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1. Foreword

Food industry research to date shows that unpredictable environmental and technological hazards increasingly affect both food product safety and the stability of agricultural and food markets. In the last decade, several large-scale food emergencies have taken place in Europe such that stakeholders associated with the food supply chain now recognise that in order to retain high levels of consumer confidence, and sustain healthy populations across Europe, there is an urgent need to improve the management of quality and safety monitoring in European food supply chains. In addition, improving the integration of agriculture with processes and players beyond the farm-gate is likely to increase food production stability.

The e-MENSA project was based therefore on the premise that improved quality and safety performance of European food supply chains can be achieved through **improved management of the infrastructures of supply chains**. The project examined the potential for innovations in logistics information and communication technologies (ICT's), to provide the necessary sophistication to overcome the perceived deficiencies in the current food chain infrastructure. To this end, the project specifically addressed the possibility for assuring safety and quality standards throughout the food chain, from primary production to consumption, through the introduction of 'electronic platforms'.

The project anticipated that an integrated food supply management electronic platform (e-platform) would be likely to consist of the following elements:

- A system to collect, manage and store data for the validation and verification of food safety and quality from farm to fork;
- Active participation of stakeholders in the supply chain through mechanisms such as 'co-responsibility' of organisations and the concept of agri-food supply chain 'communities';
- A communication and management ICT infrastructure enabling the coordination and free flow of information across individual organisations' systems interfaces within supply communities
- A framework for the harmonisation of quality assurance (QA) protocols along the entire food production, processing and distribution chain;
- Computer software to maintain high levels of data security for the e-platform community.

In this way, the benefits of an e-platform, not only to the members of the industry community but equally to consumers, could include:

- maintenance of EU safety and quality parameters
- systems appropriate for traceability recording
- preservation of regional and/or traditional product and process identity e.g. through authenticity labelling
- stable supply of product
- farm-gate and retail price stability
- enhanced competitiveness of the European food system on the global market
- the active recruitment of small businesses (SME's) into e-platform communities





The project integrated opinion from both public and private organisations in the food sector, including SMEs agricultural cooperatives and individual farmers thereby eliciting an overview of the nature of socio-technical environments required to sustain a platform technology.

E-MENSA comprises three phases:

- Preliminary desk research on the existing technological, economic and organisational elements of European food supply chains, highlighting key innovations and challenges for the effective management of food supply chains;
- Transnational discussion groups in three chain sectors – Production, Processing and Distribution - involving academic experts and food-chain players, to identify and evaluate the range of technologies in use as tools for supply chain management;
- Dialogue with public, non-government and private sectors policy-makers regarding the potential for implementation of e-platforms in small and micro businesses (SMEs) in the food industry.

The debate on electronic platforms thus created areas of consensus amongst discussants that represents a solid foundation for the provision of advice to policy makers and future research activities .

1. CURRENT SCENARIO

Critical points and diseconomies in the agri-food supply chain

Europe's Single Market was created by eliminating barriers for companies wanting to do business across the EU, providing a much larger 'home market', and enabling an increasingly competitive globalised economy.

Recent trends, such as the outsourcing of specific activities to specialized enterprises, have made supply chains more complex and increased the need to monitor product and process quality. As a consequence, supply chains have become longer and increasingly difficult to coordinate; they have become less cohesive. Within this scenario, large businesses, mainly large retailers, are able to use both economies of scale to increase their control of the chain often approaching monopolistic proportions, particularly when combined with the privileged knowledge of consumer demand enjoyed by multiple retailers. An alternative view for food industry development is offered by the concept of the 'decentralised supply chain', which is currently the subject of a significant body of international research.

The presence of a large company leader favours the introduction of innovations within the supply chain, but the related benefits are dictated and mostly collected by the dominant member; that, in turn, limits the overall positive impact of the innovation on the efficiency and on the quality output of the activities of the supply chain, considered as a whole.





