Voluntary traceability standards: which is the role of economic incentives?

Stranieri S.[1], Cavaliere A.[1], Banterle A.[1]

[1] *Department of Economics, Management and Quantitative Methods, University of Milan, Via Celoria 2, 20133 Milano, Italy;* stefanella.stranieri@unimi.it, *phone: +390250316460, fax +390250316484*

1. Introduction

Over the past decades increasing consumers' concerns due to repeated food scares has lead firms and policy makers to adopt mandatory and voluntary normative instruments in order to reduce consumers loss of confidence towards food products. Traceability is one of the most important interventions aimed at assuring the safety and quality characteristics of food products. Firms can use such tool to reduce the risk of food safety non-compliance, to impact on consumer behaviour through the labelling of traced quality attributes, and to reinforce vertical relationships within the food supply chain through a system aimed at guaranteeing a more transparent management of transactions.

The EU mandatory legal framework on traceability is based on general food law (Regulation 178/2002) and on Regulations 1760/2000 and 1825/2000 for the meat supply chain. The strategic role played by traceability standards has been recently strengthened by Regulation (EU) 1337/2013 that has extended the European legal framework on traceability to most of meat products. This Regulation has highlighted the important role of fine traceability in assuring specific safety and quality attributes connected to the supply chain.

In addition to European mandatory legal framework several voluntary standards offer to food firms a wide range of alternative possible systems (Karlsen *et al*., 2013). Traceability systems vary greatly among operators depending on the business activity and the applied standards (Canavari *et al*., 2010). Among voluntary traceability standards there are significant differences between formal international standards and other private standards. Moreover, also in relation to a specific traceability voluntary standard differences in terms of traceability levels (breadth, depth and precision) are revealed (McEntire *et al*., 2010; Golan *et al*., 2004).

According to Karlsen *et al*. (2013) there is a need to develop a conceptual framework for traceability in order to explain the different kinds of existing standards within food supply chains. Current economic literature has concentrated the attention both on the drivers for traceability in terms of motivations and on the economic consequences of its implementation in terms of costs, benefits and vertical reorganization of activities within the supply chains (Cembalo, 2015; Chen *et al*., 2015; Karlsen *et al*., 2013; Saltini and Akkerman, 2012; Mai *et al*., 2010; Manos and Manikas, 2010; Schulz and Tonsor, 2010; Olsen, 2009; Banterle and Stranieri, 2008; Jayasinghe and Henson, 2007). What it is not clear from an economic perspective so far concerns the analysis of the incentives leading firms to decide which kind of traceability standard to adopt and the traceability level to implement. Several studies have analyzed the effects of different traceability levels after their implementation but not the motivations which lead firm to choose among different traceability levels. Recent literature found a positive relationship between the level of traceability, in terms of breadth, depth and

precision, and the costs faced by food firms (Lavelli, 2013). However, the role of incentives in the amount of financial resources firms decide to allocate for different traceability levels remains still unexplored.

Starting from this background, the aim of this paper is to contribute to a better understanding of motivations that lead firms to adopt different levels of voluntary traceability. In our analysis we concentrate the attention on traceability systems based on the standard ISO 22005:2008 which can be implemented with different levels of traceability complexity. The study is based on a survey addressed to a sample of Italian firms belonging to the main agri-food Italian sectors (dairy, meat, fruit and vegetables, wine).

The paper is organized as follows. Section 2 focuses on issues related to the legal background of traceability standards. Section 3 analyses the existing literature on the economic incentives related to the implementation of voluntary traceability and food safety standards. Section 4 deals with methodological issues and section 5 presents the empirical results. In the last section, we draw our conclusions.

2. Legal Background to the research

EU regulation addresses the mandatory traceability of a broad range of food of both domestic and imported origin. The European legislation of food traceability is among the most complete normative frameworks in terms of products involved in the respect of normative requirements (Charlebois *et al.*, 2014). The EU Regulation 178/2002 has translated the general European food safety principles through the introduction of a mandatory traceability system for food, feed, food-producing animals, and any other substance incorporated into a food at all stages of production, processing and distribution. The EU Regulation introduces a scare traceability system as it obliges food firms to be able to identify from whom and to whom an agri-food product has been supplied (Karlsen *et al.*, 2012). No normative requirements related to the identification of information about the product flow within the firms part of the traced food supply chain are introduced by the EU Regulation 178/2002. On the contrary, EU Regulation 1760/2000 established a fine stricter mandatory traceability system for bovine animals and the labelling of beef and beef products. Such Regulation obliges supply chain food firms to implement a traceability system aimed at identifying and registering not only the product flows among the firms part of the supply chain but also the product flows within the traced firms (internal and external traceability). The recent EU Regulation 1337/2013 has highlighted the important role of fine traceability system in assuring specific safety and quality attributes connected to the supply chain by extending the European legal framework on beef traceability to most of meat supply chains for fresh, chilled and frozen meat of swine, sheep, goats and poultry.

