

# The Interdisciplinary Research Project IT FoodTrace - Introduction and Selected Preliminary Results

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## Abstract

Increasing pressure by consumers, provoked by numerous food scandals, forced the European Union and national authorities to strengthen the regulations on food safety and traceability along food supply chains. Commercial members of food chains are only partially prepared to implement such regulations and to fulfil the respective requirements. The interdisciplinary research project IT FoodTrace faces these challenges and develops a comprehensive IT-solution to improve food safety and traceability in food supply chains of products from livestock origin. The aim of this paper is (i) to screen and assess available approaches, (ii) to define requirements of the comprehensive solution to be developed, (iii) to introduce the interdisciplinary research project IT FoodTrace, its visions, objectives, structure and organization, (iv) to present preliminary results from selected sub-projects, as they deal with integrated animal health systems, cost-benefit considerations for food safety and traceability systems and the overall integrated IT Agro-Technical-Solution-Model (ATSM), and (v) to describe the expected surplus values and perspectives of this research approach.

**Keywords:** *Food Safety, Traceability, Food Supply Chain, Integrated It-solution, Animal Health, Cost/Benefit*

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## 1 Introduction

Increasing pressure by consumers, provoked by numerous food scandals, forced the European Union and national authorities to strengthen the regulations on food safety and traceability along food supply chains. The regulation (EC) 178/2002 can be regarded as an initial example of such a policy shift.

Commercial members of food chains are only partially prepared to implement such regulations and to fulfil the requirements. Major impediments are that (i) existing IT-solutions are, in most cases, limited to single enterprises, (ii) there is an absence of authorities that control whole chains, (iii) small-scale enterprises at the supply and primary production level have to interact with large, (sometimes) multinational groups of companies and (iv) food chains show significant fractures in data flows, as is shown in Fig. 1.

The interdisciplinary research project IT FoodTrace faces these challenges and develops a comprehensive IT-solution to improve food safety and traceability in food supply chains of products from livestock origin. The project is financed by the German Federal Ministry of Education and Research and has a runtime from June 2006 to May 2009. A total of 12 sub-projects and numerous commercial partners from all levels of the supply chain are involved, including IBM Germany Ltd. as the major IT-partner. The aim of this paper is (i) to screen and assess available approaches, (ii) to define requirements of the comprehensive solution to be developed, (iii) to introduce the interdisciplinary research project IT FoodTrace, its visions, objectives, structure and organization, (iv) to present preliminary results from selected sub-projects, as they deal with integrated animal health systems, cost-benefit considerations for food safety and traceability systems and the overall integrated IT Agro-Technical-Solution-Model (ATSM), and (v) to describe the expected surplus values and perspectives of this research approach.

