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1. Executive Summary

This document reports the results of the stakeholder and expert consultation activities of the SSA project e-MENSA, supported by the Sixth Framework Programme of the European Union. The European agri-food supply chains can greatly benefit from the development of tailored e-platforms. E-Platforms are software infrastructures which allow all members to share some specific information. The benefits of information sharing results in improved food chain management and efficiency and as a consequence reduces diseconomies and transaction costs. However, fundamental aspects of e-platforms still need to be developed with future scientific and technological research activities. In particular, research is needed in new technologies and new tools and in new approaches and concepts tailored for the agri-food chain in order to make e-platforms reality.

1. Background

The e-MENSA project started in Feb 2005 and ended in July 2006. It is coordinated by Tecnoalimenti and funded within the Sixth Framework Programme of the European Commission.

The proposed project aims at assessing if an innovative supply chain management infrastructure based on Information and Communication Technology (e-platforms) in agri-food through multi-stakeholder trans-national working groups in order to explore consensus across players/academia on technological strategies, to prepare for future research activities, to support policy development at EU level and to contribute to identifying research agendas for future community research. The issue will be addressed from the scientific, technological, economic, organisational, regulative, ethical and legislative point of view.

The project implemented a plan which combined three different blocks of work:

- Preliminary studies acquiring technological, economic and organisational elements for the most effective structuring of the key issues which were discussed in the subsequent focus groups/discussion platforms,
- Multi-stakeholders and trans-national discussion platforms organised in two structured rounds.
- Dissemination of technological strategies, research agendas, potential advantages concerning food supply chain e-platforms to consumer,

business, scientific and policy-makers' communities for promoting and gathering consensus and involvement.

The result will be a durable pan-European technology platform of academia, industry and consumers for continuous knowledge-based exchange beyond the project duration.

The partners of this project were:

- Tecnoalimenti S.C.p.A. , Italy (Project co-ordinator)
- Asociaciòn para la Investigaciòn de la Industria Agroalimentaria (AINIA), Spain
- Imperial College of Science - Centre for Food Chain Research, UK
- Ente per le Nuove Tecnologie, l'Energia e l'Ambiente (ENEA), Italy
- Institute of the Logistics and Warehousing (ILIM), Poland
- Federazione Italiana dell'Industria Alimentare (FEDERALIMENTARE), Italy
- The Agriculture and Food Development Authority (TEAGASC-AFRC), Ireland
- AGER S.r.l., Italy
- Technische Universitaet Berlin - Department of Food Biotechnology and Food Process Engineering, Germany
- Mediterranean Agronomic Institute of Bari (IAMB- CIHEAM), Italy

2. Objective

The e-MENSA project has highlighted the fact that the management of supply chains has become an issue after the control of most phases of the product/service life cycle passed (usually during the 90's) from one (large) enterprise to many independent SME's, giving rise to the difficult problem of their coordination. In this light, the implementation of e-platforms into agri-food supply chains poses new challenges.

The objective of this document is to identify future research needs in order for e-platforms to be realised in the near future across European agri-food chains. The document is a result of stakeholder and expert consultations of the e-MENSA Strategic Support Action and is formatted to serve as an input to the European Commission for the Seventh Framework Programme and to the National and Regional Innovation Authorities for the regional programmes.

3. Potentiality of e-platforms

A *supply chain* may be defined as a network of enterprises consisting of suppliers, producers, manufacturers, transporters and distributors whose activities are aimed at creating products and/or services.

An *e-platform* may be defined as a software infrastructure on which other programs, that provide specific functionalities for the user, can be installed, so that these programs can run and communicate with each other. In other words, an e-platform can support a user in the performance of complex tasks through the coordinated set of functionalities it provides.
The basic components of an e-platform are:

* e-procurement;
* e-supply chain;

} B2B Platform

* ERP

The first two components are the constituents of the so called *B2B Platforms*, where B2B stands for "Business to Business".
The third one refers to packaged software applications which provide the set of functionalities needed for enterprise management and therefore referred to as Enterprise Resource Planning (ERP).

e-procurement includes the set of tools used to manage, over the Internet, the two streams of information flowing between the enterprise and its potential suppliers and between the enterprise and its potential customers.

e-supply chain aims at supporting and facilitating the integrated and collaborative management of the processes that involve an enterprise and its partners within a Supply Chain, so as to achieve the benefits provided by planning and managing in a perspective of "extended enterprise", a term which refers to the effort of having the Supply Chain to work as if it were just one sole larger enterprise, rather than a multitude of different enterprises.

e-supply chain is the *e-platform* component with much broader strategic impact, as it aims at framing the chain into one larger enterprise.

