



Food traceability system from governmental, corporate, and consumer perspectives in the European Union and China: A comparative review

Jianping Qian^{a,*}, Luis Ruiz-Garcia^{b,**}, Beilei Fan^a, Jose Ignacio Robla Villalba^c, Ultan McCarthy^d, Baohui Zhang^a, Qiangyi Yu^a, Wenbin Wu^{a,***}

^a Key Laboratory of Agricultural Remote Sensing (AGRIS), Ministry of Agriculture and Rural Affairs/Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, 100081, Beijing, China

^b Department of Agroforestry Engineering, Universidad Politécnica de Madrid, Av. Complutense s/n, 28040, Madrid, Spain

^c Sensors Technology Laboratory, Centro Nacional de Investigaciones Metalúrgicas, Consejo Superior de Investigaciones Científicas (CENIM-CSIC), Avenida Gregorio del Amo 8, 28040, Madrid, Spain

^d School of Science and Computing, Department of Science, Waterford Institute of Technology, Waterford, Ireland

ARTICLE INFO

Keywords:

Traceability
Traceability system
Food safety
Artificial intelligence
Blockchain
EU
China

ABSTRACT

Background: Food safety has garnered much worldwide attention recently for reasons that are, unfortunately, not always positive. Traceability system (TS) is designed to assure safe and good quality food, while reducing the costs of food recalls. It should encompass all stakeholders, including governments, companies, and consumers, each of whom has an important role in the implementation and guardianship of such systems. The EU and China are amongst the main players implementing TS and are constantly exploring new opportunities and monitoring challenges for TS in a time of shifting consumer demands and rapid new technology innovation.

Scope and approach: This article states development stages from TS 1.0 to 3.0. and reviews TS development in a number of key countries and regions. Comparisons between the EU and China are drawn in terms of government, corporate, and consumer involvement in traceability.

Key findings and conclusions: A functional TS, while providing bi-directional communication between trading partners, must meet the laws and regulations where it operates. A functional system must also consider consumer value and perception, which varies with geography. There are a variety of promising technologies available on the market today to modernize TS, including artificial intelligence (AI) and blockchain. A key finding of this research is that both the EU and China have developed significant trade links in recent years which will certainly positively impact both economies. Key to underpinning the sustainability of these trade links will be the adoption of common TS to prevent negative associations.

1. Introduction

Global food supply systems are under increased pressure due to human activity and consumer requirements. This increased pressure negatively impacts global food security and health (McCarthy et al., 2018). Climate change, land degradation, pesticide use, the development of antibiotic-resistant microorganisms, and residual animal growth hormone in human food all contribute to food supply challenges (Notarnicola, Hayashi, Curran, & Huisingh, 2012; Thiollet-Scholtus & Bockstaller, 2015). Similarly, recent food scares, including the bovine spongiform encephalopathy (BSE) outbreak (Wales, Harvey, & Warde, 2006) and the contamination of chicken feed with dioxin in Belgium

(Bernard et al., 2002), highlight the need to either implement or improve TS in the food sector.

The aim of a food TS is to identify food product origin, safeguard food in transit, and decrease the associated time and cost of food recalls (Regattieri, Gamberi, & Manzini, 2007). A well-designed TS can track products at each stage, including harvest, processing, transport, storage, distribution, and sales (Olsen & Aschan, 2010). While there is certainly a cost associated with implementing a TS, the ability of a TS to assist in identifying problems with food safety and quality result in a decrease in the production and distribution of unsafe or low-quality products and the associated negative publicity, liability, and recalls (Golan et al., 2004). An effective TS will also help improve business

* Corresponding author.

** Corresponding author.

*** Corresponding author.

E-mail addresses: qianjianping@caas.cn (J. Qian), luis.ruiz@upm.es (L. Ruiz-Garcia), wuwenbin@caas.cn (W. Wu).