

# Investigating Stakeholder Perceptions of ISO Management Systems in the UK Agricultural Sector

Christopher Bamber

Business and Management Department, Organisational Learning Centre, Greater Manchester, UK  
[cbamber@olceurope.com](mailto:cbamber@olceurope.com)

Enis Elezi\*

Business and Management Department, Organisational Learning Centre, Greater Manchester, UK  
[eelezi@olceurope.com](mailto:eelezi@olceurope.com)

Li Guoxi

Zhongshan, Guangdong province, Educational Bureau, China  
[agrilinguoxi@126.com](mailto:agrilinguoxi@126.com)

## Abstract

This paper considered perceptions from a relatively small sample of case studies but acknowledges other respondents views have been triangulated to an extent that verifies the samples used are representative of the UK agricultural supply chain. The present study provides a starting-point for further research into the adoption and uptake of ISO management systems standards in the UK agricultural sector and its supply chain. Therefore this paper does not explore the relationships between adoption of ISO management systems and the impact of them it rather explores perceptions of different ISO management systems from stakeholders viewpoints. Following an extensive review of stakeholder perceptions this paper concludes that the uptake of ISO management systems in the UK will continue and more areas of the agriculture supply chain will feel obliged to certify their management systems to a wider range of standards than just the well known quality management and environmental management system standards. The extensive certification of ISO management systems in the UK is well known and this paper focuses on acceptance and perceptions of such standards in the UK agricultural sector. The research identified a lack of understanding and hence encourages agricultural specialists, teachers and policy makers to provide information to the agricultural sector regarding the value and scope of ISO management systems in supporting best practice and identification of regulatory compliance issues. This paper is significant in that it has acknowledged an uptake and trend in certification of management systems within the agricultural sector in the UK but has identified a lack of understanding of such systems amongst stakeholders of the agricultural supply chain. Finally, the paper clearly shows many noteworthy opportunities for further certified management systems research within the worldwide agricultural supply chain.

**Keywords:** ISO standards, management systems, stakeholder perceptions, agriculture, food safety, food control

## 1. Introduction and Justification for the research

The UK agriculture and related food processing sector is highly regulated with both government and consumers expecting complete control and traceability of products and food safety (Green and Kane, 2014; Abdul Halim Lim *et al.*, 2017). Accordingly and in response to consumer and legislative pressures, certification of agricultural systems and related products in the UK agricultural sector is big business. For instance the Scottish based agricultural assessment centre, SFQC (2014) declare that:

“Each year we certify over 16,000 farms, food processors and food related companies on behalf of a broad range of businesses, organisations and public sector bodies who want independent assurance that their specified standards have been met (SFQC, 2014).”

More specifically market analysis shows that for, International Organisation for Standardisation (ISO) management systems certification, the UK top three [*SGS, LRQA and BSi*] United Kingdom Accreditation Services (UKAS) accredited certifying bodies all declare agricultural management systems as part of their portfolio of ISO assessment services, UKAS (2014). The number of farms within the UK is in the region of 300,000 with an average size of 57 hectares and they are considered to be relatively larger when compared with the average size of European Union farms (16.1 hectares average across EU-28, Eurostat 2017). According to The World Bank (2013) the agricultural sector in the UK employs 1 % of the workforce and their profits reach just above medium annual earnings salary of £22,000, while the UK Government (2016) suggest a larger figure and the industry represents approximately 1.8% of the workforce in Great Britain. The National Farmers Union, NFU (2016) have said that there are more farm business than the number of businesses involved in the motor trade, education, finance and insurance and go on to say; “...success stories from British manufacturing, services and construction sectors have been scarce in recent years, yet the reality is that the fields and farms of Britain have yielded impressive growth.”

The agriculture sector in the UK is categorised as organic, conventional and integrated and likewise almost every food product within the UK supply chain is produced in accordance with quality assurance schemes that meet the regulations and fulfil quality and environmental standards while also allowing full traceability of the product. According to the UK Department for Environment Food and Rural Affairs (DEFRA) total income from farming in 2012 decreased by up to £4.70 billion. This was arguably as a result of adverse weather conditions. A report published by DEFRA (2014) for farm income in England, forecasts a decrease of income by 28 percent on cereal farms and 8 percent on general cropping farms. However, the GB consumer liquid milk market comparing 2014 with 2013 shows that total market value shows growth, both in the volume growth and the higher average milk prices (1.3%) with more GB households buying milk and more GB households buying more milk per supermarket visit, Kantar Worldpanel (2014).

UK agriculture has therefore had mixed publicity in the press, as on the one hand there have been a lot of consumer pressure following failures to meet regulation and quality control requirements, while on the other hand certain markets such as milk products is confidently growing in consumer demand. In support of growing demand alongside the growing concern the agricultural sector is embracing various local certification schemes, European regulatory frameworks such as Regulation 1166/2008 (see Eurostat, 2017) and globally recognized standards such as the International Organisation for Standardisation series of management system standards. The National Farmers Union (NFU, 2016) represent UK farming communities and they have noted recently that: "Part of what makes farming unique is its structure with over 90 per cent of British farms made up of sole traders or family partnerships." The NFU continue to say that agriculture and particularly farming remains an industry characterised by family farming businesses. The uptake of ISO standards is not restricted to large companies and there is evidence that sole traders, small companies, family partnerships and family businesses are equally likely to certify their management systems to ISO requirements, (Psomas, Kafetzopoulos and Fotopoulos, 2013). Although within the agricultural sector regulatory frameworks do not insist on adoption of ISO management standards it is widely considered by all regulators that certification to an ISO management system demonstrates adoption of best practice. Likewise, McMahan and Desta (2012) discuss how legislation relates to management system standards with reference to new and emerging issues in international agricultural trade law.

## 2. Methodology

Initial exploratory research by experienced academics, agriculturalist practitioners and the authors of this paper carried out over the two year period leading up to a conference in Thessaloniki at the American Farm College indicated a need for the UK agricultural sector to develop an understanding of certified management systems, Bamber et al., (2014). During this period the authors of this paper participated, attended and networked at a host of agricultural events in the UK and obtained anecdotal evidence from agricultural supply chain specialists. That initial exploratory research and anecdotal evidence from various supply chain partners had identified that the agricultural sector in the UK was adopting frameworks, EU regulations, global certification schemes and local industry targeted standards but little has been documented about the role of International Standards and in particular the ISO series of certifiable management system standards. Hence, the research team comprising of 4 senior academics from Business Schools and a Professor of Agriculture Science identified through a brainstorming session the research problem and question which was finally considered as:

*"ISO management systems are present in the UK agricultural sector but which ones and to what extent are those ISO management systems perceived as relevant within the sector?"*

Identification of that research problem and question focused the researchers in conducting a literature review that was directed to identify which and to what extent ISO management systems were present in the UK and consequently which are present in the agricultural sector. Following the literature review and for the purpose of this research, primary and secondary data has been collected and analysed. The primary data regarding the world top seven most popular ISO management system standards and the relevance of those top seven ISO management system standards to the agricultural sector were determined via semi structured interviews held over the telephone with representatives of the three top UK certification bodies, discussions with staff members of 12 case study organisations and representatives of the agricultural supply chain. This mix of representative respondent groups provided saturation in responses indicating further primary data collection was not necessary. This saturation overcomes any argument that responses do not come from the highest market share of UK certification bodies, moreover, the data collected is considered by the researchers, representative of perceptions of the UK agricultural sector. Additionally, secondary data was collected through rigorous research of archival data collected from FSA (Food Standards Agency), the International Standard Organisation (ISO), DEFRA (Department for Environment, Food and Rural Affairs), UKAS (United Kingdom Accredited Services) and SFQC (Scottish Food Quality Certification).