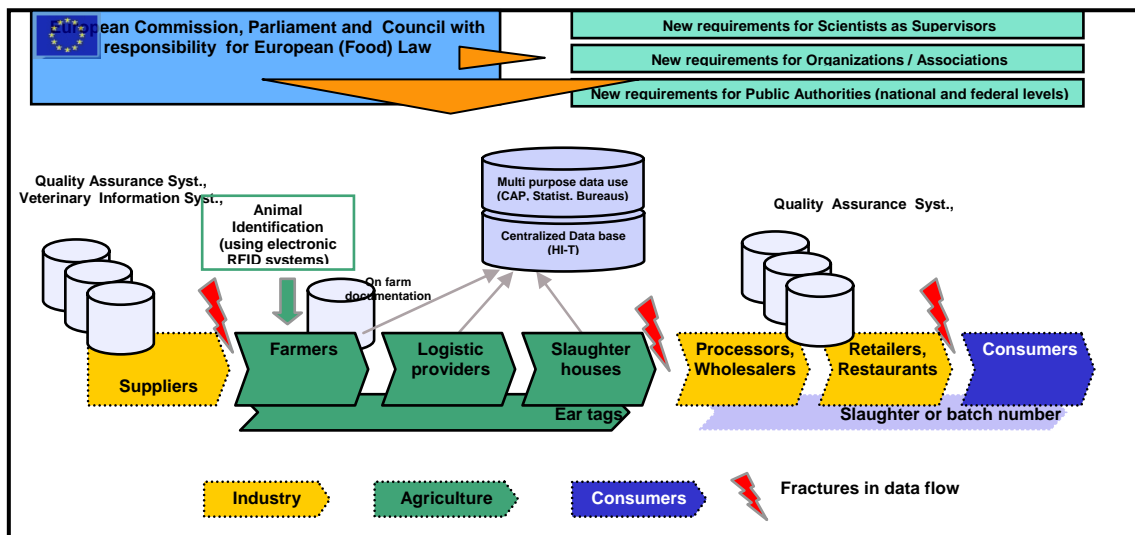


Fig. 1: Increasing pressure on food supply chains

## 2 Existing Solutions

As these few examples illustrate, diverse individual attempts, including integrated packages in the field of agricultural and other sectors' software, which however do not comprehensively cover the value-added chain or only conditional reach the process level. Each of these attempts contains sensible and valuable components. One comprehensive value-added chain integration of data and 'software-islands,' as well as one standard data format does not currently exist, although components are being developed.

Currently, numerous attempts are being made, including scientific explorations. Table 1 briefly presents the goals of several research projects.

The small-structured primary production and the small and medium sized enterprises in the pre and processing stage of the value-added meat and meat products chain stand in contrast to the often large corporations in the field of processing (slaughterhouses and processors amongst others). The current starkest transitions, including in some instances structural breaks at the intersections points along the value-added chain, are presented in Figure 1. The problems at these points of intersection have not been satisfactorily resolved.

## 3 Performance Spectrum of an IT-solution for traceability and quality assurance

A coordination and motivation problem crystallized as a key challenge in the provision of traceability and quality assurance according to Theuvsen (2003). The coordination problem results from the division of labour in the value-added chain of agribusiness. This leads to the development of organizational intersections, which act as fractures in the information flow, with the result that the information flow is interrupted. The motivation problem is also a result of the division of labour. Diverse people and enterprises, with differing goals, are involved in the production, processing and distribution of food stuffs. The diverse actors must be motivated to ensure the complete and correct gathering and sharing of information needed to guarantee traceability, even if this does not contribute directly to their own interests (Theuvsen, 2003).

Tab. 1: Overview of the current research projects for the valued-added chain meat and meat products

<b>Name</b>	<b>Goal(s) and Product</b>	<b>IT solutions</b>	<b>Partner</b>
GIQS e.V.	Improvement of cross-border information exchange between participants in the quality and health management systems (pork, fruits, vegetables)	Connection of already-existing solutions into the “GIQS Backbone”. Existing data sources should be make available. (“data warehouse concept”)	Research, private sector, government
Q-Porkchains	Development of sustainable solutions, according to the consumer demands for high quality (pork)	No information	Research with the involvement of Small Enterprises
European Technology Platform (ETP): Food for Life	Amongst other aspects foster the attempt “from field to fork” (plant and animal products)	No particular specifications	Research, Small Enterprises (,stakeholder’)
FOODTRACE Concerted Action Programme	Development of a “general framework” for the traceability (all foodstuffs)	No indication of a technical focus (e.g. RFID use)	Research, Small Enterprises
QUALINT/QUALINTSYS	Model for the optimization of the introduction of quality systems within enterprises (all foodstuffs)	Databases with information for all criteria of the different QS-systems	Research
P2P – Traceability of the swine value chain	Simple and comprehensive access for consumers and regulatory agencies for all relevant information from diverse traceability systems (pork)	Development of a software architecture that integrates the information of diverse RV systems	Research, industry, Small Enterprises

The presented information makes it clear that an IT-based system for traceability and quality management of foodstuffs, in the value-added chain meat and meat products, must respond to diverse demands. The following spectrum of needs must be satisfied:

- gap-free traceability of foodstuffs from the farm to the fork, at the touch of a button,
- prevent redundancy of data,
- time-efficiency for the actors in the value-added chain (only in the transition year),
- facilitate sector-wide quality management,
- automatic transfer of already existing data to regulatory agencies (facilitation of controls for the regulatory agencies) and of faster response in emergency situations.

Taking into consideration of:

- up-to-date, etc.,
- motivation of all affected actors along the chain,
- coordination: prevent media fractures,
- data protection and security (who has access to which data),
- little to no extra effort for the participants (because only currently existing systems will be used).

#### **4 The interdisciplinary research project IT FoodTrace**

The visions of the interdisciplinary research project IT FoodTrace are

- to develop a sustainable and comprehensive IT-solution (non-redundant data input, open standards, interface solutions, common data formats, up-to-date web-based technologies, data protection and security, etc.),
- to sustainably improve traceability and quality assurance along food supply chains by significantly reducing fractures in data flow,
- to foster innovative and profit-oriented business models
  - that produce sustained improvement in consumer trust,
  - that reduce liability and image risks for all members of the food supply chain.