In addition to mandatory traceability rules, European food firms have also the possibility to implement: *i)* non-regulatory international traceability standards leaded by non-governmental organizations (ISO, Fairtrade, Globalgap, etc); *ii)* private industry sector standards on a voluntary basis (Chen *et al.*, 2015); *iii)* individual firm standards. International standards are issued by non-governmental organizations, whereas industry sector and individual firm standards belong to private initiatives (Hall, 2010; Gawron and Theuvsen, 2009). ISO 22005/2008 and Global-G.A.P. standards are two international standards used by European firms to complete or enhance the traceability requirements of the European legislation. With regards to traceability industry standards, the retailing sector has played an important role in setting different certification programs to

facilitate the transparency of trade between sector operators. Within European countries different of these standards are applied, like, for example, British Retail Consortium (BRC), Safe Quality Food Program (SQ), and International Food Standard (IFS). Also individual firm standards are often used by food firms and retailers. In Italy, some big meat processors and food retailers have established their own standards (Banterle and Stranieri, 2013). Retailers apply individual traceability standards especially to their private label supply chains.

The variety of voluntary traceability standards does not depend only by the kind of standard applied but also from the characteristics of traceability systems implemented. According to Golan *et al.*, (2004) the main factors which characterize a traceability systems are their 'breadth', 'depth' and 'precision'. The breadth relates to the amount of information recorded by the traceability standard. The depth of the system refers to the distance the system is able to trace, i.e. the identification of the sectors which are involved in the traceability system. The system precision is associated to the degree of assurance with which the system can pinpoint a particular product's movement or characteristics (Bosona and Gebresenbet, 2013; Ruiz-Garcia, *et al.*, 2010). McEntire *et al.*, (2010) added 'access' as other factor to characterize voluntary traceability systems. The access refers to the speed with which traced information can be communicated to supply chain members and public health institutions during food emergencies. Hence, voluntary traceability systems vary greatly among operators depending on the applied standards and on the characteristics of the system implemented.

3. Incentives and voluntary traceability standards

The occurrence of repeated safety scares within the food sector has lead countries to introduce different traceability systems in order to regain consumer confidence. Apart from the management of consumer food safety concerns, current literature has stressed some other important consequences associated to the implementation of food traceability systems, as the improvement of food crises management (Resende-Filho and Hurley, 2012), the increase of supply chains efficiency by a reduction of logistic costs and the improvement of information management, the possibility to differentiate quality attributes of food products and to better distribute liabilities among the agents of supply chains (Chen *et al.*, 2015). The implementation of different food traceability systems has economic consequences also in terms of costs and vertical reorganization of activities within the supply chains (Banterle and Stranieri, 2008). Recent economic studies have also concentrate the attention on the economic consequences of different traceability levels in terms of costs and benefits (Donnelly *et al.*, 2013; Shamsuzzoha *et al.*, 2013; Chryssochoidis *et al.*, 2009; Wilson *et al.*, 2008). The finer the traceability system is in term of breadth, depth and precision, the higher the costs and benefits associated to the standard implementation will be (Saltini and Akkerman, 2012).

What is missing so far is an in-depth analysis of the determinants which lead firms to decide how to allocate their financial resources in implementing different levels of voluntary traceability. Holleran *et al.*, (1999) concentrate the attention on perceived cost and benefits associated to the adoption of voluntary food safety standards. Their results stressed that if benefits outweigh the costs perceived firms will implement finer traceability systems.

Karlsen *et al.*, (2013) stressed that the identification of perceived costs and benefits of traceability standards is closely linked to firm's incentives and that firms' incentives represent an important step to understand the

mechanisms which regulate the adoption of different voluntary traceability. Starting from this background our interest was to investigate the role of incentives in the determination of firms traceability level.

Different economic incentives for food firms to adopt food traceability have been identified in the literature as significant drivers of food traceability: efficient management of food safety non-compliance (Pouliot and Sumner, 2013; Resende-Filho and Hurley, 2012; Starbird and Amanor-Boadu, 2006), quality differentiation of food products (Heyder *et al.*, 2012; Mai, 2010; Manos and Manikas, 2010), firm performance and competitive advantage (Epelbaum and Martinez, 2014; Canavari *et al.*, 2010; Ruitz-Garcia *et al.*, 2010; Fritz and Schiefer, 2009; Wilson *et al.*, 2008), supply chain efficiency in terms of liabilities distribution and information transparency (Hu *et al.*, 2013; Hobbs, 2004) and the regulatory updating (Liao *et al.*, 2011; Senneset *et al.*, 2007; Shwagele, 2005; Smith *et al.*, 2005).