The analysis of the data collected allowed the researchers to answer the research problem and question and further helped to identify the implications such ISO management systems have on the UK agricultural sector. During the collection of data it was identified that an eighth certifiable management system standard was being

developed by ISO and that was due to be published in 2017. That standard is the ISO 45001 Health and Safety Management Systems standard and currently in the UK its predecessor OHSAS 18001 is being adopted which stands for Occupational Health and Safety Assessment Specification.

This research approach has led to development of the following guiding research objectives that continued to focus the epistemological stance and data collected by the research team.

- Identify the implications of adoption ISO management systems in the UK agricultural sector.
- Classify the popular ISO management systems within the context of the UK agricultural sector.
- Categorise the operational areas within the agricultural sector that have embraced ISO management systems or are likely to adopt them.
- Discuss UK agricultural sector evidence that illustrates the benefits of ISO management systems application.
- Elicit the perceptions of ISO management systems certification in the UK agricultural sector stakeholder

### 3. Research Findings and Analysis

The sources of the findings mainly come from the regulatory authorities for the agricultural sector in the UK and from the International Organisation for Standardisation statistics. Further to those sources the research team elicited information from United Kingdom Accreditation Services (UKAS) accredited ISO certifying bodies. This has been supported with elicited information, perceptions and opinions collected from unstructured interviews with sector representatives and in particular discussions with staff members of the 12 case study organisations. Consequently, the following sections summarise the research findings and outline the scope of ISO management systems standards adoption in the UK agricultural sector. Those sections also provide an overview and description of the likely impact, benefit and uptake of the seven ISO management systems under investigation in the UK agricultural sector.

#### 3.1 UK Food Standards Agency (FSA) view of ISO management systems

The UK Food Standards Agency (FSA) is responsible for developing policy and enforcing frameworks for safety and food hygiene across the UK, which includes four distinct geographical regions; a) England, b) Wales, c) Scotland and d) Northern Ireland. The FSA works with local authorities to enforce food safety regulations and also with the UK government's Department for Environment Food and Rural Affairs (DEFRA), FSA in Wales, FSA in Scotland and FSA in Northern Ireland (FSA, 2014). The FSA operates with a remit that covers five main areas of responsibility as shown in table 1; a) policy and advice, b) business and industry, c) legislation, enforcement and regulation, d) science and research and d) media management. Those five areas of responsibility cover many sub-areas as shown in table 1 which indicates the extent of the agricultural supply chain. Even though the espoused values of the FSA concern; i) putting the consumer first, ii) openness and transparency, iii) science and evidence based, iv) acting independently and v) enforcing food law fairly, which overlap the principles of continual improvement as expected by ISO management systems certification, the FSA said during interview it does not explicitly promote ISO certification. The seven ISO management system standards considered in this research contain requirements for organisations to consider 'the context of their organisation'. With respect to the FSA enforcing regulatory compliance that particular ISO requirement means [UK agricultural] organisations must be aware of the role of FSA firstly, as a stakeholder and, secondly as an enforcement authority.

As a result of scandals in the food industry the concerns and awareness of consumers are increasing and setting more pressure on food companies to be more transparent in their quality control endeavours. For instance, throughout the whole cereal food chain, starting from the seed to the final processed product and distribution, there are many steps where the process might, intentionally or not, be compromised from a quality control point of view (Trienekens and Zuurbier, 2008; Karaman, *et al.*, 2012; Wyness *et al.*, 2012). Consequently, food safety and security becomes a necessity in achieving and maintaining an outstanding service. This phenomenon has generated international quality standards utilized to eliminate any unpleasant scenario and offer products that would be safe to consume. On one hand, the implementation of these standards increases the marginal costs, utilizes more resources and compromising organisations profits'. On the other hand embracing such standards adds value to the enterprise in the long run, improving the relationship with suppliers, employers, customers and appearing as socially responsible businesses (Giraud - Héraud *et al.*, 2012; Lee *et al.*, 2012; Gould, 2013). So, this conflict of high costs in the short term and business development in the long term seems to be the issue that many farmers are facing. Generally speaking, in the UK farmers are becoming more aware of quality systems introduced by the International Organisation for Standards (ISO) and implementing those, aiming to add value to their products (Madsen, *et al.*, 2012; Hu *et al.*, 2012).

**Table 1: UK FSA Areas of Responsibility (indicating the extent of the UK food supply chain)**

<b>Policy and Advice</b>	
Additives E numbers Allergy and intolerance Bisphenol-A(BPA) BSE Food poisoning GM foods Hygiene ratings	Importing food Incidents Irradiated food Mycotoxins Novel foods Packaging Pesticides Radioactivity in food
<b>Business and industry</b>	
Catering and retail Farming Meat plants Manufactures Guidance notes	Imports Exports Wine Industry committees Industry publications
<b>Enforcement and regulation</b>	
Approved premises Audit of local authorities Enforcement strategy and tools Training and funding Food alerts	Monitoring Regulation and legislation Search for a local authority Enforcement committees
<b>Science and research</b>	
Applying for research funding Management and policy Research reports	FSA approach to science Scientific committees
<b>Media management</b>	
Food alerts news Allergy alerts news	Consultations Campaigns

*Source: FSA (2014)*

### 3.2 Certification to International Management System Standards

The adoption and certification of international management systems standards has been growing steadily since the introduction in 1987. Since 1987 the acknowledged popularity of certifiable management systems by the International Organisation for Standardisation has led to development of variations of the quality management standard such as ISO/TS 16949 for the automotive sector and ISO 13485 for the medical devices supply chain. Moreover, management system standards have extended beyond the scope of quality and include ISO 14001 for environmental systems, ISO 27001 for information systems security and the likes of ISO 22000 covering food safety systems. The International Organisation for Standardisation released the results of its 2014 survey of management systems certifications which show increased adoption across the range of standards. This is an annual study showing the number of certificates issued to management system standards in the previous year. A summary of the statistics from that study is shown in table 2 below which lists the top seven certified ISO management system standards in terms of actual standards published and distributed by ISO.

**Table 2: The ISO Survey of Management System Standard Certifications – 2014**

Standard	Number of certificates in 2014	Number of certificates in 2013	Annual Increase (in numbers)	Annual increase (in %)
ISO 9001	1 138 155	1 126 460	11 695	1 %
ISO 14001	324 148	301 622	22 526	7 %
ISO/TS16949	57 950	53 723	4 227	8 %
ISO 13485	27 791	25 655	2 136	8 %
ISO 27001	23 972	22 349	1 623	7 %
ISO 22000	30 500	26 847	3 653	14 %
ISO 50001	6 778	4 826	1 952	40 %
<b>TOTAL</b>	<b>1 609 294</b>	<b>1 561 482</b>	<b>47 812</b>	<b>3 %</b>

Analysis of table 2 shows that the greatest percentage growth was with ISO 50001, which covers energy management systems, a relatively new introduction to management standards. It was published in mid-June 2011 and certifications started soon after that. According to the International Standards Organisation, up to the

end of December 2014, it was noticed that at least 6,778 ISO 50001: 2011 certificates were attained, a growth of 40% (+1,952). Additionally, food scandals occurred in the past have increased the awareness of food safety management practices within food related businesses which have had an impact on the increase of ISO 22000 which appears from table 2 to have the second largest increase by 14% (+ 3,653). The positive trend of ISO implementation continuous to grow and relevance of uptake in the UK agricultural sector is provided in table 3 showing the title of the standard and areas within the sector were applicable.