In such a context, small and medium companies, experience greater difficulty in bringing their own innovations to market. The following barriers to innovation amongst SMEs were identified by e-MENSA desk research:

Farmers

1. Inability to gain economies of scale
2. Lack of an entrepreneurial mentality
3. Lack of effective market knowledge
4. Inability to plan production in relation to demand
5. Small quantities of output
6. Lack of cooperation between farmers
7. Weak negotiating position in contractual arrangements
8. Low level of productive standardisation

Processors:

1. Lack of economies of scale, in particular higher costs of raw materials;
2. Inconsistent level of quality standards for raw materials;
3. Inefficient distribution systems and high distribution costs;
4. Variable quantity and quality of output;
5. Low levels of output;
6. Weak negotiating position in comparison with wholesalers and retailers;
7. Logistical and financial problems;
8. Delay in the introduction of technological innovations.

From e-MENSA discussion groups, it was hypothesised that greater coordination amongst producers and processors would address the needs coming from the enlargement of the markets, including growing competition from new entrants more stringent regulations of and recommendations for health and environmental benefits and growing pressure from the consumer to provide detailed information about food production and processing methods.

e-Business has been shown to help eliminate many of the above barriers to improved supply chain management identified by desk research / discussion groups. Internet technology enables all companies to trade worldwide from a single website. Information and Communication Technologies (ICTs) allow new forms of partnership between companies, suppliers and consumers. However, capitalising on these new technologies will require new sets of skills throughout the workforce.

Quality and safety: competitive tools in the agri-food chain

Food quality is a more complex issue now than previously as a result of the rapid increase in consumer interest in social responsibility, health, animal welfare and sustainability. Supply chains need to meet customer demand for sophisticated quality attributes and at the same time remain competitive. The dramatic rise in consumers' interest for product guarantees has led to





increased certification demand that has assumed a remarkable importance in the agri-food sector and raised concerns amongst food processors. Because large companies are generally more interested in certifying their Quality System than small and medium enterprises, certification is seen, by some in the agri-food sector, as a strategic instrument to promote own-label and leading brands at the expense of lesser-known brands.

Traceability: a practical tool for getting more transparency about the quality of agri-food products

Traceability can be defined as: "the possibility to track, and if necessary to reconstruct, all movements of raw materials and food products through all phases of production, transformation and distribution". Since, traceability is an obligation enshrined in EU legislation by Reg. CE 178/2002, it must therefore be considered a prerequisite for the management of any agri-food chain infrastructure.

Currently, at SMEs level many traceability systems still rely on documents rather than electronic records but the use of computers offer a greater number of possibilities for data processing and information production. The main barriers to the implementation of electronic recording systems are:

- Lack of IT skills.
- Lack of existing systems for document recording and recovery.
- Inadequate information management for continuous improvement.
- Cost of hardware and software.

ICT skills

Poor communication between stakeholders in the agri-food chain can seriously hinder development and operation efficiently. The main difficulty for enterprises operating in the agri-food chain is the asynchronous treatment of information regarding parameters that directly or indirectly influence a stakeholder's activity.

The SME approach of towards technology depends on two main aspects:

1. The cost of technology (hardware and software)
2. Farmers and processors attitudes towards IT.

Both of these points are critical and need to be addressed. However, the low levels of computerisation in production and processing SMEs tend to be due to the lack of IT skills rather than the cost of hardware. Communications at this level tend to be by fax or phone.

Consumer expectations

In recent years, the process of globalisation has drawn consumers attention not only to the organoleptic characteristics of foodstuffs but also to attributes that cannot be controlled directly by the consumer such as hygiene, health, production and processing methods, and origin of raw materials and therefore the purchasing decision is increasingly based on belief and trust in the supplier or product label and thus the consumer is more interested in





certificated guarantees. The use of certification systems in turn implies the need for rapid flow of comprehensive information up, down and across the supply chain.

2. THE CONSENSUS VISION

An e-platform is a software infrastructure that provides specific functionalities to support a user in the performance of complex tasks. E-platforms can manage information flow and are considered to be a useful tool in increasing the competitiveness of food businesses in developed markets. In particular e-platforms have the potential to reduce the challenges faced by SMEs in the food supply chain by:

- Creating symmetric market and market research information systems
- Increasing leverage in contractual negotiations with corporate operators
- Aggregating the excessive number of micro enterprises into trading hubs
- Reduced costs through sharing information
- Improving the integration of different and contingent activities along the processing and marketing chain.
- Adding value through the connection of suppliers to niche markets;
- Generating critical mass for innovation in technical and market research;
- Enhanced environmental lifecycle profiles through improved waste management and energy assessments;
- Enabling large processors to deal with small quantities from many producers.