The literature has grouped these different economic incentives in different ways. Jayasinghe-Mudalige and Henson (2007) classified the incentives for enhanced food safety control systems into 'market-based', 'regulatory' and 'liability' incentives. Wu (2012) gave an insight of the motivations which lead international tourist hotels to voluntarily adopt food safety control systems. She distinguishes between external and internal incentives leading to the adoption of such systems.

On the basis of the existing literature we identified different kind of traceability incentives and we analyzed their influence on the level of voluntary traceability implemented.

From the adapted conceptual framework reported above we can subdivide the economic incentives into the following groups: 'market incentives', 'supply chain incentives' and 'regulatory incentives'. The first group is related to those incentives generated by stakeholders within a certain market, namely consumers, food firms, retailers, which can have an influence on firm financial performance. We distinguish between 'monetary incentives' and 'non-monetary incentives' (figure 1). Monetary incentives are quantifiable and have direct effects on firm financial performance. Non-monetary incentives cannot be directly estimated and, thus, have indirect effects on firm financial performance. The second group entails those incentives related to an enhancement of supply chain management, in terms of better liability distribution and more transparency during vertical economic exchanges (Banterle and Stranieri, 2008). The third group refers to those incentives driven by safety normative requirements within the international market or to update with future normative issues.

Figure 1. Incentives classification

Non-monetary Market Incentives	Monetary Market Incentives
ECONOMIC INCENTIVES	
Supply Chain Incentives	Regulatory Incentives
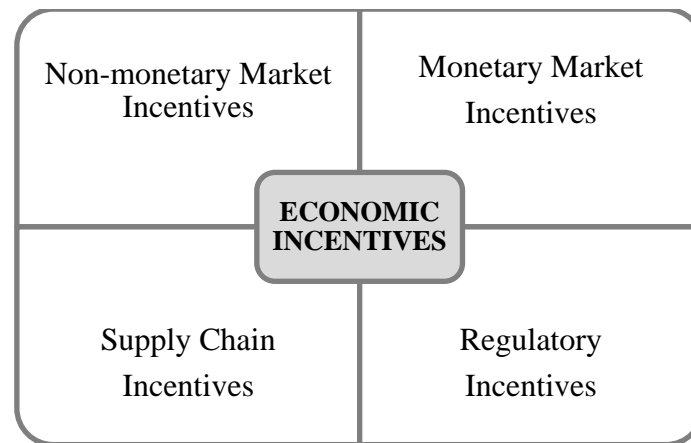
4. Methodology

4.1 Sample and questions

The analysis is based on an ad hoc questionnaire with closed questions (5 point Likert scale or dummy variables). The selection of the firms interviewed followed the following steps. We selected the organizations of certification licensed by the Italian National Institute of Certification (ACCREDIA). We downloaded 13 organizations and we found the firms certified ISO 22005:2008 operating in the food industry (more than 200 firms). Afterwards, we segmented them on the basis of geographic distribution. We chose to consider in the sample all the firms located in the north of Italy, as in this area there is the large number of firms certified. At the date, the sample is composed by 20 firms certified ISO 22005:2008, which are those that give positive response at the first call.

Table 1 describes the variables used in the analysis subdivided in different sections on the basis of the conceptual framework presented above: level of traceability, non-monetary market incentives, monetary market incentives, supply chain incentives, and regulatory incentives. In addition to these, we also collected general data of the firms interviewed (sector, number of employees, other certifications implemented by the firm).

The first set of variables measure the level of traceability. According to Karlsen *et al.*, (2013) the lack of a common conceptual framework for traceability brings with it the difficulty to measure and evaluate different levels of traceability system implemented. We took into account three main characteristics used in the literature to analyse the different traceability systems, i.e. breadth, depth and precision (Lavelli, 2013; Golan *et al.*, 2004). To define the 'depth' we asked to the firms the number of sectors traced with voluntary traceability system (scale 1-3). For 'precision' we asked about the size of traceable batch (scale 1-5). To define the 'breadth' we analysed the increase of the amount of information exchanged along the supply chain (scale 1-5).

With regard to non-monetary market incentives we consider all those incentives that do not determine profit for the firms in a short-medium period of time. In this part we asked for motivations related to the reduction of food contamination risks with the implementation of traceability (score 1-5), the improvement of quality

characteristics of food product (scale 1-5), the improvement of reputation towards retailers (scale 1-5) and consumers (scale 1-5) and the commercial pressure played by retailers (scale 0-1).

