting', where information is delivered, if certain characteristics of products do not match requirements (e.g., in food safety).

The first and last alternative are 'push' approaches, the second one is a 'pull' approach. Each of the approaches relates to a certain scenario.

General delivery

In principle, general delivery is the way to go if all information is needed by recipients. However, in situations where *data ownership* is with the information provider, general delivery is subject to exchange arrangements between providers and users where the exchange is beneficial to the provider or can be enforced by the recipient. These conditions usually restrict general delivery to information where delivery is legally enforced or a pre-condition for market access.

On demand

Information on demand is an approach somewhere in-between the two other alternatives. It leaves data with the provider but provides access on a case by case basis if requested by the recipient. This approach is usually a supporting control element in the provision of guarantees.

Exception reporting

Exception reporting leaves data with the provider except for specific cases determined beforehand, as, e.g. in situations where the consumption of products involves health risks.

4.2 Information carrier

The move of information from information providers to information users along the food value chain requires carriers. Traditionally, information is communicated through sales documents. This approach limits information quantity, is slow in the linkage of information across several stages of the chain (e.g. in tracking and tracing scenarios) and has difficulties in the integration of information provided after products have been shipped (e.g. results of laboratory test).

State-of-the-art approaches (Reiche et al., 2009) build on the utilization of
a) communication networks (as, e.g., internet, GMS, or satellite networks) and
b) centrally managed data bases.

Communication systems based on this technology can serve a broad range of communication needs. However, they face resistance in the market place because of their requirements on centrally managed communication systems which requires agreements on system features, finances, and investments across the whole sector and food value chain on

a regional and global scale to be successful. Reaching these agreements involves high (and for the moment prohibitive) transformation costs.

Actual developments in technology might have the potential to change the scenario dramatically in the future. RFID chips involving the capability of computers combined with sensor and communication technology (receiving/sending) allow to attaching information to products. This could lead to decentralized communication systems where transparency could be realized without general sector agreements (www.cuteloop.org).

4.3 Identification of information sources

In the identification of information sources, one needs to distinguish between a horizontal and vertical dimension of information generation. The **horizontal** dimension describes generally available and useable information with relevance for enterprises at certain stages of the food chain about e.g. food safety regulations, good hygienic practices, opportunities to save waste, the organization of sustainable production processes, but also horizontal monitoring schemes that serve the quality development of enterprises at certain stages of the chain etc.

The horizontal dimension involves information which has a value of its own irrespective of its integration into a value chain concept. This type of information does not need to be communicated along the value chain but could be made available at the point of generation.

Vertical information is linked to the food value chain and the movement of products from their initial source to the consumers. It builds on a flow of information from production to consumption which requires agreements on information content, on information exchange, on the protection of data ownership, on institutional arrangements for data communication, etc. The information available at the end develops through communication throughout the

chain. A baseline information of this type includes product based tracking and tracing schemes.

In vertical information generation, any brake in the communication line might diminish the value of the remaining communication part. In an open network environment such brakes might be more the rule than the exception. To reach stability (and sustainability) in transparency systems a 'corrective action approach' needs to be established which allows
a) to fill the gaps and
b) to give an indication on the resulting variation in results.

5. The role of tracking and tracing

Tracking and tracing schemes are a baseline approach for realizing transparency along the food value chain (Fritz and Schiefer, 2009). They provide opportunities for communicating information on product characteristics (e.g. their composition, quality, etc., characterized by '**what**'), processes (e.g. product transformation activities with consequences for environmental, social or ethical concerns, etc., characterized by '**how**'), the origin of products (characterized by '**where from**'), and the actors involved (characterized by '**who**'). These issues require a tracking and tracing scheme that is based on **product units** ('lots' etc.) of whatever kind.

The challenge is to isolating and identifying production and trade units and to monitoring their movements through enterprises and between enterprises from an initial point until its destination. European legislation has introduced requirements on tracking and tracing in its regulation (EC) 178/2002. However, the tracking and tracing requirements established in the regulation have been restricted to an enterprise's ability to identify suppliers and customers. This approach does not allow the organization of transparency systems that involve information related to product units or batches. As a consequence, the realization of

suitable transparency systems requires the organization of tracking and tracing systems that reach beyond legislative requirements. The standard ISO22000 has taken up batch based tracking and tracing requirements. This allows to establishing a coherent tracking and tracing capability throughout the whole chain.