Areas where conflicts in developing an e-Platform could arise are:

- Ownership of the e-platform;
- Responsibility for the management of traceability information and other non-food processing data;
- Estimating the costs/savings of different functionalities;
- Assimilation of existing diverse quality assurance schemes (QAS) into European standards such as EurepGAP;
- The specific nature of supply chain requirements for particular products.

The e-platform can be structured as a centralised or decentralised system, depending on the common objectives selected by members of the platform. However, there is a tendency for collaborative approaches to evolve the more closely objectives are shared between members and the greater the mutuality of benefits obtainable, which include:

- Potential competitive advantage of platform communities (particularly for SMEs)
- Improved traceability data recording and monitoring;
- Optimisation of logistics operations, including reverse logistics;
- Less pressure on members to strive for dominance of the platform;
- Easier access to niche markets for speciality foods;
- Enhanced visibility in B2B and B2C markets;





- Greater transparency in exchange of technical and commercial standards and protocols;
- Improved product liability awareness and product recall procedures.

Integration and collaboration could become the basis for e-platform management, not only of operational functions but also, strategic functions that allow medium and long term enterprise level planning are available to members. To this end, three components, each with a different role in the management of complex activities, need to be taken into consideration:

1. E-procurement, including the set of tools to manage, usually via the internet, product information flow between the enterprise and potential suppliers and customers.
2. E-chain, including a set of tools to support the integration of businesses and collaborative management of the supply chain or “extended enterprise”.
3. E-management within the individual enterprises and for the extended enterprise via Enterprise Resource Planning (ERP) applications.

Food safety issues are an important element of reduced consumer confidence and trust in the food chain. By establishing a long-term partnership between food businesses it is anticipated that the management and transparency of quality will increase and that ICTs enable such an approach to be cost efficient. However, e-platform management systems cannot completely overcome problems posed by fraud. But the integration of HACCP systems into e-Platforms offers additional security through the early warning system of HACCP Critical Control Point monitoring. E-platforms could act as a source of information about HACCP violations amongst members, which was not considered desirable. Nevertheless, e-Platforms were considered useful for establishing responsibility for the inspection of products transported from one country to another. Moreover, e-Platforms were considered to be useful vehicles for the dissemination of local, national and EU regulations for all quality and process standards, certification and legislation and import/export trade regulations and identification marks such as PDO and PGI what are these abbreviations standing for.

Co-operation was identified as a means of achieving critical mass for market access by micro and small enterprises, and relationships leading to co-operation need to be based not only on short term commercial transactions but also on a marketing vision for the product. Shared goals create a greater level of trust amongst businesses enabling easy transition to e-platform membership. Once goals are agreed, appropriate levels of access and costs of services thereof need to be determined. Other important considerations for e-platform implementation include the commitment and duration required of members.

To implement this kind of infrastructure it is first necessary to understand what level of service the customer wants. In the case of logistics it is important to know what type of packaging is required, whether information relating to ongoing status of the delivery is required, etc. This enables the service seeker to specify what they need from the logistics provider to meet their customers’ needs. Secondly the service seeker needs to consider whether their volume of production/output is sufficient to justify the level of service required.





Some small-scale producers may be unrealistic in this regard. However, such producers could identify other food suppliers in the same position before negotiating logistics services and thus benefit from negotiating from a larger volume. Consumers can be involved in the e-platform in two ways:

- Active participation: consumers as initiators of e-platforms. This would be a slow process involving public opinion groups and cultural change.
- Passive participation: consumers buy specific preferred e-platform-labelled products.

Benefits of e-platforms

E-platforms can be viewed as providing a dual function for consolidation of both sellers and buyers. E-platform benefits fall into two main categories. The first category relates to creating a new environment and facilitating access to new markets for a chain of businesses. The second category relates to improving effectiveness and efficiency within individual businesses. E-platforms could also confer significant price efficiencies in relation to customer-derived value although further research is needed in this area.

Traceability has evolved from a voluntary practice to a legal requirement in many food sectors. Traceability may provide benefits in product knowledge and efficiency savings but represents a technical and administrative cost and the ability to balance costs and benefits, and thus to reap benefits, may vary by scale of operation. That there is a possibility for using e-platforms to help small businesses overcome the burden of traceability recording was agreed by survey experts.