Table 1. Variables description

Variables	Variables description	Variables coding	Scale
Level of traceability			
Sectors traced (depth)	The sectors traced by voluntary traceability	1=agricultural sector and food processing; 2=agricultural sector, food processing and retailer; 3=agricultural inputs, agricultural sector, food processing and retailer	1-3
Information traced (breadth)	Voluntary traceability increased the traced information about quality characterisitcs of raw materials and suppliers characteristics	from strongly disagree = 1 to strongly agree = 5	1-5
Size of a traceable batch (precision)	By voluntary traceability a reduced size of traceable batches was implemented	1=not at all; 2= yes, the dimension of batches relate to more than one day of production; 3= yes, the dimension of batches relate to one day production; 4= yes, the dimension of batches relate to different product packages produced during the same day; 5=yes, the dimension of batches correspond to a single product package	1-5
Non-monetary market incentives			
Food safety	Voluntary traceability was introduced to improve food safety	from strongly disagree = 1 to strongly agree = 5	1-5
Food quality	Voluntary traceability was introduced to improve raw material quality characterisitcs	from strongly disagree = 1 to strongly agree = 5	1-5
Reputation toward retailers	Voluntary traceability was introduced to improve product reputation toward retailers	from strongly disagree = 1 to strongly agree = 5	1-5
Reputation toward consumers	Voluntary traceability was introduced to improve product reputation toward consumers	from strongly disagree = 1 to strongly agree = 5	1-5
Commercial pressure	Voluntary traceability was introduced to comply with retailers requirements	0 = no; 1 = yes	0-1
Monetary market incentives			
Firm productivity	Voluntary traceability was introduced to increase firm productivity	from strongly disagree = 1 to strongly agree = 5	1-5
Human resource management	Voluntary traceability was introduced to improve human resource management through technical training	from strongly disagree = 1 to strongly agree = 5	1-5
Firm profit	Voluntary traceability was introduced to increase firm profit	from strongly disagree = 1 to strongly agree = 5	1-5
Supply chain incentives			
Supply chain transparency	Voluntary traceability was introduced to increase the information exchanged along the supply chain	from strongly disagree = 1 to strongly agree = 5	1-5
Information truthfulness	Voluntary traceability was introduced to improve the truthfulness of information exchanged	from strongly disagree = 1 to strongly agree = 5	1-5
Liability	Voluntary traceability was introduced to improve the liability among supply chain stackeholders	from strongly disagree = 1 to strongly agree = 5	1-5
Regulatory incentives			
Future normative requirements	Voluntary traceability was introduced to comply with possible future normative requirements	0 = no; 1 = yes	0-1
international compliance	Voluntary traceability was introduced to comply with international standards	0 = no; 1 = yes	0-1

To evaluate monetary market incentives we analysed the incentives leading to an immediate utility for the firms in terms of profit, thus if the implementation of this kind of standard increased the profit (scale 1-5), firm productivity in terms of input/output efficiency (scale 1-5), and human resource management (scale 1-5). Supply chain incentives concern the improvement of supply chain transparency (scale 1-5), the information truthfulness among the agents of supply chain (scale 1-5), and the increase of partners liability (scale 1-5). Regulatory incentives regard the update with mandatory normative rules (scale 0-1) and the harmonization of regulation also outside EU countries (scale 0-1).

4.2 Data Analysis

The analysis of data has followed three main steps. In the first step was performed the standardization of the variables. Indeed, due to the fact that the variables have a different scale measures, some 5-point and some dummy, we standardized them in order to compare the scores.

In the second step a hierarchical cluster analysis was employed using SPSS 21. This analysis was run in order to explore the influence of economic incentives on the level of voluntary traceability implemented by food firms.

Hierarchical clustering involves generating clusters that have a predetermined ordering from highest to lowest (organized in a hierarchy). In this method we assign each observation to its own cluster. We computed similarity (Euclidean distance) between each of the clusters and joined the two most similar clusters. For the dimension of how the distance between each cluster was measured we used the average linkage, were the distance between two clusters is defined as the average distance between each point in one cluster to every point in the other cluster. This technique led us to the identification of a number of clusters that seems to be the best results in terms of some important criteria, such as the number of firms for each cluster, the degree of inter-cluster distances, and the different characteristics of the resulting clusters.

Afterward, in the third step of analysis, we conducted one-way ANOVA in order to confirm differences in the mean scores of the variables within each cluster found.

Results and discussion

The sectors considered in the analysis reflect the distribution of the main Italian firms certified ISO 22005:2008. More than 50% of the interviewed firms belong to the fruit and vegetable and wine sector. In specific, 5 belong to wine sector, 4 to fruits and vegetables sector, 4 to diary sector, 3 to the meat sector, 2 to the fish sector and the 2 to rice sector. Most of firms interviewed are SMEs and have implemented other quality and safety certifications in addition to ISO 22005:2008. BRC, IFS, HACCP and PDO are the certifications represented most.