### 3.3 Benefits of ISO Certification of Management Systems in Agriculture

Agriculture certification, inspection and testing according to Stewart (2016) provides great benefits to consumers by ensuring that the products they acquire comply with a set of norms and ecological procedures that come from sustainable standards such as ISO 9001, 22001, 14001 and ISO 27001. It also benefits agriculture workers, farmers and producers by adopting a certification program that is linked to promoting improved working conditions. These certifiable management standards encourage continuous improvement through the adoption of the widely recognised processes of the plan, do, check and act cycle (Sampaio *et al.*, 2012). It also provides an opportunity for small-scale agriculture workers to stay in business thanks to the support of consumers that are willing to pay a higher price for products from certified sources (De Vries *et al.*, 2012). Certification also benefits local communities, governments and society in general since they receive much more income from exports, foreign investment and capacity building.

A less commonly adopted management standard in Agriculture would be certification to ISO 27001, but that is not to say that this is not useful for the agricultural sector. Intellectual property, data protection and data security are becoming more of an important issue in a global agricultural marketplace (Santos *et al.*, 2013) and adoption of a management system may help control data security, particularly the use of ISO 27001. Furthermore, a major important issue in the agricultural sector is occupational health and safety, accordingly this research paper presents a short review of the uptake of certified health and safety schemes in the UK. Often seen as a higher risk sector than other sectors, agriculture is closely monitored in the UK by the Government Body, The Health and Safety Executive (Prajogo *et al.*, 2012).

### 3.4 The Potential Rewards of ISO Certified Systems

The potential rewards within the agricultural sector are related to lower costs from reduced input use or lower premiums and increased revenue from new customers or market premiums. That is because all these management standards are based on the fundamental premise that continuous improvement is at the heart of a successful and controlled business (Tricker, 2013). Likewise, ISO Certification has become a most critical pre-requisite, world over. It is argued by Prajogo *et al.*, (2012), Sampaio *et al.*, (2012) and Tricker, (2013) that there is no better guarantee than ISO Certification in earning the buyer's confidence and recognition for a product, internationally. Therefore, for the UK agricultural sector, ISO standards ensure characteristics such as data security, quality, ecology, safety, economy, reliability, efficiency and effectiveness of the supply chain. These standards arguable facilitate global trade, spread knowledge, and share technological advances and promote good management practices.

### 3.5 Certified Agricultural Related Products

Within management systems it is expected that there is control of products as well as management of processes and as such certified products from the agricultural supply chain can be characterized with a special label known as the "ecolabel" (Youssef and Abderrazak, 2009; Brécard *et al.*, 2012; Daugbjerg *et al.*, 2014). This label guarantees to the consumer that the product or service follows the criteria for environmental care. Environmental labelling is defined according to the ISO 14020 as a set of voluntary tools aimed at stimulating the demand for products and services with lower environmental burdens as provides relevant information on their life cycle to address consumer requirements. Many agricultural companies such as Dalefarm, are now considering the environmental consequences of their activities as means to obtain competitive advantage (Dalefarm, 2014). The shift is highlighted by the significant interest found in ISO 14000. Government policy makers are also interested in the ability of such standards to address agriculture environmental concerns that lead to reduction in negative environmental impacts (Zobel, 2013).

### 3.6 The certification body view of management standards uptake in agricultural

The list of the top seven most popular management standards are also shown below in table 3 which has been compiled after telephone discussions with three UK certification bodies and unstructured interviews with agricultural supply chain representatives, between January 2015 and June 2016 in order to ascertain their views on which area of agriculture those standards may be most relevant too, based on their opinions of future certification uptake within the sector.

**Table 3: The certification body view of management standards uptake in agricultural sectors**

Standard Number	Title of Standard	Agricultural Operational Area
ISO 9001:2015	Quality Management Systems	All operational areas of Agricultural Management
ISO 14001:2015	Environmental Management Systems	All operational areas of Agricultural Management
ISO/TS 16949: 2009	Quality Management System Requirements for the Automotive Sector	Agricultural Machinery Manufacturers, Farm Vehicles Manufacturer, Agricultural Automotive Supply Chain
ISO 13485: 2016	Quality Management System Requirements for Medical Devices	Veterinary Equipment Suppliers and Manufacturers
ISO/IEC 27001: 2013	Information Security Management systems	Specialist Livestock Farmers, Pharmaceutical Companies, Agricultural Research and Development Centres, Advertising, Marketing and PR, Educators and Training providers
ISO 22000: 2005 [revision underway and due 2017]	Food Safety Management systems	Farm Stockists, Farming, The Food Supply Chain
ISO 50001: 2011	Energy management Systems	Large Government Organisations, Power Hungry Farming, Alternative Energy Producers such as Bio Technology Plants, Chemical Process Industry
OHSAS 18001 and ISO 45001 [Expected publication date December 2017]	Occupational Health and Safety Systems	All aspects operational areas

### 3.7 Findings related to Management Systems uptake in the UK agricultural sector

The agricultural sector is a comprehensive and extensive sector with interrelated supply chains and as such table 3, although not necessary exhaustive, shows that international standards can be and have been adopted across a wide range of agricultural related industries and organizations. The agricultural sector as shown in table 3 is heavily supported by the transport, energy and chemical industries and has customers and consumers of pharmaceuticals, food and other processing industries.

The UK's diverse agricultural production base also means a demand for a range of specialist inputs and services. Table 4 has been created from the findings and discussions with the 12 case study organisations that support agriculture and thus to some degree represent the complex agricultural supply chain. These interrelated industries within the realm of agriculture are further discussed in the following sections with regard to each of the eight management systems and their relevance to the UK agricultural sector.

Further to discussion of the findings related to the uptake and acceptance of ISO management system standards the certification bodies recognize that occupational health and safety is vital within the agricultural sector. Consequently, the top three certification bodies in the UK are actively preparing for and promoting occupational health and safety (OHS) management systems certification. This is therefore included in table 4 and also discussed in section 3.7.8 alongside the sector stakeholder views of OHS management systems.

The 12 case study organisations, shown in table 4, all operate within the UK and include small to medium sized organisations (SMEs) and large Public Limited Companies (PLCs) and they are all registered businesses with the UK government Companies House, CH (2016). Each of the 12 case study organisations shown in table 4 have achieved and maintained certification to one or more of the eight management systems standards being investigated by this research. Like suggested in table 2 the ISO Survey 2014 indicated, the largest number of certifications across these 12 case study organisations is ISO 9001 quality management and ISO 14001 environmental management demonstrating the popularity of these standards within the agricultural supply chain. Incidentally, OHSAS 18001 occupational health and safety assessment framework was well understood by the case study organisations but not all of them saw it necessary to achieve and maintain certification to a health and safety related certifiable standard. The United Kingdom Standard Industrial Classification of Economic Activities (SIC) are used to classify business establishments by the type of economic activity in which they are engaged, (ONS, 2017). The SIC codes, taken from Companies House, are presented for each case study organisation as shown in table 4 which gives an indication of their categories of operation within the UK agricultural supply chain, Companies House (2016).