There is an approach that bypasses these requirements but is still able to provide product related information at the end of the value chain. Certification systems that have strict requirements on products (e.g. limits on pesticides) and production processes for each individual stage along the value chain (as Q+S or IKB) allow enterprises at the end of the chain to attach information on requirements to products from enterprises linked to the certification systems. This approach, however, has its limits as it needs to restrict itself to rather basic requirements with a broader relevance in the sector.

The example of incorporating the tracking and tracing requirements of the ISO22000 standard identifies one of the key problems in improving the tracking and tracing situation in an open network situation. It works well in chain relationship where all groups involved agree to cooperate. Tracking and tracing can only be effective, if it is implemented as a sector encompassing systems approach. In an open network situation, the investment in a batch based tracking and tracing system by any individual enterprise is of limited value if suppliers and customers do not invest in similar systems. This brakes the chain link (Fritz and Schiefer, 2009). Finding agreement in a network situation that avoids any brakes in the chain is a challenging task. The global dimension of many food chain relationships adds to the complexity.

The difficulties in the establishment of sector-wide batch based tracking and tracing system are not only a crucial deficiency in the assurance of food safety and quality but limit developments towards improved transparency along the chain and especially with consumers.

There are differences in modeling complexity. The internal processes are usually characterized by complex relationships with a corresponding complexity in process models whereas the communication between enterprises is characterized by simple 1:1 relationships that are already captured in traditional trade contracts. However, the communication between enterprises for tracking and tracing activities within an enterprise network environment depends on the universal acceptance of organizational and technical communication standards and on agreements for information exchange. For the identification of batches, the very basic tracking and tracing requirement, solution proposals have been formulated by the universal standard committee GS1 ('General Standard One'; www.gs1.org) with its specification of

a) Global Location Numbers (GLN),
b) a universal trade unit identification scheme with the Global Trade Item Number (GTIN), and
c) the development of Electronic Product Codes (EPC) that facilitate the use of electronic identification devices like RFIDs and others.

For a further discussion of electronic coordination issues see also Hill and Scudder (2002), Kuhlmann (2003) or Fritz and Hausen (2008).

The difficulty of finding sector agreements is aggravated by the fact that the sectors' enterprise infrastructure, in which global industries and retail chains are linked with huge numbers of small and medium sized enterprises and farms (CIAA, 2008), does not support coordinated efforts to cope with these complexities without external support. This might ask for regulatory support for the initiation and in some cases even for the operation of sector initiatives.

Alternatively, the sector might be forced to enter a step-by-step development path that builds on individual development clusters of innovator enterprises instead of identifying and implementing a comprehensive best solution. This could reduce the initiating costs but

increase costs for the organization, management and operation of the information exchange between the clusters.

6. Organizational system design

The provision of transparency in a sector environment depends not only on the specification and availability of appropriate information and communication schemes but also on the existence of an appropriate **organizational infrastructure** that

a) provides the managerial and technical basis,

b) provides the political platform for reaching sector agreements,

c) organizes the appropriate information flows,

d) protects data ownership interests, and

e) provides guarantees for data reliability and system security.

The **combination of '*content*' and '*organization*'** is the prerequisite for reaching transparency in a sector environment. A critical issue is data ownership, especially on the farm level. Data ownership is closely related to the way information might be provided for use in the chain which could be built on continuous provision, provision on demand (query), or through exception reporting. With respect to data ownership, the provision of information on demand is less sensitive than continuous information delivery. Guarantees for data reliability might require the communication of additional information on, e.g. the reliability of the sender (enterprise) through information on certification etc. With the diversity of the sector and countries involved, the organizational infrastructure cannot follow a universal concept but will need to build on many different clusters and solutions. Integration would need to build on the capability for interactions on the basis of generally agreed exchange standards.

In the documentation of transparency systems one needs to distinguish a number of phases. They involve

a) the *collection* of information,

b) the *processing* of information,

c) the *communication* of information, and

d) the *utilization* of information.

It has been demonstrated (www.cuteloop.org) that these phases can be adequately represented by a few generic functionalities with 'information filters' and 'action triggers' at the core. Filters and triggers are rule-based system elements. The specification of rules identifies the characteristics of any transparency system. One could distinguish generic rules, sector specific rules and application specific rules. Examples of generic rules involve the consideration of limits in content (as, e.g., limits on pesticides) and the identification of products with certain characteristics (as, e.g., GMOs). The combination of these core functionalities with input, output and communication functionalities and their organization into generic sequences of functionalities allows a sufficient description of information flows embedded in transparency systems.