With regard to the traceability systems implemented, different characteristics in term of the degree of segregation applied (precision), the sectors traced (depth) and the quantity of information recorded by the system (breadth) are revealed. Cluster analysis is conducted in order to group firms and verify if differences in terms of incentives exist for different level of traceability. Traceability level is obtained by calculating an index expressing the mean score of the variables concerning the batch size adopted (precision), the sectors traced (depth) and the quantity of information recorded by the system (breadth) for each firm. The higher is the index score the higher is the level of traceability complexity.

Cluster analysis segmented the sample in 3 clusters. The first one groups 5 firms with a high level of traceability complexity (fine traceability). The second one clusters 11 firms with a medium level of system complexity (medium traceability) and the third cluster refers to 4 firms with a low level of traceability (coarse traceability). To analyse the specificities of these groups of firms we compared the medium scores of economic incentives within each cluster (figure 2).

Figure 2. Average scores of clusters for different economic incentives
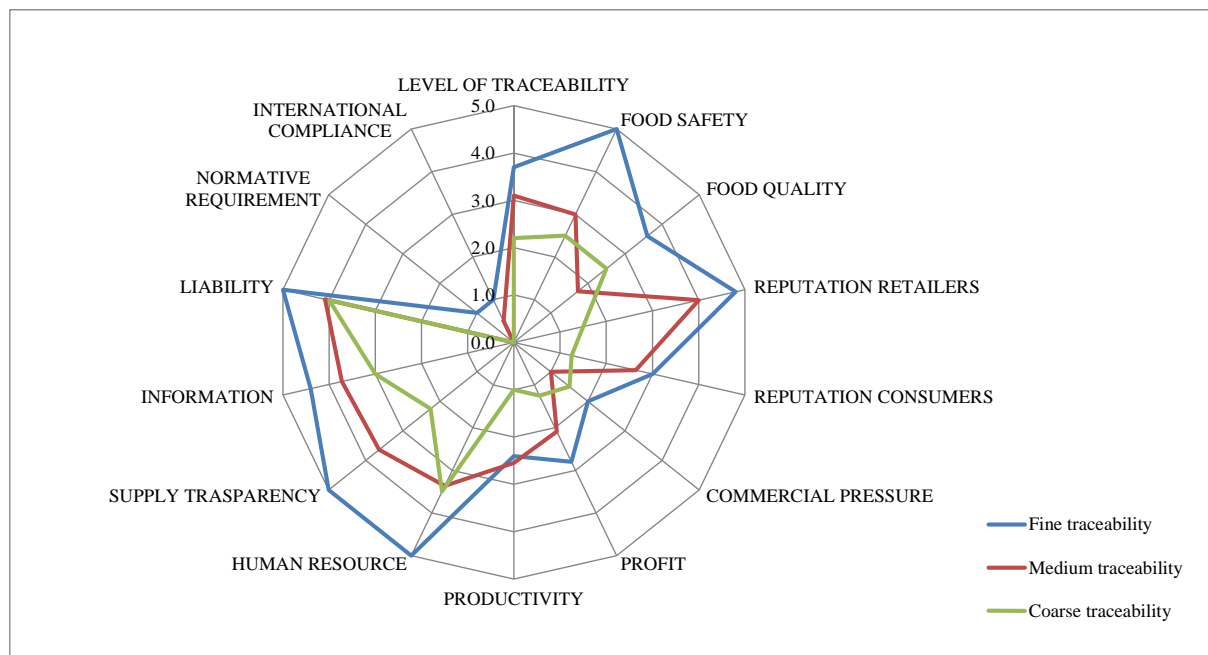
The cluster 'fine traceability' groups firms which reached the highest scores for almost all the economic incentives. The 'medium traceability' firms reveal average scores for monetary market incentives, non-monetary-market incentives and supply chain incentives. The cluster 'coarse traceability' groups firms with the lowest scores for the economic incentives.

All the clusters reveal that supply chain incentives play a key role for the firms interviewed. All the firms consider the improvement of supplier liabilities as an important economic incentive for the adoption of voluntary traceability system. Thus, it seems that voluntary standard can be considered as an alternative mode of transaction organization which helps economic agents to better regulate economic exchanges within the supply chains.

On the contrary, regulatory incentives don not reveal their importance in any of the clusters analysed. This is probably due to the fact that traceability is a mandatory requirement within the EU. Thus, the incentives for the adoption of voluntary standard should not be related to the institution of missing regulatory aspects by the certified food firms.

Apart from supply chain liability where all firms revealed good scores, clusters analysis show differences among groups of firms in terms of economic incentives for the voluntary standard applied. In the cluster 'fine traceability' the incentives related to 'food safety', and 'supply chain transparency' are considered as important determinants for the adoption of voluntary traceability standard. This could suggest that the implementation of a high level of traceability complexity seem to be driven by incentives related to a reduction of risks associated to food safety and a better management of supply chain relationships. This last aspect relates to the reduction of transaction risk failure due to an increase of information transparency within supply chains.