Win-win constellations are expected for all participating parties - science, commerce and public bodies.

The objectives of the cooperating sub-projects are shown in Table 2.

Tab. 2: Objectives of the sub-projects

SP	Objectives
1.1	Comprehensive valuation and quality assurance of feedstuff
1.2	Process optimization in livestock systems
1.3	Development of a HACCP-system for hygienic measures for prevention of zoonosis
1.4	Development of an IT-supported system for supplier assessment
1.5	Development of a traceability system for chain restaurants
1.6	Investigation of consumer expectations and information
2.1	Investigations on telematic-supported logistics optimization
2.2	Conception and development of an integrated animal health system; investigation of cost/benefit considerations; development of a food systematics-system
2.3	Investigations on database-supported controlling-systems in food supply chains
2.4	Development and implementation of an Agro-Technical-Solution-Model (ATSM); extension of agroXML; development of business models
2.5	Investigation of sustainability concepts and diffusion strategies
3	Optimized project management and milestone supervision

The structure, members and respective tasks of the research consortium are shown in Figure 2.

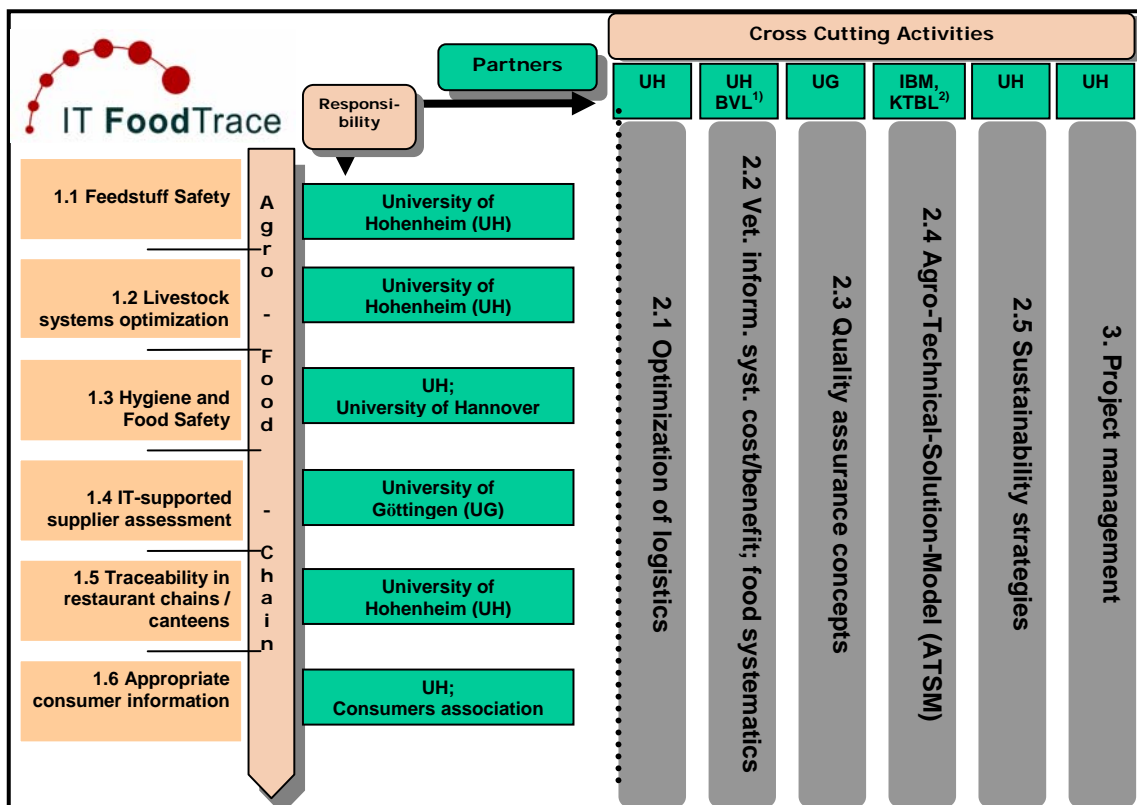


Fig. 2: Structure of the interdisciplinary research project IT FoodTrace (<sup>1)</sup>BVL = Bundesamt für Verbraucherschutz und Lebensmittelsicherheit, Berlin; <sup>2)</sup>KTBL = Kuratorium für Technik und Bauwesen in der Landwirtschaft, Darmstadt)

## 5 Selected preliminary results

### 5.1 Integrated animal health systems

Farmers and veterinarians partially document redundant parameters and are dependent on information from each other (e.g. veterinary medicine chest). The documentations of both groups are also important information sources for public administrations. Increased transparency of quality assurance and

traceability could be attained, but this would cause higher administrative expenses for all participants, as well as redundancy of some data (e.g. identity of animals) and inefficiency.