Among the benefits sought through the adoption of e-platforms, fast, easy and error free processing of transactions between members of a supply chain are the most yearned. However, if the adoption of an e-platform comes with the appropriate managerial approach, or even business reengineering where necessary, the potential benefits are much broader, such as:

- granting total quality of products (consistency among quality features of product constituents);
- lowering time-to-market;
- minimising costs;
- providing flexibility in order to meet market changes
- supporting co-ordination activities among supply chain members.

4. Needs for future research

The consultation within e-MENSA project brought to light the following general needs:

- *Information Sharing:* first of all it is necessary to identify what information is worth sharing among the supply chain members, in which conditions (e.g. kind of competition and supply chain configuration) and with what expected benefits. One type of information which is most significant is the one relevant to forecasting; regardless of whether the forecasting model can be adopted, it is of paramount importance that this information be propagated through the whole chain in order to coordinate the planning activity. This investigation should be done from the perspective of the different types of members (primary producers, processors, distributors, retailers, consumers).

- *Operations Optimisation*: it refers to the process of concurrent optimisation of the activities of all members and identifies the most appropriate supply chain configurations (e.g. centralised vs. decentralised stocking), the best processes of exchange of resources among the members (e.g. supply/buy contracts) and the optimum operation parameters for the supply chain (e.g. production levels, stock levels, prices of the resources exchanged among members). Future research should provide solutions to facilitate sharing of relevant information.

- *Consistence of the Quality Features*: there is a need to identify incentives for the supply chain members to grant that the quality features of their outcomes are consistent with each other and, hence, with the consumer's requirements. The problem originates from the various quality features being the subjects of different contractual agreements undersigned by different members.

- *Operations Analyses:* the most significant factors that measure performances of the supply chain in the agri-food business need to be addressed. It is necessary to cope with mismatches between what is planned and what can actually be provided by members and how to provide this feedback in order to keep the strategic plan updated.

- *Financing of Improvements:* incentives for the supply chain members to contribute collectively to financing the projects of improvement and innovation of the supply

chain need to be defined. These improvements often imply costs on few members and benefits for all members.

- *Execution:* deals with implementing the collaborative strategic plan and its operation through the adoption of the most appropriate technological platforms. These criteria help identify which e-platforms to adopt in order to meet the diverse supply chain requirements and how to cope with the issues of integration of tools built in the platform and those which are not. Familiarity of new web technologies need to be increased in the agri-food supply chain.
- *Technological Tools:* the current IT and technological tools available are not tailored for the agri-food sector. It is necessary that reduced cost technologies are developed and that new systems tailored for agri-food chain processes are developed.

In light of the above, the e-MENSA consultation work extracted the following research issues, to be divided in two main chapters: the first dealing with technologies and new tools, the second with methods and concepts.

4.1 Research Chapter: Technologies and New Tools

RESEARCH ISSUE 1

Previsional systems for a new agri-food chain management to improve product quality and safety and reduce wastes.

An innovative feature of e-platforms is the capacity of forecasting and of detailed planning of product flows along the agri-food chain. This platform should be linked with all possible external parameters (e.g. climate, soil, markets) in order to facilitate any variability for the improved technological planning choices such as the avoidance of contamination and development of toxins, fine tuning agrochemical treatments, forecasting shelf-life and demand. An e-platform could also supply many services to farmers, as information about climate (for example temperature, humidity, etc), MRL of different Countries, European and national current regulation, agricultural management, chemical treatments, harvesting and storage systems, to reduce chemical and biological risk.

Regarding the environment, e-platforms should also take into account parameters such us the quantity of raw material or packaging materials used and, the quantity of wastes generated in the production process, in order to control the sustainable development of the food industry. User-friendly information access for the consumer will increase their confidence in the products and will simultaneously force the food industry to clarify all materials and processes used.

Major research challenges:

- Develop planning features (medium and long term planning) and forecasting for vertical e-platforms
- New IT approaches to complex data management
- Development of new communication technologies to offer real-time information to the consumer and to the different stakeholders in the chain

RESEARCH ISSUE 2

New technological systems for control of liquid foods and commodities during continuous processes

When controlling food chain flows, batch approaches are necessary in order to allow tracing and tracking of production along the food chain. However, in continuous processes this is not possible. Advanced and reduced cost systems for allowing tracing and tracking in liquid products and agri-food commodities are necessary.