The group 'medium traceability' reveals a high score with regard to the variable 'reputation toward retailers' in addition to the 'liability' variable. Firms grouped in this cluster consider the maintenance or enhancement of their reputation towards their main clients an important incentive to adopt a voluntary traceability standard. This cluster seems to highlight that when firms consider the risk associated to the loss of a good standing are more likely to support the costs for the implementation of traceability systems compared to those grouped in the cluster 'coarse traceability'. The firms in this last cluster adopt traceability systems with a low level of complexity. The incentives leading these firms to adopt voluntary traceability standards are related to the enhancement of quality characteristics of products and the improvement of firm productivity through technical training of human resources within the firms. This could suggest that when firm strategy is oriented towards the quality differentiation of food products the adoption of voluntary traceability is only considered as a formal requirement that allows the certification of product quality attributes on food labels.

One-way ANOVA confirms significant differences among the three clusters in relation to the variables used for the analysis. The average scores of most of the incentives considered among groups were different. Only the variables 'reputation towards consumer', 'commercial pressure', 'future normative requirement' and 'international compliance' are not significant (table 2).

Table 2. Cluster results and one-way ANOVA

	Fine traceability	Medium traceability	Coarse traceability	F	Sign.
Level of traceability	3.2	2.6	1.9	6.02	**
Non monetary market incentives					
Food safety	5.0	3.0	2.5	6.58	**
Food quality	3.6	1.7	2.5	3.64	**
Reputation-Ret.	4.8	4.0	1.5	22.9	***
Reputation-cons.	3.0	2.6	1.3	1.74	
Commercial pressure	0.4	0.2	0.3	0.39	
Monetary market incentives					
Firm profit	2.8	2.1	1.3	2.76	*
Firm productivity	2.4	2.5	1.0	3.88	**
Human res. Managenet	5.0	3.4	3.5	3.49	**
Supply chain incentives					
Supply chain transparency	5.0	3.6	2.3	19.7	***
Information truthfulness	4.4	3.7	3.0	5.03	**
Liability	5.0	4.1	4.0	5.7	**
Regulatory incentives					
Legal adjustment	0.2	0.0	0.0	1.59	
International compliance	0.2	0.1	0.0	0.45	

$*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

Concluding remarks

The empirical analysis presented above reveals that the main determinants related to the implementation of voluntary traceability deal with market and supply chain incentives. With regard to market incentives, non-monetary market incentives seem to play a more important role than the monetary-market ones. Moreover,

most of the firms interviewed consider the aspect related to the organization of supply chains one of the main determinants for the implementation of voluntary traceability. In specific, a better information management and a strengthening of liability among the agents of supply chains are among the incentives which lead firms to adopt voluntary traceability standard.

The analysis conducted seems to highlight that there should be a positive relationship between the level of traceability implemented and the amount of incentives firms have for the adoption of such standard. The cluster 'fine traceability' reveals the highest average scores for almost all the economic incentives. This is in accordance with present literature linking the amount of benefits perceived by food firms and the complexity level of traceability system implemented. If a company cannot identify any benefits in carrying out an implementation, the motivation will soon wane. This should affect the willingness to invest in any technology needed to achieve better documentation of produced products.

Moreover, cluster analysis has identified firms which differ in terms of the level of traceability system implemented and the economic incentives for the adoption of voluntary traceability. Results show that firms driven by food safety reasons are those characterised by a high level of traceability complexity. The firms that implement a medium level of traceability consider firm reputation an important determinant for the adoption of voluntary standards. The firms driven by food quality incentives for the introduction of traceability are those with the lowest level of traceability complexity level. These results highlight that there should be a relationship between the kind of firm economic incentives towards voluntary traceability and the level of system complexity adopted.

From the analysis conducted, different managerial implications can be discussed. First, it has to be considered that the implementation of traceability system leads to the necessity to reorganize economic exchanges among supply chain agents due to the centralization of the traceability system management and the strategic role of the leader-firm in the elaboration of good practices connected to the traceability system (Banterle and Stranieri, 2013; 2008). The reorganization of supply chains leads to a reduction of non-conformity risks related to the improvement of liability management along the traced supply chain. Moreover, it leads also to an improvement of risks management, due to a better liability distribution among the agents of the supply chains, an easier management of safety and quality requirements within the production processes and an increase of information transparency within the supply chain.

Second, the increase of information exchanged along supply chain due to voluntary traceability system allows also an easier management of the quality guarantee of extrinsic attributes labelled on food products (the type of breed, the origin, etc.). Thus, traceability standard does not imply product differentiation itself but it makes quality certification processes possible and easier to apply.