**Table 4: The 12 case study organisations uptake of management standards**

The UK agricultural sector supply chain case study organisations	Management System Certification							
	ISO 9001	ISO 14001	ISO/TS 16949	ISO 13485	ISO 27001	ISO 22000	ISO 50001	OHSAS 18001
HydraPower Dynamics Ltd 25620 – Machining; 25990 - Manufacture of other fabricated metal products not elsewhere classified	Y	Y	Y					
Pektron [PLC] 26110 - Manufacture of electronic components	Y	Y	Y					
Veolia [including Dalkia] 35110 - Production of electricity; 35300 - Steam and air conditioning supply; 42220 - Construction of utility projects for electricity and telecommunications; 96090 - Other service activities not elsewhere classified	Y	Y						Y
Steller packing UK Ltd 82990 – Packaging suppliers and Other business support service activities not elsewhere classified	Y					Y		
Kerry Foods UK [PLC] 10130 - Production of meat and poultry meat products	Y	Y				Y		
UK Mail [Supply Chain Logistics] 53201 - Licensed carriers; 53202 - Unlicensed carrier	Y	Y			Y			
Daray Medical Ltd [veterinary] 46690 - Wholesale of other machinery and equipment	Y			Y				
Ultrawave UK 27900 - Manufacture of other electrical equipment	Y			Y				
FGS Agri Ltd 01110 - Growing of cereals (except rice), leguminous crops and oil seeds; 01420 - Raising of other cattle and buffaloes; 01610 - Support activities for crop production	Y	Y						Y
Viridor Ltd 82990 – waste management and Other business support service activities not elsewhere classified	Y	Y					Y	Y
Huhtamaki BCP Ltd 17211 - Manufacture of corrugated paper and paperboard, sacks and bags	Y	Y					Y	Y
Carrs Billington Agri UK Ltd 10910 - Manufacture of prepared feeds for farm animals		Y						

Those 12 case study organisations shown in table 4 provided, during correspondence either by phone or email, their views on their commitment and understanding of certification to management system standards. Consequently, each case respondent from each study organisation was asked about their knowledge of all the eight management systems being investigated and the expected applicability in the agricultural supply chain. For each of the management systems examined, the knowledge elicited from this case study data collection is discussed in the next sections along with the findings from discussions with certification bodies and secondary data gathered from other agricultural sector stakeholders.

### 3.7.1 Quality Management Systems

The quality management systems ISO 9000 series is a set of standards created and presented by the International Organisation for Standardisation (ISO) which intend to build and sustain quality assurance systems implemented into the manufacturing and service sectors. The significance of ISO 9001 demonstrates that any enterprise will assure its processes in accordance with the documented requirements to accomplish contractual responsibilities and customer needs (Zobel, 2013). ISO 9001: 2015 therefore encourages compliance to the specific standards that any organisation needs to accomplish. Likewise, the popularity and support of ISO9001 is demonstrated with 11 of the 12 case study organisations shown in figure 4 obtaining certification to the standard. Although one case study was not certified to ISO 9001 it was operating a quality management system in line with the

standard and the Group it belonged to have been actively encouraging certification to quality management systems.

The agriculture sector includes both the manufacturing and service industry. As a result implementation of ISO 9001: 2015 is seen as supporting the overall performance of the UK agricultural sector, for instance there is much evidence that fertilizer processing and sales, farm vehicles, seed merchandising and farm supplies are produced by certified companies. According to Psomas *et al.*, (2013) and Heras-Saizarbitoria *et al.*, (2013a) implementation of ISO 9001 was first tracked by the manufacturing sector. However, considering the trends of economic developments in the agricultural sector, where services occupy a larger stake of actors, ISO 9001 is embraced by services companies (Lam, *et al.*, 2012; Dora, Kumar *et al.*, 2013) such as agricultural education and training providers, farm utility providers, staffing and recruitment services and plant after sales service providers. Accordingly, adaptation of ISO 9001 across the supply chain assures the farms build an efficient management system consisting of structured processes, waste management, eliminating errors and fostering continuous improvement (Hudson and Orviska, 2013). According to Kafel (2013) and Halaseh and Sundarakani (2012) implementation of ISO 9001 will assist farms in:

- spotting errors easily and quicker,
- updating and adjusting the farm's objectives,
- enhancing the relationships with the suppliers and customers,
- improving efficiency in terms of time and resources,
- clearly identifying roles and responsibilities and
- contributing to the overall image of the farm and its products.

This research found that anecdotally the case study organisations suggest the agricultural supply chain embracing ISO 9001 highlighted its crucial impact towards enhancement in productivity and a higher level of customer satisfaction. Additionally, other research has shown farm managers noticed a decrease of costs as a result of eliminating internal pitfalls which has been confirmed by Heras- Saizarbitoria and Boiral (2013 b). Similarly a survey published by the British Journal of Food notice, in ISO 9001 farm businesses, a decrease of internal failures by 40 percent and an increase of 54 percent of returning customers (Tunalioglu *et al.*, 2012).

### 3.7.2 Environmental Management Systems

The 12 case study organisations recognise that environmental management systems ISO 14001, similarly to ISO 9001, can be adopted from any organisation regardless of the sector. In comparison to ISO 9001 where the focus is on quality of the product or service, ISO 14001 considers the environmental impact of any enterprise. Standards of ISO 14001 are grouped as evaluating and auditing tools, management systems of standards and support on tools of production or service (Castillo- Barrera *et al.*, 2013). Environment is a common concern for any company, however, when it comes to farming and food production there is a higher interest as it influences production, consumption and to some extent the economic level of regions and countries. Therefore, UK farms have increasingly acknowledged implementation of the ISO 14001 framework as a sign of fostering sustainable agriculture and minimising the possible negative effects caused by society (White *et al.*, 2014). Moreover, this internationally recognised standard contributes to the financial aspect, by waiving any required registration or bureaucratic procedures (UKAS, 2014). In addition, farms implementing ISO 14001 set informing labels on their products, which strengthens their competitive advantage by representing the aspect of corporate socially responsibility (To and Tang, 2014). However, from a farming perspective, Dora *et al.*, (2013) and Marimon *et al.*, (2011) argue that it is quite challenging to have a finalised template or guideline to apply ISO 14001 uniformly among every farm in the UK. It is not surprising that of the 12 case study organisations nine of them have already achieved ISO 14001 certification while the remaining three indicated that they will aim to achieve the standard. This is due to the type and surface of the farm, technology utilized, range of products and frequency, managerial practices and operations. Consequently, the successful implementation of ISO 14001 might differ as a result of several factors; however respondents suggest its benefits are visible on managerial practices related to waste and pollution management and cutting internal operational costs (Marimon *et al.*, 2011).

### 3.7.3 Automotive Quality Management Systems

Introduced in 2002 based on the foundations of ISO 9001, the objective of ISO 16949 is to serve as a technical standard for the development of quality management systems. Its focus is on detecting and preventing errors, variation and waste in the automotive supply chain by applying principles of continuous improvement particularly using statistical quality control methods (UKAS, 2014). The extensive development of technology is commonly stretched among the agricultural sector as well, where farmers have continuously aimed to enhance farms' productivity. As a result of high demands regarding the quantity of products, processed or raw, there is a propensity of the farming transport supply chain to approach ISO 16949 as a technique of fulfilling customer expectations faster (Castillo-Barrera *et al.*, 2013; Dangwal and Chaubey, 2013). Only two of the 12 case study organisations, which are incidentally large corporations, have achieved certification to ISO 16949 but this is not seen as a standard that is less welcome in the sector, moreover the applicability across the supply chain is limited to the automotive related industry. Nevertheless, implementation of ISO 16949 is slowly being integrated into

the agricultural sector and in particular transport supply chain experts within the UK are becoming more aware of the impact of the standard. It is being adapted into the manufacturing sector of agricultural machineries, farm vehicles manufacturer and agricultural supply chains as table 4 shows. ISO 16949 is therefore applicable to the design, development, and installation of products related to automated machines and requirements are applied amid the supply chain (Šurinová, 2013). The research, although identified from respondents' interest in the agricultural sector, indicated that this management system standard is not as popular or widely adopted as others.