The combination of functionalities with technology elements as e.g. RFIDs or scanners of any level of sophistication determines the principal capability (quality) and efficiency of transparency systems. As a consequence, certain requirements on the capability of transparency systems might require the implementation of a certain level of technology or, in other words, developments in technology support development paths towards higher levels of transparency.

To sum it up, the quality of a transparency system is a function of needs, ability and willingness to provide transparency, and the level of technology available for its support. If we take transparency needs in a certain scenario as granted, the potential for delivery is characterized by

a) the **ability and willingness** of information providers to utilize technology that is in place, available for implementation or expected in the future (in literature referred to as '**E-readiness**') and

b) the **ability and willingness** of information providers to provide and communicate the necessary information which might be available, could be made available or could be expected for utilization in the future (referred to as '**T-readiness**'; Fritz and Schiefer, 2010).

E-readiness could take care of issues as diverse as technology, literacy of people, organizational conditions in the sector, agreements on standards, etc. T-readiness clarifies barriers through data ownership or analyses the ability of enterprises to provide the necessary information. This could involve a clarification regarding information sources and, e.g., the possibility of using data bases or certificates instead of process monitoring schemes.

7. Readiness

Information and communication technology (ICT) developments, especially in the area of Internet related technologies, are fast paced and provide potentials for companies to improve transparency processes along the food value chain. The integration of technology into transparency processes builds on an analysis and mapping of the sequence of process steps and functionalities with relevance for information supply, information processing, and information communication. The various process steps and functionalities are linked with technology devices and communication networks of a certain level of technology (e.g. low,

medium, high) that fit together and avoid technology breaks as much as possible. With this approach one could develop a set of **technology driven reference processes** each one based on a different level of technology.

A similar discussion captures the problems associated with the provision of information for transparency. The identification of suitable information sources, of information collection approaches (e.g. monitoring), the responsibility of different stages and of information exchange opportunities that fit together, lead to a predefined transparency level within the value chain as well as in the communication with consumers. This defines a reference process. Considering different levels of transparency needs allows to developing a set of **information based reference processes**, each one based on a different level of information provision.

Figure 2 describes the relationships between transparency needs, information requirements and transparency reference processes that could best serve the transparency needs. Transparency processes are a fitting combination of information based and of technology driven reference processes.

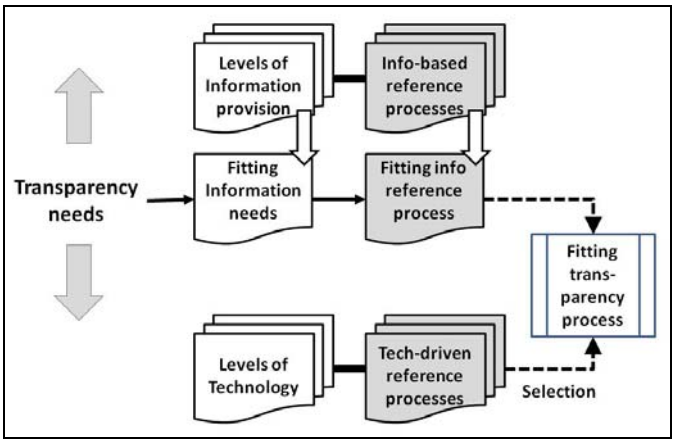

Figure 2: Relationships between transparency needs, information requirements and the delineation of a fitting transparency process.

The development of reference processes builds on an analysis and mapping of the sequence of process steps and functionalities with relevance for information supply, information processing, and information communication. However, the adoption of information and communication technologies as well as of an information provision scheme for transparency process support is not only a technological or information issue, but also an **organizational problem** captured in the terms E-readiness and T-readiness.

In the identification of suitable transparency processes one needs to make sure that there is a fit between the levels of technology and information scheme, and the sectors' **E-readiness** and **T-readiness**. The relationships are described in figure 3. This leads to the following argument:

If transparency needs require a level of technology and of information provision scheme that cannot be realized with the present level of E-readiness and T-readiness one needs either
a) to work on improving (invest in) E-readiness and T-readiness or
b) to lower transparency expectations.

Deficiencies in 'Readiness' within the sector limit individual enterprises' interest in improving readiness within the enterprise and, in turn, their ability to link up with reference processes of higher levels of technology and information provision scheme, etc. With the absence of any guiding institution or anchor enterprise this is a vicious circle which is difficult to break.