Third, food safety enhancement and firm reputation toward retailers are among the relevant incentives toward the implementation of voluntary traceability. The adoption of such standard is considered as a mean to preserve or enhance firm reputation on the market by the reduction of food safety hazard or within the supply chain by the implementation of a standardized procedure of product flow management.

Forth, cluster analysis suggests that there should be a relationship between the firm economic incentives for the adoption of voluntary traceability and the levels (and thus the costs) chosen by the firms to implement a

traceability system. In the present analysis food safety, food quality and firm reputation seem to play a role in the explanation of the differences in traceability systems complexity. However, such results need to be verified on a bigger sample.

Future research is oriented to test such results in a larger sample and to analyse statistically the relationships between the levels of traceability system implemented and the different kind of economic incentives for traceability standards.

References

Banterle, A. and Stranieri, S. (2013), "Sustainability Standards and the Reorganization of Private Label Supply Chains: A Transaction Cost Perspective", *Sustainability,* Vol. *5 No.* 12, pp. 5272-5288.

Banterle, A. and Stranieri, S. (2008), "Information, Labelling, and Vertical Coordination : An Analysis of the Italian Meat Supply Networks", *Agribusiness*, Vol. 24, pp. 320-331.

Bosona, T. and Gebresenbet, G. (2013), "Food traceability as an integral part of logistics management in food and agricultural supply chain", *Food Control,* Vol. 33, pp. 32-48.

Canavari, M., Centonze, R., Hingley, M. and Spadoni, R. (2010), "Traceability as part of competitive strategy in the fruit supply chain", *British Food Journal*, Vol. 112 No. 2, pp. 171-184.

Cembalo, L. (2015), "Innovation and valorization in supply chain network", *Agricultural and Food Economics*, Vol. 3 No. 5, pp. 1-4.

Charlebois, S., Sterling, B., Haratifar, S. and Naing, S.K. (2014), "Comparison of Global Food Traceability Regulations and Requirements", *Comprehensive Reviews in Food Science and Food safety,* Vol. 13, pp. 1104-1123.

Chen, E., Flint, S., Perry, P., Perry, M. and Lau, R. (2015), "Implementation of non-regulatory food safety management schemes in New Zealand: A survey of the food and beverage industry", *Food control*, Vol. 47, pp. 569-576.

Chryssochoidis, G., Karagiannaki, A., Pramatari, K. and Kehagia, O. (2009), "A cost-benefit evaluation framework of an electronic-based traceability system", *British Food Journal*, Vol. 111, pp. 565–582.

Donnelly, K.A.M., Thakur, M. and Sakai, J. (2013), "Following the mackerel e cost and benefits of improved information exchange in food supply chains", *Food Control*, Vol. 33 No. 1, pp. 25-31.

Epelbaum F.M.B. and Martinez, M.G. (2014), "The technological evolution of food traceability systems and their impact on firm sustainable performance: A RBV approach", *International Journal of Production Economics,* Vol. 150, pp. 215-224.

Fritz, M. and Schiefer, G. (2009), "Tracking, tracing, and business process interests in food commodities: a multi-level decision complexity", *International Journal of Production Economics*, Vol. 117, pp. 317–329.

Gawron, J. and Theuvsen, L. (2009), "The international food standard: bureaucratic burden or helpful management instrument in global markets? Empirical results from the German food industry", *Journal of International Food and Agribusiness Marketing*, Vol. 21 No. 4, pp. 239-252.

Golan, E., Krissoff, B., Kuchler, F., Calvin, L., Nelson, K. and Price, G. (2004), "Traceability in the US food supply: Economic theory and industry studies" Agricultural economic report n. 380. Economic Research Service, United States Department of Agriculture (USDA).

Hall, D. (2010), "Food with a visible face: Traceability and the public promotion of private governance in the Japanese food system", *Geoforum*, Vol. 41, pp. 826-835.

Heyder, M., Theuvsen, L. and Hollmann-Hespos, T. (2012), "Investments in tracking and tracing systems in the food industry: A PLS analysis", *Food Policy*, Vol. 37, pp. 102-113

Hobbs, J.E. (2004), "Information asymmetry and the role of traceability systems", *Agribusiness*, Vol. 20 No. 4, pp. 397-415.

Holleran, E., Bredahl, M.E., Zaibet, L. (1999), "Private incentives for adopting food safety and quality assurance", *Food Policy*, Vol. 24 No. 6, pp. 669-683.

Hu, J., Zhang, X., Moga, L. M. and Neculita, M. (2013), "Modeling and implementation of the vegetable supply chain traceability system", *Food Control*, Vol. 30 No. 1, pp. 341-353.

Jayasinghe-Mudalige, U. and Henson, S. (2007), "Identifying economic incentives for Canadian red meat and poultry processing enterprises to adopt enhanced food safety controls", *Food control*, Vol. 18, pp. 1363-1371.