Experts also agreed that ICT training solutions are likely to improve efficiency and profitability in SMEs and are an important trigger for encouraging cooperation in the agri-food supply chain and in preparation for the implementation of e-platforms.

Critical points

The length of the food chain is highly variable for different products and product chains often intersect in complex ways. Furthermore, products subject to food processing are a heterogeneous group, e.g. pizza involves multi-step processing whereas fresh products such as spinach have simple chains, although these may stretch over a long distance. These factors render contact and control at all steps of the supply chain difficult. In highly complex chains, suppliers are often not truly independent businesses but are closely linked to the factory.

The major challenges to e-platform implementation are not technical but revolve around the nature of inter and intra organisational human resource relationships, three existing models for which are identified as:

1. Established by one large commercial company,
2. Publicly owned for benefit of facilitating trade,
3. Voluntary systems whereby like-minded individuals co-operate for similar benefits.





Regardless of the model, such a system would require high level of trust and most probably a code or set of procedures to help avoid and deal with conflict. Other obstacles to be overcome which experts identified include lack of understanding of potential e-platform benefits and the low level of ICTs skills combined with an often high level of resistance to change in small businesses. Currently, the levels of innovation and communication between food businesses are weak points in supply chain. To implement an e-platform system to overcome these weaknesses, all businesses have to be prepared to share information and resources, within the confines of agreed limits of privacy. Moreover, there need to be visible trading opportunities and demonstrable economic gain in the short-medium period.

Technological tool options

RFID is perceived as a good tool for traceability implementation, but due to its cost it is currently not as widely spread as the bar code. It was suggested that CPFR implementation could be driven by farmers associations that could support the cost of the system. They could collect farm data and market information, and the system could be introduced at farm level by the implementation of connected ERP utilities. It could be a real tool for the introduction of innovations. The SCOR could be a good solution for a long-term management of the whole sector, but it should be introduced at farmer association level and subsequently tested. There is no known direct experience of such a system at farm level and its implementation looks very far away.

E-platforms as service providers.

The more e-services that an e-platform provides to food businesses, the wider the community of involved businesses would be because services such as quality assurance monitoring and recording, strategic and operational marketing and logistics, and training, guarantee membership benefits. The Government Body should also have access to services such as verification of food safety and quality and access to information related to food security. The information about dangers should be distributed to the Crisis Centres (Emergency Teams).

3. POSITION FOR THE PROPOSED IMPLEMENTATION OF FOOD SUPPLY CHAIN MANAGEMENT E-PLATFORMS

An e-Platform is defined as ‘the integration of various services and applications accessed by the Internet.’ Different services and applications will be available for different users depending on their profile and use of specific services. An e-platform is a software infrastructure on which other programs provide specific functionalities, “applications”, can be installed to run and communicate with each other. An e-platform can support a user in the performance of complex tasks through the coordinated set of functionalities it provides. Interesting examples of e-platforms in the food industry exist but none of these has yet achieved a fully collaborative approach in the following three managerial domains:

- Operation
- Strategy





- Quality assurance.

Integrated and collaborative management calls for switching from the traditional supplier-customer relationship among supply chain members, to one of **partnership**. The component concepts of collaborative electronic supply chains are:

- Harmonising quality assurance procedures and standards *within* commercial and other stakeholder alliances *and* electronic communications networks, whilst
- Protecting the right of commerce *and* European citizens to privacy.

To be successfully implemented in the agri-food chain, e-platforms should have the following features:

1. Designed on a pre-existing will to cooperate around specific objectives;
2. Need not necessarily encompass all stages of the supply chain;
3. Provide services covering training, marketing and contractual matters to members in order to improve logistics, delivery, and freshness to end-users.

Among the benefits sought through the adoption of e-platforms are speedy, accurate and/or error free processing of transactions between members of a supply community. This frees human resources from repetitive activities allowing the extended enterprise to move to more strategic activities, such as customer care. However, total benefits of an e-platform are broader if implementation is combined with the appropriate managerial approach, such as:

- Total consistency of quality;
- Lowered time-to-market;
- Minimised costs;
- Flexibility to meet market fluctuations;
- Support for coordination activities among e-platform members.