#### 3.7.4 Medical Devices Quality Management Systems

The medical devices quality management systems ISO 13485 is essential for utilization in any organisation that is directly or indirectly related to the medical or pharmaceutical supply chain. Likewise, two of the case study organisations have adopted the ISO 13485 management standard but on the other hand indicated that the agricultural sector was only a small part of their income portfolio. Having said this, the agricultural sector can clearly make a positive usage of this standard, particularly within the veterinary equipment suppliers and animal pharmaceutical firms. ISO 13485 aim is to facilitate regulatory requirements for medical devices this includes adoption of the standard in the agricultural sector. Commonly, in terms of application ISO 13485 is synchronised with ISO 9001 (Leppala *et al.*, 2013). The successful implementation of this medical devices quality management standard consists of accomplishing a risk analysis of product development, validating the processes, agreeing to statutory and regulatory requirements and establishing effective product traceability as described by Thuemmler *et al.*, (2013), Nerbrink and Mitchell (2012) and Mc Caffery *et al.*, (2012). Additionally, adhering to this standard reduces operational costs of medical devices that for instance will benefit veterinary practices, as a result of continuous improvement and strengthens the relationship between stakeholders. Therefore, obtaining ISO 13485: 2016 demonstrates that the supply chain fulfils requirements for a quality management system regarding any medical device and service. In the agricultural context this improves the image of the animal related farm activities and among suppliers, provides a safe environment for employees and customers are more appreciative towards such practices.

#### 3.7.5 Information Security Management Systems

The information management systems standard, ISO 27001, can be implemented in any industry where its main focus is to provide security on the volume and value of an organisation's data. As a result of globalisation and directives set by governments, farms are seeking the implementation of ISO 27001 as an approach that would support a sound information management system (Susanto *et al.*, 2012). Likewise, farms in the UK aiming to extend the market presence or encompass a range of products, are considering ISO 27001 as a pre-requisite for enhancing their businesses. Within the UK any business enterprise is required by the Data Protection Act (DPA) to assure the confidentiality of customers' data. However, the DPA does not guide on the protection of data, whereas, ISO 27001 deliberates the traits to achieve an effective information security management system (ISMS) (Sheikhpour and Modiri, 2012; Sharma and Dash, 2012; Hoy and Foley, 2014). Accordingly, the ISO 27001 standard pinpoints the required guideline and steps to generate, utilize, maintain and approach continuous improvement within the ISMS. Requirements of 27001 are general and aim at an extensive application regardless of the size and type of agricultural business by helping managers to maintain their information safety (Crowder, 2013).

Only one of the 12 case study organisations is certified to ISO 27001 and the agricultural supply chain is not a main target for that organisation which is probably indicating that ISO 27001 is not well known in the agricultural sector. Further to that discussion with agricultural sector specialists suggest that ISO 27001 is not well known by their colleagues. Even though the development of technology and its benefits in implementation of ISO 27001 could allow the agricultural sector to assure their sensitive information related to employees, suppliers, customers, operational processes, financial data and the IT systems. Like several ISO standards the 27001 standard is not obligatory, however, the agricultural sector should see this as an opportunity to reframe their operational structure, maintaining internal costs and enhancing the image amid customers and suppliers (Calder, 2013). Further to that the ISO 27001 standard could be used as the framework within an information system that secures intellectual property and sensitive data of the agricultural enterprise, for instance livestock information, blood line data, crop management and processing traceability, confidential food recipe data and commercially protected food supply chain information or pharmaceutical and medical records could be consider intellectual property or sensitive data. Having said that the indication within the agricultural sector is that ISO 27001 will only have a slow and minimal uptake.

#### 3.7.6 Food Safety Systems and Standards

The research indicates that farms that produce livestock are now looking at adopting ISO 22000: 2005 certification for its ability to control food safety hazards. In order to be awarded this certificate, companies involved in agriculture have to plan, implement, operate, maintain and update a food safety management system, demonstrating compliance with applicable statutory and regulatory food safety requirements. The standard ensures they effectively communicate food safety issues to their suppliers, customers and relevant interested parties in the food chain (Leppala *et al.*, 2013). Accordingly all respondents for the case studies recognise that

ISO 22000 certification covers all the processes in the food chain that impact the safety of the end product. It specifies the requirements for comprehensive food safety management systems as well as incorporating the elements of Good Manufacturing Practices (GMP) and Hazard Analysis Critical Control Points (HACCP) (Lawley *et al.*, 2012; Marimon *et al.*, 2011) which were also well known by participants in the research. This internationally recognized food safety standard could be used by all organisations in the food supply chain from farming to food services, processing, transportation and storage through packaging to retail. The fact that two of the case studies hold ISO 22000 certification shows interest in the standard and discussions with agricultural supply chain specialists show that knowledge of certification in food processing companies is widespread. Developed in 2005, ISO 22000 certification creates a single food safety standard that harmonizes the various national standards into one easy to understand set of requirements that are simple to apply and recognised around the world (Escanciano and Santos-Vijande, 2014). ISO 22000 is the core basis of FSSC 22000, the Global Food Safety Initiative recognised standard which additionally addresses the specific requirements of major retailers and global manufacturers.

### 3.7.8 Energy Management Systems

This energy management system ISO 50001 standard is introduced as a development of ISO 9001 quality management system and 14001 environmental management systems specifically focusing on energy management. However, ISO 5001 focuses directly and explicitly on the improvement of energy performance. The initial objective of ISO 5001 is to enhance the performance of energy within an enterprise regardless of the industry, size and type (LRQA, 2014). It relies on continuous improvement by considering opportunities of reducing energy costs and proposing suggestions that would effectively adjust systems and processes (Duflou *et al.*, 2012). Farms aim to reduce costs, fulfill legislative or self-imposed carbon targets, minimise the consumption of fuel and establish a positive socially responsible image (UKAS, 2014). Accordingly, the farming sector is very sensitive to climate changes; therefore, the consideration of energy standards will, to an extent, positively influence several decisions in the agricultural sector. For instance, farms reducing their energy utilization also decrease operational costs and reduce their greenhouse gas emissions (Calder, 2013). However, the findings indicate that it is more likely that larger organisations or suppliers of power will take the lead in achieving and promoting ISO 50001 within the agricultural sector and farms will not necessarily see the standard as a priority. Nevertheless, ISO 50001 if adopted will assist the farmers in developing, measuring, reviewing and continually improving a policy for an effective use of energy management. ISO 50001 contributes to the development of an energy management system (EnMS) which helps farms to utilise energy more efficiently in the long run. The two case study organisations that adopted the standard are large corporations that have a huge energy demand compared to the other cases. Although table 4 indicates there are certifications to ISO 50001 in the UK agricultural supply chain the discussions indicate that farms directly are not pursuing adopting ISO 50001. This standard is applicable to farms with a high energy usage but within the agricultural supply chain the support enterprises such as waste management, food packaging and utility suppliers could benefit from adopting ISO 50001 energy management standards.

### 3.7.9 Occupational Health and Safety Certifications

The occupational health and safety management systems OHSAS 18001 is for all organisations large or small and covers all sectors however, this is most likely going to be superseded by ISO 45001 in December 2017, ISO (2016). All of the case study organisations shown in figure 4 have considerable knowledge of occupational health and safety and likewise are aware of OHSAS 18001 but only four out of those 12 have achieved certification. The farming industry represents approximately 1.8% of the workforce in Great Britain but accounts for about 19% of the reported fatal injuries each year, UK Gov (2016) indicating a need for sector adoption of effective management of occupational health and safety. The ISO 45001 standard, although currently not an ISO is presented here as the UK top three certifying bodies intend to offer this, is designed to clarify an organisation's impact on health and safety issues, as well as help to reduce the risk of accidents and any breach in legal requirements. The OHSAS 18001 published in the UK was developed to bridge the gap where no international standard existed for occupational health and safety. Development involved input from a number of leading bodies, including certifiers, trade bodies and expert consultancies (Hudson and Orviska, 2013). OHSAS 18001: 2007 supersedes OHSAS 18001: 1999, which was phased out completely in July 2009 (Leppala *et al.*, 2013) consequently the four case study organisations with certification have been re-assessed to that new version.