Karlsen, K.M., Dreyer, B., Olsen, P. and Elvevoll, E.O. (2013), "Literature review: does a common theoretical framework to implement food traceability exist?", *Food Control*, Vol. 32, pp. 409-417.

Karlsen, K.M., Dreyer, B., Olsen, P. and Elvevoll, E.O. (2012), "Granularity and its role in implementation of seafood traceability", *Journal of Food Engineering*, Vol. 112 No. 1-2, pp. 78-85.

Lavelli, V. (2013), "High-warranty traceability system in the poultry meat supply chain: a medium-sized enterprise case study", *Food Control*, Vol. 33 No. 1, pp. 148-156.

Liao, P.A., Chang, H.H. and Chang, C.Y. (2011), "Why is the food traceability system unsuccessful in Taiwan? Empirical evidence from a national survey of fruit and vegetable farmers", *Food Policy*, Vol. 36, pp. 686-693.

Mai, N., Bogason, S.G., Arason, S., Arnason, S.V. and Matthiasson, T.G. (2010), "Benefits of traceability in fish supply chains e case studies", *British Food Journal*, Vol. 112 No. 8-9, pp. 976-1002.

Manos, B. and Manikas, I. (2010), "Traceability in the Greek fresh produce sector: drivers and constraints", *British Food Journal*, Vol. 112 No. 6, pp. 640-652.

McEntire, J. C., Arens, S., Bernstein, M., Bugusu, B., Busta, F. F., Cole, M., et al. (2010), "Traceability (product tracing) in food systems: an IFT (Institute of Food Technology) report submitted to the FDA (Food and Drug Administration), volume 1: technical aspects and recommendations", *Comprehensive Reviews in Food Science and Food Safety*, Vol. 9, pp. 92-158.

Olsen, P. (2009), "Food traceability process mapping. Standard method for analysing material flow, information flow and information loss in food supply chains". In K.A.M. Donnelly, and P. Olsen (Eds.), *Harmonizing methods for food traceability process mapping and cost/benefit calculations related to implementation of electronic traceability systems* - Workshop hosted by Nofima association with the trace project 25-26th February 2009. Tromsø, Norway: Nofima, ISBN 978-82-7251-679-5, Report 15/2009.

Pouliot, S. and Sumner, D.A. (2013), "Traceability, recalls, industry reputation and product safety", *European Review of Agricultural Economics*, Vol. 40 No. 1, pp. 121-142.

Resende-Filho, M.A. and Hurley, T.M. (2012), "Information asymmetry and traceability incentives for food safety", *International Journal of Production Economics*, Vol. 139, pp. 596-603.

Ruiz-Garcia, L., Steinberger, G. and Rothmund, M. (2010), "A model and prototype implementation for tracking and tracing agricultural batch products along the e food chain", *Food Control*, Vol. 21, pp. 112-121.

Saltini, R. and Akkerman, R. (2012), "Testing improvements in the chocolate traceability system: Impact on product recalls and production efficiency", *Food Control*, Vol. 23 No. 1, pp. 221-226.

Schulz, L.L., and Tonsor, G.T. (2010), "Cow-calf producer preferences for voluntary traceability systems", *Journal of Agricultural Economics*, Vol. 61 No. 1, pp. 138-162.

Senneset, G., Forås, E. and Fremme, K. (2007), "Challenges Regarding Implementation of Electronic Chain Traceability", *British Food Journal*, Vol. 109, pp. 805-818.

Shamsuzzoha, A.H.M., Ehrs, M., Addo-Tenkorang, R., Nguyen, D. and Helo, P. T. (2013), "Performance evaluation of tracking and tracing for logistics operations", *International Journal of Shipping and Transport Logistics*, Vol. 5 No. 1, pp. 31-54.

Shwagele, F. (2005), "Traceability from a European perspective", *Meat Science*, Vol. 71 No. 1, pp. 164-173.

Smith, G.C., Tatum, J.D., Belk, K.E., Scanga, J.A., Grandin, T. and Sofos, J.N. (2005), "Traceability from a US perspective", *Meat Science*, Vol. 71, pp. 174-193.

Starbird, S.A. and Amanor-Boadu,V. (2006), "Do inspection and traceability provide incentives for food safety? ", *Journal of Agricultural Resource Economics*, Vol. 31, pp. 14-26.

Wilson, W.W., Henry, X. and Dahl, B.L. (2008), "Costs and risks of conforming to EU traceability requirements: the case of hard red spring wheat", *Agribusiness*, Vol. 24, pp. 85-101.

Wu, S.L. (2012), "Factors influencing the implementation of food safety control systems in Taiwanese international tourist hotels", *Food Control*, Vol. 28, pp. 265-272.