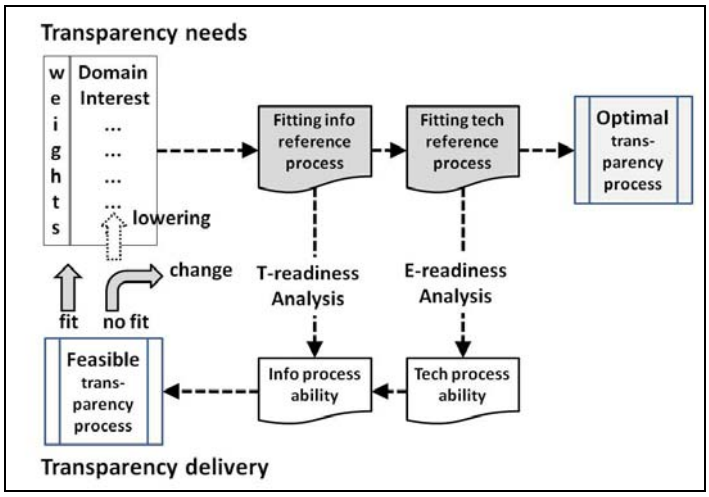

Figure 3: Relationship between transparency needs and delivery considering E-readiness and T-readiness.

8. Embedment into reality

With the sector encompassing network view of transparency, the chances for improvements depend not only on a suitable concept and the engagement of stakeholders but the **integration of existing solutions** and best practice experiences. There are many different clusters of successful contributions to transparency. Examples involve

a) monitoring schemes established by enterprise groups in meat (e.g. Campylobacter and Salmonella) and plant (e.g. Mycotoxin) production,

b) the Global Reporting Initiative (GRI),

c) quality certification systems (e.g. BRC, IFS, etc.),

d) tracking and tracing schemes established by many system providers in Europe and beyond,

e) experimental solutions established by individual enterprise innovators or by closely cooperating chains, and

f) signalling systems established by e.g. retail (with the UK in the forefront of developments).

However, any analysis of needs, opportunities, and especially best practice experiences has to take into account that transparency is a **dynamic concept** which needs to be adjusted to changes in external scenarios (e.g. price relationships or climatic changes), in production and distribution technology, in management concepts, in consumer diets and lifestyles, or in society's priorities regarding, e.g., social or ethical norms, etc. This has consequences for investments which are easier to activate for transparency solutions that are expected to remain stable within the foreseeable future. To reach acceptance in the market, development proposals need to take this issue into account.

9. Summary and Conclusion

With a broad range of definitions dealing with transparency in literature, this report builds on the understanding that transparency is being reached if everybody with stakes and interest in food production and consumption understands the relevant aspects of products, processes, and process environments that allow to making informed decisions.

From this definition as a base, the report has moved towards an outline on how to make transparency work. The focus is not on information content which is being dealt with in the project as such but on the integration of information into a transparency scheme. This discussion shows the complexity of issues to consider but also provides a clear sequence of issues that have to be dealt with.

The view is sector oriented, i.e. the discussion is not on the efforts by any individual enterprises but on how to provide support to the sectors' enterprises altogether and especially its SMEs to move forward in meeting transparency expectations by a core group involving

a) consumers as the ultimate customers in the chain,
b) policy and related institutions that represent society's interests, and
c) enterprises along the value chain that are responsible for providing the food to consumers.

Starting from an identification of transparency needs, discussions on transparency would have to look at
a) the cluster of impact domains agreed upon as being of relevance,
b) the vectors of relative importance differentiated according to sectors and cultural environments, and
c) the expected changes of vectors over time.

The specification of impact domains has been dealt with intensively in the past. Less effort has been focused on the identification of priorities and the dynamics in development. The impact domains are an integral part of a chain of dependencies building on information on products, processes and production environment, leading to indicators for impact assessment and the specification of signals towards transparency recipients. These relationships need clarification regarding content, priorities (weights), and dynamics.

A specific challenge involves the identification of a framework for information collection. This involves especially the identification of the information domains that could be served through standardized data bases or e.g. certification schemes, facilitating the realization of transparency on a broader scale.

For an operationalization of transparency schemes, they have to be related to application scenarios which require information on a regular basis, on demand, or in certain pre-defined situations only. Economic considerations ask for a reduction in delivery frequency as much as possible, limiting delivery on a regular basis to application scenarios where this is explicitly required.

However, whatever needs and opportunities are being specified, realization needs to check the implementation efforts enterprises' as individuals and as members of the food chain network would need to invest in to meet expectations. The analysis of E-readiness and T-readiness provides hints on efforts and feasibility. As this analysis might deliver different results for different sectors, regions, etc., it provides hints on differences in development dynamics and needs for support to reach comparable transparency objectives throughout the European food sector.

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