Major research challenges:

- New systems of batch-analogue approaches in continuous processes

RESEARCH ISSUE 3

New systems for the supply chain governance tailored for agrifood SMEs

In the current trend of the globalisation of food markets, long distance trans-national supply chains become of paramount importance. Food quality and safety need to be assured at every point of these supply chains, regardless of the size of the enterprise. It is important that raw materials and finished food products maintain their intrinsic properties especially if the processor and consumer are located geographically distanced. Wide regional areas, such as the Mediterranean, would greatly benefit from these new systems of supply chain governance. New e-platform systems with advanced governance features, new sustainable shipping, new logistic architectures, advanced systems of monitoring and control would be integrated into one major infrastructure.

Major research challenges:

- Advanced IT solutions for the governance of complexity
- New sustainable transportation modules

RESEARCH ISSUE 4

Novel systems and devices for deriving shelf-life prediction to be implemented in the fresh produce industry.

The challenge is to set up systems to monitor the status of fresh produce during distribution that are applicable as standard within this industrial sector. The systems developed have to be robust for complexity and work in commercial situations. Information generated by monitoring systems could be integrated into the chain management, providing continuous control, avoiding deviations and adapting parameters within the chain. The control of these products will also produce an increase in the development of analytical methods that will be quick and specific for microbiological, chemical and sensorial food evaluation.

Major research challenges:

- New devices for acquiring data on product condition and behaviour during transportation and distribution
- Improved and cost-reduced tagging technologies
- Technologies for product differentiation according to their origin, avoiding irregularities in their composition (for example, molecular markers to identify different species)
- Physical, chemical and biological quality product parameters and their interaction, it is the combination process-food-package, to design specific processes to the needs of each product.
- Development of non destructive technologies to determine internal parameters of food products (for example, use of infrared to determine internal parameters in food matrixes like humidity or to measure film thickness)

4.2 Research Chapter: Approaches and Concepts

RESEARCH ISSUE 5

Food chain economic studies leading to improve benefits within collaborative e-platform approaches in the food chain

At collaborative approach could be the new paradigm of the agri-food chain. It ensures participation of players in a vertical collaborative framework. The collaboration of players results in optimisation of interfaces and flows, thus fostering competitiveness of the aggregate in the global market. The e-platforms will then be the infrastructure which will allow collaborative approaches to be managed. The research issue should address how to create benefits for all members, how to distribute them and how to facilitate industrial investment in a collaborative approach.

Major research challenges:

- Define the priorities of the agri-food chain to be addressed with collaborative approaches and e-platforms
- Identify the real "cost to serve" of food products in retail for different European countries (this would need to be done for a range of "long" and "short" chains)
- Study of the implications of the Nash vs Pareto approach in the case of vertical collaboration frameworks

RESEARCH ISSUE 6

Standardisation issues and organisational studies of collaborative agrifood e-platforms

In order to boost vertical supply chains, new forms of collaboration and organisation between players are to be explored and standardised across Europe. The new collaborative food chains could function as an extended enterprise and incorporate instruments enabling trust between players and consumers in a substantial way. Standardisation is needed to ensure a pan-European implementation of the proposed solutions.

Major research challenges:

- New approaches to incentivise vertical collaboration between players and new legal frameworks
- New instruments to ensure substantial transparency and trust along the agri-food supply chain
- Standard interfaces and criteria across Europe concerning e.g. IT languages, software communication protocols, parameters to be monitored.
- New systems to involve consumers by the efficient transfer upstream of consumers requirements
- New collaborative e-platforms concepts tailored for vertical co-responsibility in SME agri-food chains.

5. Conclusions

In the light of the results of the Project, we can say that e-platform could have many functions that should be developed in the future:

- Favouring a reinforcement of local supply food chain (caused to a larger information flow and a quicker exchange of ideas among players);
- Favouring a greater cohesion among players of each supply food chain (great clearness in produxts and information exchange), in a "cooperative approach" context;
- Favouring the creation of an up-to-date e-platform for discussion, where demand and supply meet;
- Offering an on-line information service for all players to consent a quicker dissemination of results;
- Implementing a data-base that collects all the discussion among players and results ("archives") to define trends and forecasts - for instance - of request of organic food, certificated food, etc.;
- Defining new agri-food sector trends and giving useful information to customer (customer taste oriented approach);

The research issues emerging from the consultation work of e-MENSA are considered a priority by stakeholders and experts involved in order to achieve the goal of a new generation of e-platform systems with advanced governance features, new sustainable delivery, new logistic architectures and advanced systems for the monitoring and control of quality and safety of food products which would guarantee the integrity and accessibility of the European food supply chains.