How a BI-wise Responsible Integrated Management System May Support Food Traceability

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ABSTRACT

Food manufacturers are required to meet certain traceability specifications. This research aims at underscoring the relevant needs and expectations of various stakeholders across the entire food supply chain. In this context, firms’ decisions on resource allocation and risk mitigation overlap several domains, such as quality, safety, environment, social responsibility and information. Business Intelligence (BI) platforms are specifically conceived to support analytical decision making by providing a centralised view on multiple distributed data sources. However, BI solutions are usually deployed within a single organization, whilst traceability involves multiple actors with potentially divergent interests and diverse levels of willingness to participate. Along this line of thought, integration of management systems within a company and throughout the overall supply chain is suggested to meet the emerging managerial challenges. After a detailed survey of integrated management systems (IMSs) in food traceability contexts, this research proposes a BI-wise solution using the IMS overarching approach and investigates its success conditions.

KEYWORDS
Business Intelligence, Food Traceability, Integrated Management System, Social Responsibility

INTRODUCTION

Food traceability (FT) refers to “all stages in the food supply chain so that the product can be checked for safety and quality control, traced upward, and tracked downward at any time required” (Bosona and Gebresenbet, 2013). Regulatory frameworks have been developed to enforce traceability measures in order to assure prevention of food contamination and to track any causes of compromising the pathway of the food commodities from farm to plate. Furthermore, voluntary schemes, such as the Hazard Analysis of Critical Control Points (HACCP) and the ISO 22000:2005 standard have been released and spread to support the efficient and effective establishment of the processes and procedures to facilitate traceability.

Traceability is anticipated to address sustainable development concerns about animal welfare, ethical production methods and environmental issues, including herbicides used in farming, animal feed and water, providing a fast and efficient support to decision making in the management of any identified quality incident in the food supply chain. Food incidents, such as “mad cow disease”, dioxins in chicken feed and genetically modified crops (Aung & Chang, 2014), can provide illustrative...
examples of the transparency and inter-operational weaknesses in traceability systems that may endanger health and question consumers’ trust.

Therefore, traceability is a highly significant issue that isolated practices and stand-alone management systems (MSs) have yet failed to adequately address. It requires the joint management of several domains, such as quality, safety, supply chain, environment, social responsibility, information management and decision support. Moreover, the lack of a theoretical framework to embrace all aspects and foster synergies is acknowledged (Karlsen et al., 2013). To this end, integration of MSs seems to be the most suitable approach. An Integrated Management System (IMS) builds upon the individual management sub-systems aligning strategic objectives with business processes, allocating resources and meeting stakeholders’ needs and expectations.

Information-wise, food traceability demands for multiple sourced data that needs to be uniquely codified and recorded. Next, data has to be interpreted within a regulatory and managerial framework from a strategic perspective, since critical decision making is involved. In this context, key challenges are the availability, content uniformity and sufficiency of information, the access velocity, and the strategic perspective of information use. Information availability and uniformity are addressed by regulations (Aiello et al., 2015). However, the degree of direct access to information depends on the stakeholders’ communication, which is yet quite limited (Bevilacqua et al., 2009). Finally, the question of speed and accuracy is not at all under control. Indeed, a great amount of information is paper-trailed, i.e. collected by hand and stored on sheets of paper (Bosona & Gebresenbet, 2013; Manos & Manikas, 2010). Consequently, data capture entails time-consuming and error-prone human interactions.

These observations advocate for a centralised and formalized access to information to meet the analytical needs that arise in a food chain. Stakeholders, including institutions, regulatory authorities, non-governmental organizations (NGOs), retailers, and consumers, raise their own needs and requirements in terms of food safety, quality and traceability. In this context, farmers and food manufacturers need support towards making decisions on the allocation of resources based on economic, social, and environmental criteria via metrics, such as the optimal information value and the economic traceability lot. In addition, given the lack of a common and centralized data base to capture food and feed processing data, the lack of a dedicated holistic ontology and the overlapping and non-harmonized regulations and standards, business intelligence (BI) platforms offer a typical architecture and framework to address these needs. As a prelude to the design of a BI system for food traceability, this paper explores how a BI-wise responsible IMS may support food traceability. In this context, extant research on FT management is discussed. Additional research topics are traceability’s relationship with social responsibility, information management embeddedness in an IMS and the critical success factors. This paper concludes with the identification of the challenges and the expected benefits from the implementation of a BI platform for FT management.

The remainder of this paper is structured as follows. Next section provides a detailed overview of traceability and IMSs. Then BI concepts are introduced and two sections are respectively dedicated to the identification of critical success factors and challenges of the development of a BI platform for FT management. This paper ends with conclusions and future research directions.

**TRACEABILITY**

Traceability is an interdisciplinary concept with a variety of definitions and perspectives. According to ISO, traceability is defined as the “ability to trace the history, application and location of that which is under consideration”, including the origin of materials and parts, the processing and the distribution. Karlsen et al. (2013) contend lack of a common understanding and a common theoretical framework with respect to FT implementation. Moreover, traceability is a critical issue that MSs alone have failed to adequately address, so far. It requires the simultaneous and efficient alignment of several domains, i.e. quality, safety, supply chain, environment and information. The respective standards that interact
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