According to EU-regulations, IT-solutions are allowed. However, currently only isolated applications exist along the supply-value chain “livestock farming”. An integrated IT-solution for farmers and veterinarians has not been developed, and standardised interfaces are not common among the applied technologies. An IT-based, integrated animal health system would not only guarantee a higher level of traceability and quality assurance for customers and public authorities, but should also help livestock farmers and veterinarians optimize production management. For example, one-on-one specific animal analysis could be carried out. More animal health prophylaxis can also lead to cost reductions. The corresponding sub-project focuses on data retrieval and data flows of and between selected process participants (e.g. livestock farmers, veterinarians, public authorities). Currently available data (systems) from each process participant, which are often distributed, deficient and redundant on their own, will be consolidated in an integrated animal health system for cattle and pigs.

The conception and development of this integrated IT-model will be divided into four steps:

1. Sensitization and analysis of acceptance of stakeholders (livestock farmers, veterinarians, public authorities).
2. Analysis of comparable IT-applications in other countries.
3. Exemplary implementation of the IT-model.
4. Evaluation and optimization of the IT-model.

The results of this research will be the conception and development of an IT-model which integrates distributed, fragmented and redundant animal-health-related information from different process participants in livestock farming. At the EFITA/WCCA 2007 Conference results of Steps 1 (analysis of acceptance) and 2 (comparison of existing IT-applications) will be presented.

### *5.2 Cost-benefit considerations for food safety and traceability*

Actors in the supply chain will find benefits from contributing to the IT-solution developed in the IT FoodTrace project (ATSM), which are difficult to localize and even harder to quantify. Therefore, statements regarding the profitability and efficiency of the ATSM can be made only with reservations. However, the quantification of costs and benefits is crucial for the adoption of the system.

So far, analyses of the benefits have only been carried out for single parts of the agricultural supply chain. Substantiated analyses of profitability and efficiency are difficult because cash flows can only be estimated on the benefits side.

The main objective of this sub-project is a cost-benefit-analysis of the quality assurance and traceability system (ATSM) developed in the IT FoodTrace project by means of a profitability-and-adoption analysis. In a cost-benefit-analysis, macro-economical costs and predicted benefits will be valued in terms of cash. Each of them will then be added and set into relation to the others. In a first step, all relevant stakeholders and all aspects of their benefits will be identified and measured. Direct and indirect economical valuation methods will be applied. In order to verify the results, surveys with internal experts (project members) as well as external experts will be carried out. Based on these results, a survey of the willingness to pay will also be carried out (*analysis of adoption*). In a further step all costs related to the project will be analysed. Fixed and non-fixed costs, as well as costs for personnel and transactions will be examined. Opportunity costs of not taking part in the ATSM will also be considered. In a final step, the valuated benefits will be set into relation with the results of the cost analysis (*analysis of profitability and efficiency*). Working at different scales of probability requires elaborating different possible scenarios, because real cash flows will only appear in an already implemented system.

At the EFITA/WCCA 2007 Conference results of the analysis of the background and the state of the art will be available and presented. A screening of the methods to be used will be completed by then and presented as well. Furthermore, an outlook of expected results will be provided.

### *5.3 Agro-technical-solution-model*

The development of the Agro-Technical-Solution-Model is in constant progress. A first draft showcase has been completed in February 2007. The development of this IT-solution provides the major input for the milestone planning. The current state of the model will be presented at the EFITA/WCCA 2007 Conference.

## **6 Expected surplus values and perspectives**

Added values are expected in terms of economic benefits at different levels, unique scientific findings resulting from the application of an interdisciplinary approach, progress in quality assurance, as well as impacts on society and consumers. No new paragraph

Furthermore, the system developed for livestock and meat food supply chains is expected to also be suitable for other food supply chains. From a farmer's perspective, there is great interest in having such a system available for the whole range of production branches. Therefore, the clear perspective of this project is to expand the focus to integrate other food supply chains. Lastly, the current regional (national) focus of the project must be raised to an international level.

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