Traceability tools and the monitoring of Critical Control Points through the e-platform could facilitate rapid identification of hazards, a solution to create reliability in the food supply chain, and a welcome and timely mechanism to facilitate dialogue between farmers and firms and with the consumer. The closer to the consumer a food business is the more it benefits from the asymmetry of information. E-platforms act to bring all businesses to the consumer-supply chain interface and create symmetries in information not previously seen. The extent to which e-platforms can reduce information asymmetry depends also on the level of active versus passive involvement of the consumer in the e-platform. However, this depends on the cultural background of consumers in a market and the specific food sector. In some market situations the centralised e-platform management model is more feasible while in other cases, particularly for foods embodying concepts of provenance and authenticity, a decentralised model is potentially not only applicable but preferable, in terms of conferring competitive





advantage to the small producer.

Enterprise Resource Planning (ERP) was considered very important because the set of applications could reduce the lack of uncertainty many small producers feel towards e-platforms by helping them to manage traceability, HACCP, and the EurepGap assurance scheme. Farmers already appreciate the possibility of accessing technical advice through an e-platform in order to remain up to date with agricultural practices, and provide customised information to customers, and detailed information on product origin and production and processing methods to consumers.

The triggers for initiating collaboration between food businesses are related to:

- Legal requirements and standards: such as product for liability (traceability, HACCP)
- Voluntary: for example co-operation based on logistics, product innovation, supplier data protocols, consumer-led food networks
- Dominating commercial power: for example from scan-based trading and the retailer imposition of supplier' data protocols.

Once e-platform collaboration has been established, legal, commercial and administrative enforcement takes place to transfer contractual agreements into e-platforms. The membership structure of the e-platform must be underwritten and shared by all the members. In this phase the following aspects must be taken in consideration:

- Planning of production, supply and sales;
- Supply/buy contracts, production levels, stock levels, prices, quality levels, lead times, production risks, etc.;
- Quality clauses included in the contractual agreements with suppliers;
- Innovation and improvement of food chain performance;
- Maximum sustainable cost for belonging to an e-platform.

The management aspects to be considered in implementing an e-platform are:

- The owner of the platforms - possible owners can be:
 - IT companies
 - Combination of private and public information platforms
- Strategic decision-makers (e.g. an appointed board of all stakeholders, including consumer representative)
- Possible solutions for improving trust among consumers are:
 - involving consumers in the platform
 - Independent third party body certificates (e.g. logos)





The Small Medium Enterprise Chain (SMEC) Model (Tononi et al, 2006), presents a mechanism for building a decentralised supply chain in which SMEs participate on equitable terms. The SMEC model implies that global product quality is defined collaboratively by chain members, and that these same members accept co-responsibility for the monitoring and maintenance of agreed standards.

However, decentralised food chain configuration requires more complex and extended processes of collaboration among the chain members, such as those for strategic planning, information sharing, product quality assurance and monitoring, supply chain operation planning and optimisation and collaborative financing of technological updating. These factors make coordination of the supply chain more complex. However, a greater propensity to collaborate is becoming apparent as collaboration becomes an unavoidable route to global research efforts for products such as novel IT technologies (e.g. Business Process Management and Service Oriented Architecture). These products are being offered by an increasing number of IT companies with the express purpose of circumnavigating e-platform problems through the automation of collaboration within supply chains but the adoption of these new processes of collaboration and of the novel supporting IT technologies requires in turn, coordinated and consistent research efforts in the near future.

It is necessary to take into consideration the costs of membership to the platform according to the costs of the range of services offered and the possibility of access to them at several levels. Attention needs to be paid to the duration of the contract and to the contemporary membership of different platforms for the same product.

Innovative management models are needed to highlight and surmount the above obstacles, and technical tools such as e-platforms make the high level of collaboration required possible and less expensive. Supply chains with Logistic Centres and transportation using advanced ITS systems (Galileo Project services) will be the next step. In a world where small businesses are threatened by competition and food quality and diversity is flattened, e-platforms allow cooperation to develop and to become efficient. In the same way that agricultural cooperatives have provided a tool for horizontal cooperation between small scale producers, so e-platforms could become a tool for the vertical cooperation of small scale producers, processors, distributors and retailers in a food supply chain. Legal, organisational, business and technological instruments need to be prepared thereby enabling this vision to become a reality in the near future.





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