Despite not currently being an ISO standard, OHSAS 18001 has been designed to be compatible with the ISO 9001 (Quality) and ISO 14001 (Environmental) standards, thus helping organisations to achieve an integrated management strategy. In 2017, a new Health and Safety Management System standard called ISO 45001 is expected to be published - this will then supersede OHSAS 18001. The four case study organisations have said they will transition to the new standard without much problem because each of them hold certification to ISO 9001 and ISO 14001 and are currently working towards harmonisation of those management systems. No doubt, because of the potentially risky nature of agricultural processes, this will become a popular standard and there will probably be a large take up in the agricultural sector in the UK.

#### 4. Further Discussion

It was noticed from the data collected that since the introduction of ISO 9001 in 1987 there has been a higher level of understanding and therefore applicability of ISO management systems in different industries and particularly within the agricultural sector. This trend was an interesting finding as justifies the significance of such management systems and their impact on the performance of an agricultural supply chain enterprise. The agricultural sector recognise that application of any of the seven (eight including OHSAS 18001) most popular internationally recognized management systems standards aim to enhance the financial performance of the sector through better housekeeping by reducing cost and adding value to the end product.

Within the agricultural supply chain, management systems standards ISO9001 and ISO 14001 are the most implemented because of the main food safety concerns and public trend related to awareness of quality and environmental business aspects. The explanation of this trend consists of the awareness that customers have regarding these systems and their consequent agricultural supply chain purchasing behaviour is highly influenced by these certificates. The case study organisations confirmed that attaining such certification facilitates the communication of values between producer, suppliers and consumers such as from the farm to consumer and subsequent waste streams.

On the other hand the quality management system for the automotive sector, TS 16949, appeared to have a small uptake and a lack of awareness among farmers and their supply chain for its benefits. This has been argued, in part, as a result of expensive implementation, while some farms are not very technologically advanced and it is not very influential towards customer's buying behaviour, as agricultural buyers have a lower awareness of this certificate when compared with ISO 9001 and ISO 14001. Nevertheless, the application of such certification is seen by the sector as being positive when applied to the agricultural automotive and vehicle supply chain particularly for those entities applying precision agricultural concepts and techniques.

The medical devices standard, ISO 13585 has been adopted in the UK agricultural sector but does not appear to be a priority across the supply chain and the prediction is a slow uptake is expected. The lack of interest in ISO 13585 is probably because of the lack of understanding of the standard rather than the lack of applicability to the sector. Similarly, the ISO 27001 information security management system standard, although applicability to certain agricultural settings, is equally not well understood in the sector even though there have been sector certifications. Contrary to that lack of knowledge of those standards, the findings of this research, detected a significant increase in knowledge of applicability regarding food safety ISO 22000 and ISO 50001. Likewise, taking into consideration numerous food scandals some farms and food processors see the food management system as a pre-requisite to distinguish their products and communicate their best values to the customer. Even though implementation of energy management system does not directly impact the buying behaviour of the customer, farms consider they could implement it to reduce cost, minimise pollution and introduce green practices. Both ISO 22000 and ISO 50001 have seen increases in uptake worldwide, with 50001 having a higher percentage uptake than 22000 year upon year since 2012, but the findings indicate with a greater interest in food safety than energy management ISO 22000 is likely to have greater uptake in future UK agricultural sector certifications.

Health and Safety is a major concern in the high risk agricultural sector and is accordingly given emphasis by employers and the UK government. There is therefore knowledge within the UK agricultural sector of the upcoming ISO 45001 occupational health and safety management systems standards and companies are hence considering transition from OHSAS 18001 or adopting the new standard. Since certification to the ISO 45001 standard will not be mandatory the indication from the findings is that although occupational health and safety is a sector main concern implementation of a certifiable system may not be a priority.

#### 4.1 Further Research Directions

This research was based on archival data, stakeholders' perception and a literature review of ISO management systems to investigate their applicability within the UK agricultural sector. Additionally, discussions took place with representatives from certification bodies, regulators and from the agricultural supply chain case study organisations. That approach to data collection consequently identified 12 certified case study organisations covering all management systems and from those elicited perceptions and anecdotal benefits to implementing ISO systems. This research therefore briefly discusses the beneficial aspects and challenges of management system certification in terms of application and perceived applicability to the agricultural enterprise. Additionally, the difficulty in obtaining complete uptake data, because of the methods of categorization of certifications, from certification statistics has led to an inconclusive quantitative statement of the number of certifications within the agricultural sector therefore, the authors propose that further research may collect such data and might focus on empirical research by:

- Data mining of UKAS, the top three certification bodies and International Organisation for Standardisation data bases to assess statistical records and to identify the quantities of take up of each of the most popular seven (eight including OHSAS 18001) management systems standards in UK

agriculture.

That proposed future empirical research could provide more detailed information for the agricultural sector, for farmers and their supply chain to help understanding the extent of certifications within the agricultural sector. Consequently, the UK certifying bodies and UK government interested parties may find quantitative analysis of ISO management systems uptake of interest when considering public relations campaigns. Further research directions are therefore encouraged by the authors that would aim; firstly to identify best methods, for use by educators, regulators and Government bodies, of communicating the benefits of management systems certification across the UK agricultural supply chain; secondly using case study analysis of UK agricultural supply chain companies identify through evidential analysis the benefits of certified management systems and; thirdly the authors encourage other management systems international researchers to examine the uptake of certified management systems in agricultural sectors applied outside of the UK and identify the challenges that stakeholders encounter.

This paper has provided information on stakeholder perceptions of a wide range of ISO management systems from the UK agricultural sector and hence the findings are considered useful for agricultural supply chain stakeholders in other countries. This research acknowledges the UK is leading the world in certification to management systems and that other researchers in less developed nations may repeat this study but find completely different perceptions of stakeholders.

As this research has focused on UK agricultural sector stakeholders' perceptions of ISO management systems, rather than looking at benefits like many other researchers have done, further research could investigate what drives the agricultural sector to take up, or not to take up, ISO management systems. Likewise, further research could consider whether there are significant differences across and within the agricultural supply chain.

## 5. Conclusions

This research has gone beyond looking at the most commonly known ISO management system standards of quality and environment and has considered many ISO managements systems in the agricultural sector which is often overlooked by researchers of management standards and academics. This paper provides information and can therefore guide practitioners, consultants and academics searching for management systems information when working within or across the agricultural sector. International management systems standards have arguably been used within the agricultural sector to enhance performance and improve effectiveness and efficiency across the supply chain. The top seven ISO management system standards are all considered by the sector, regulators, employers and employees as relevant to agriculture, but those stakeholders argue that not all of them are relevant or necessary for each category of agriculture. Furthermore, occupational health and safety management and control is a popular public topic and will remain a major requirement in the agricultural sector within the UK and in 2017 it is likely that ISO 45001 an occupational health and safety management systems standard will be published by International Standards Organisation. This paper therefore urges the UK agricultural sector to consider adoption of ISO 45001 as a framework for managing occupational health and safety risks as this will soon supersede OHSAS 18001.

This research documented that ISO management systems (the top seven plus ISO 45001) are argued by agricultural supply chain specialists as important in enhancing the efficiency of an agricultural organisation. Moreover, more organisations are implementing such systems-aiming to add value to their products and have a better control of the internal and external environment. Nevertheless this research has significantly identified, in terms of implementation within the agricultural sector for example in farms, difficulties are faced because of four things (i) the farmers' lack of knowledge of such management systems and lack of appreciation of their benefits; (ii) with respect to ISO 27001, ISO 16949 and ISO 13485 the lack applicability of the management systems directly to the farm; (iii) not all farms are energy intensive and farmers do not see ISO 50001 as a direct benefit or need, and (iv) OHSAS 18001 or the future ISO45001 although applicable are not mandatory. The paper therefore encourages agricultural specialists, teachers and policy makers to provide information to the agricultural sector regarding the value and scope of ISO management systems in supporting best practice and identification of regulatory compliance issues.

As a result of competition and regulation the agricultural supply chain is highly focused on systems certification which includes management systems that would contribute to the marketing side in enhancing their image in the public's eyes. Additionally, government bodies will continue to promote the certification of management systems through their publication of regulatory codes of practice, their supply chain purchasing and control strategies, and their drive to improve the image of the agricultural sector.

This paper concludes that the uptake of ISO management systems in the UK agricultural sector will continue and more areas of the agriculture supply chain will feel obliged to certify their management systems to a wider range of standards than just the well known quality management and environmental management system standards.

## 6.0 References

- Abdul Halim Lim, S., Antony, J., He, Z., and Arshed, N. (2017). Critical observations on the statistical process control implementation in the UK food industry: A survey. *International Journal of Quality & Reliability Management*, Vol. 34 No. 5, pp. 684-700.
- Bamber, C., Elezi, M. E., Bamber, D., and Sharp, J. (2014). A Critical Review of ISO Management Systems Certification in the UK Agricultural Sector. *Conference of Management of Innovative Business, Education and Support systems*, Thessaloniki- Greece, pp. 351-367.
- Ben Youssef, A. and Abderrazak, C. (2009). Multiplicity of ecolabels, competition, and the environment. *Journal of Agricultural & Food Industrial Organization*, Vol. 7 No. 2, pp. 1-22
- Brécard, D., Lucas, S., Pichot, N. and Salladarré, F. (2012). Consumer preferences for eco, health and fair trade labels: An application to seafood product in France, *Journal of Agricultural & Food Industrial Organization*, Vol. 10 No. 1, pp.1-32
- Castillo-Barrera, F. E., Durán-Limón, H. A., Médina-Ramírez, C. and Rodriguez-Rocha, B. (2013). A method for building ontology-based electronic document management systems for quality standards-the case study of the ISO/TS 16949: 2002 automotive standard, *Applied intelligence*, Vol. 38 No. 1, pp. 99-113.
- CH (2016). Companies House-Departments, available at: <https://www.gov.uk/government/organisations/companies-house> (accessed on 15 September 2016).
- Crowder, M. (2013). Quality standards: integration within a bereavement environment, *The TQM Journal*, Vol. 25 No. 1, pp.18-28.
- Daughbjerg, C., Smed, S., Andersen, L. M. and Schwartzman, Y. (2014). Improving Eco-labelling as an Environmental Policy Instrument: Knowledge, Trust and Organic Consumption, *Journal of Environmental Policy & Planning*, Vol. 16 No.4, pp. 1-17.
- Dalefarm, (2014), available at: [http://www.dalefarm.co.uk/pages/dale\\_farm/Environmental%20Policy](http://www.dalefarm.co.uk/pages/dale_farm/Environmental%20Policy) (accessed on 21 March 2014).
- Dangwal, P. G. and Chaubey, D. S. (2013). Effect of ISO9000 and Ts16949 Quality Management Systems on Firms Performance-A Comparative Study. Pragyaa, 26
- Department for Environment, Food and Rural Affairs (2014), available at: [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/275991/fbs-businessincome-statsnotice-30jan14.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/275991/fbs-businessincome-statsnotice-30jan14.pdf) (accessed on 31 March 2014).
- De Vries, H. J., Bayramoglu, D. K. and van der Wiele, T. (2012). Business and environmental impact of ISO 14001, *International Journal of Quality & Reliability Management*, Vol. 29 No. 4, pp. 425-435.
- Dora, M., Kumar, M., Van Goubergen, D., Molnar, A. and Gellynck, X. (2013). Food quality management system: Reviewing assessment strategies and a feasibility study for European food small and medium sized enterprises, *Food Control*, Vol. 31 No. 2, pp. 607-616.
- Dufloy, J. R., Sutherland, J. W., Dornfeld, D., Herrmann, C., Jeswiet, J., Kara, S. and Kellens, K. (2012), Towards energy and resource efficient manufacturing: A processes and systems approach, *CIRP Annals-Manufacturing Technology*, Vol. 61 No. 2, pp. 587-609.
- Eurostat (2015). Farm structure statistics, The size of agricultural holdings”, available at: [http://ec.europa.eu/eurostat/statistics-explained/index.php/Farm\\_structure\\_statistics](http://ec.europa.eu/eurostat/statistics-explained/index.php/Farm_structure_statistics) (accessed 06 March 2017)
- Escanciano, C. and Santos-Vijande, M. L. (2014). Reasons and constraints to implementing an ISO 22000 food safety management system: Evidence from Spain, *Food Control*, 40, pp. 50-57.
- FSA (2014). Food Standards Agency, available at: <http://www.food.gov.uk/> (accessed 10 April 2014).
- Giraud - Héraud, E., Hammoudi, A., Hoffmann, R. and Soler, L. G. (2012). Joint private safety standards and vertical relationships in food retailing, *Journal of Economics & Management Strategy*, Vol. 21 No. 1, pp. 179-212.
- Gould, W. A. (2013). *Total quality assurance for the food industries*, 3<sup>rd</sup> Ed. Elsevier. U.S.A
- Green, R. M., and Kane, K. (2014). The effective enforcement of HACCP based food safety management systems in the UK. *Food control*, 37, 257-262.
- Halaseh, L. A. and Sundarakani, B. (2012). Study on quality attributes of halal food supply chain, *International Journal of Logistics Economics and Globalisation*, Vol. 4 No.1, pp 20-34.
- Heras-Saizarbitoria, I., Arana, G. and Cilleruelo, E. (2013 a). Adoption of ISO 9000 management standard in EU's transition economies: the case of the Baltic States, *Journal of Business Economics and Management*, Vol. 14 No.3, pp. 481-499.
- Heras Saizarbitoria, I. and Boiral, O. (2013 b). ISO 9001 and ISO 14001: Towards a Research Agenda on Management System Standards, *International Journal of Management Reviews*, Vol. 15 No.1, pp. 47-65.
- Hoy, Z. and Foley, A. (2014). A structured approach to integrating audits to create organisational efficiencies: ISO 9001 and ISO 27001 audits, *Total Quality Management & Business Excellence*, Vol. 26 No.5-6,

- pp. 1-13.
- Hu, W., Batte, M. T., Woods, T. and Ernst, S. (2012). Consumer preferences for local production and other value-added label claims for a processed food product, *European Review of Agricultural Economics*, Vol. 39 No.3, pp. 489-510.
- Hudson, J. and Orviska, M. (2013). Firms' adoption of international standards: One size fits all?, *Journal of Policy Modeling*, Vol. 35 No.2, pp. 289-306.
- ISO (2014). An Executive Bulletin: The ISO Survey of Management System Standard Certifications: 2014, available at: [http://www.iso.org/iso/home/news\\_index/news\\_archive/news.htm?](http://www.iso.org/iso/home/news_index/news_archive/news.htm?) (accessed on 12 September 2016).
- ISO (2016). ISO 45001 Occupational health and safety, available at: <http://www.iso.org/iso/home/standards/management-standards/iso45001.htm> (accessed 09 May 2016).
- Kafel, P. (2013). Food quality products in EU countries, *7<sup>th</sup> International Quality Conference, Cracow University of Economics, Cracow, Poland, Center for Quality, Faculty of Engineering, University of Kragujevac*, pp. 273-278.
- Kantar Worldpanel (2014). The GB Milk Market, available at: <http://www.kantarworldpanel.com/> (accessed 10 April 2014).
- Karaman, A. D., Cobanoglu, F., Tunalioglu, R. and Ova, G. (2012). Barriers and benefits of the implementation of food safety management systems among the Turkish dairy industry: A case study, *Food Control*, Vol.25 No.2, pp. 732-739.
- Lam, S.Y., Lee, V.H., Ooi, K.B. and Phusavat, K. (2012). A structural equation model of TQM, market orientation and service quality: evidence from a developing nation, *Managing Service Quality*, Vol.22 No.3, pp. 281-309.
- Lawley, R., Curtis, L. and Davis, J. (2012). The food safety hazard guidebook, *Royal Society of Chemistry*.
- Leppala, J., Kauranen, I. and Rautiainen, R. (2013). Effectiveness of occupational health service programmes in farmers' safety and security risk management, *International Journal of Agricultural Management*, Vol.2 No.3, pp. 130-140.
- Lee, J., Gereffi, G. and Beauvais, J. (2012). Global value chains and agrifood standards: Challenges and possibilities for smallholders in developing countries. *Proceedings of the National Academy of Sciences*, Vol.109 No.31, pp. 12326-12331.
- Lloyd's Register Quality Assurance (2014). Quality Management Systems, available at: <http://www.lrqa.co.uk/> (accessed on 25 March 2014).
- Marimon, F., Llach, J. and Bernardo, M. (2011). Comparative analysis of diffusion of the ISO 14001 standard by sector of activity, *Journal of Cleaner Production*, Vol.19 No.15, pp. 1734-1744.
- Madsen, C. B., Hattersley, S., Allen, K. J., Beyer, K., Chan, C. H., Godefroy, S. B. and Crevel R. V. (2012). Can we define a tolerable level of risk in food allergy? Report from a EuroPrevall/UK Food Standards Agency workshop, *Clinical & Experimental Allergy*, Vol.42 No.1, pp. 30-37.
- Mc Caffery, F., Casey, V., Sivakumar, M. S., Coleman, G., Donnelly, P. and Burton, J. (2012). *Medical Device Software Traceability in Software and Systems Traceability*, pp. 321-339. Springer London.
- McMahon, J., and Desta, M. G. (2012). *Research Handbook on the WTO Agriculture Agreement: New and Emerging Issues in International Agricultural Trade Law*. Edward Elgar Publishing
- Nerbrink, O. and Mitchell, J. P. (2012). Comparison of ISO Standards for Device Performance; 20072 and 27427: A Critical Appraisal, *Journal of aerosol medicine and pulmonary drug delivery*, Vol. 25 No. 4, pp. 209-216.
- NFU (2016). The Economy, available at: <http://www.nfonline.com> (accessed on 02 September 2016).
- Prajogo, D., Tang, A. K. and Lai, K. H. (2012). Do firms get what they want from ISO 14001 adoption?: an Australian perspective, *Journal of Cleaner Production*, 33, pp. 117-126.
- Psomas, E., Kafetzopoulos, D. and Fotopoulos, C. (2013). Developing and validating a measurement instrument of ISO 9001 effectiveness in food manufacturing SMEs, *Journal of Manufacturing Technology Management*, Vol. 24 No. 1, pp. 52-77.
- Santos, G., Barros, S., Mendes, F. and Lopes, N. (2013). The main benefits associated with health and safety management systems certification in Portuguese small and medium enterprises post quality management system certification, *Safety science*, Vol. 51 No. 1, pp. 29-36.
- Sampaio, P., Saraiva, P. and Domingues, P. (2012). Management systems: integration or addition?, *International Journal of Quality & Reliability Management*, Vol. 29 No. 4, pp. 402-424.
- SFQC (2014). Providing independent Assurance for the food and farming sectors, available at: <http://www.sfqc.co.uk/about-sfqc/accreditation> (accessed on 20 March 2014).
- Sharma, D. N. and Dash, P. K. (2012). Effectiveness of ISO 27001, As an Information Security Management System: An Analytical Study of Financial Aspects, *Far East Journal of Psychology and Business*, Vol. 9 No. 5, pp. 57-71.

- Office for National Statistics (2007). UK Standard Industrial Classification of Economic Activities 2007 (SIC 2007): Structure and explanatory notes Available at: <file:///C:/Users/Enis/Downloads/uksic2007web.pdf> (accessed on 14 March 2017)
- Sheikhpour, R. and Modiri, N. (2012). A best practice approach for integration of ITIL and ISO/IEC 27001 services for information security management, *Indian Journal of Science & Technology*, Vol. 5 No. pp. 2170-2176.
- Stewart, A (2016), Global network of Agriculture Inspection and Testing, available at: <http://www.alexstewartagriculture.com> (accessed on 02 September 2016).
- Surinova, Y. (2013). Review of special standards in quality management systems audits in automotive production. Research Papers Faculty of Materials Science and Technology Slovak University of Technology, Vol. 21 No. 33, pp. 21-30.
- Susanto, H., Almunawar, M. N. and Tuan, Y. C. (2012). Information security challenge and breaches: novelty approach on measuring ISO 27001 readiness level, *International Journal of Engineering and Technology*, Vol. 2 No. 1.
- Trienekens, J. and Zuurbier, P. (2008). Quality and safety standards in the food industry, developments and challenges, *International Journal of Production Economics*, Vol. 113 No. 1, pp. 107-122.
- The World Bank (2013). Data, Employment in agriculture (% of total employment). Available at: <http://data.worldbank.org/indicator/SL.AGR.EMPL.ZS> (accessed on 21 March 2014).
- Thuemmler, C., Mival, O., Benyon, D., Buchanan, W., Paulin, A., Fricker, S. and Petrakis, E. (2013). Institute of Informatics and Digital Innovation, *IEEE 15<sup>th</sup> International Conference Edinburgh Napier University; UK*. pp. 382-387.
- To, W. M. and Tang, M. N. (2014). The Adoption of ISO 14001 Environmental Management Systems in Macao SAR, China Trend, Motivations, and Perceived Benefits. *Management of Environmental Quality: An International Journal*, Vol. 25 No. 2, pp 244-256.
- Tricker, R. (2013). *ISO 9001: 2008 for Small Businesses*, Routledge, UK.
- Tunaliloglu, R., Cobanoglu, F. and Karaman, A. D. (2012). Defining economic obstacles to the adoption of food safety systems in table olive processing firms, *British Food Journal*, Vol 114 No. 10, pp. 1486-1500.
- UKAS (2014). Lists of Accredited ISO Management System Certification Bodies. Available at: <http://www.ukas.com/about-accreditation/accredited-bodies> accessed on 22/03/2014 (accessed on 30 March 2014).
- Zobel, T. (2013). ISO 14001 certification in manufacturing firms: A tool for those in need or an indication of greenness?, *Journal of Cleaner Production*, 43, pp. 37-44.
- Wyness, L. A., Buttriss, J. L. and Stanner, S. A. (2012). Reducing the population's sodium intake: the UK Food Standards Agency's salt reduction programme, *Public health nutrition*, Vol. 15 No. 2, pp. 254-261.
- White, G. R., Lomax, M. and Parry, G. (2014). The implementation of an environmental management system in the not-for-profit sector, *Benchmarking: An International Journal*, Vol. 21 No. 4, pp. 509-526.