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A 'best practice score' for the assessment of food quality and safety management systems in fresh-cut produce sector

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ABSTRACT

The purpose of the present work was to develop a tool for the assessment of the Food Safety and Quality Management Systems (FSQMSs) applied in 75 (68% participation rate) micro, small and medium-sized enterprises (SMEs) of the fresh-cut produce sector. Initially, a diagnostic quantitative questionnaire was constructed. The design and the implementation of this questionnaire were influenced by the SMEs business environment. The most common certified FSQMS was according to ISO 22000:2005 ($N = 54$). Twenty-eight SMEs had primary production in their process. Using factor analysis with the principal components method, six factors (PCF) were extracted that explained 67% of the total information of the FSQMSs performance. The six factors were 'shelf life validation', 'prerequisites', 'product labeling', 'sanitation facilities', 'packaging' and 'deviation control'. The quartiles of the PCF scores may be used as cut-offs for a simple SMEs classification (poor, moderate, good and excellent). The proposed tool and overall methodology can be used by an SME to provide the 'Best Practice Score' for the FSQMSs. It will also be an input in management review for deciding opportunities of FSQMS improvement.

1. Introduction

During the last years the fresh-cut produce sector has been under a demand to implement different food safety and quality assurance standards and guidelines. Drivers of this pressure were, primarily the requirements by the European legislation (EC, 2004) as well as markets' demands by retailers and consumers. The implementation of a Food Safety and Quality Management System (FSQMS) started at first, at inspection practices and currently developed to management system approach focused on risk management (ISO/DIS, 2014). The contemporary FSQMSs applied by organizations in the fresh-cut produce sector are self-audited or audited by customers, competent authorities (official audits) and certification bodies. After audit process, improvements need to be made in order to comply with the auditing findings (Jacxsens et al., 2011; Luning et al., 2009).

However, the necessity to develop tools for strengthening the organizations in diagnosing and improving their FSQMSs is of paramount importance and is an emergent need for the food sector. This is particularly important for SMEs, as they do not always have the necessary knowledge, experience, and resources both human and financial (Karipidis, Athanassiadis, Aggelopoulos, & Giompliakis, 2009; Lo & Humphreys, 2000; Yapp & Fairman, 2006). The development and implementation of a FSQMS in SMEs are restricted by factors such as: the absence of time and resources (human and financial), the high costs of implementation, and a lack of knowledge and experience (Aggelogiannopoulos, Drosinos, & Athanasopoulos, 2007; Karipidis et al., 2009; Mondelaers & Van Huylenbroeck, 2008). In addition, inadequate information and lack of motivation (Semos & Kontogeorgos, 2007), insufficient support and guidance, limitations in productive time, financial and personnel resources, as well as low top management and personnel commitment lead up to discouragement (Aggelogiannopoulos et al., 2007). Other barriers to the implementation of HACCP in small businesses include lack of expertise, absence of legal requirements, financial constraints and attitudes (Ehiri, Morris, & McEwen, 1995; Taylor, 2001; Walker, Pritchard, & Forsythe, 2003; WHO, 1999).

A diagnostic improvement tool (FSMS-DI, Food Safety Management Systems Diagnostic Instrument), roadmaps for improvement, protocol for validation and verification, and assessment tools (Microbial Assessment Scheme) have been proposed in the literature to

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assess the performance of current FSMS in the food industry (Jacxsens et al., 2009, 2011; Jacxsens et al., 2010; Luning, Bango, Kussaga, Rovira, & Marcelis, 2008; Luning et al., 2011, 2009; Van der Spiegel, 2004). The existing tools are guidelines for the validation of food control measures (CAC, 2008). For example, FSMS-DI is a diagnostic tool that contributes to the measurement of the performance of the FSMS in an organisation suggested for the lamb chain; it enables a systematic analysis and assessment of a company's unique FSMS. The tool consists of comprehensive lists of indicators used to analyse core control and assurance activities addressed to the company's specific FSMS and which context factors could affect the FSMS (Nanyunja et al., 2015).

Mortimore (2000) presented a straightforward and practical description of the procedures typically used within the food manufacturing industry for assessing both HACCP plans and their implementation. Wilkinson and Wheelock (2004) published a checklist of questions for Irish food production plants, designed to be applied by trained auditors. Wallace, Powell, and Holyoak (2005) developed two audit checklist tools to provide a step-wise approach to HACCP assessment. The tools were designed to assess the validity of the HACCP plan and the implementation and maintenance of the HACCP system. Domenech, Escriche, and Martorell (2008) presented an application example of a model to assess the effectiveness of CCPs. The above approaches are rather generic instruments focused on the implementation and assessment of HACCP principles in food industry.

FSQMSs commonly consists of two distinct types of activities, (i) food safety control, and (2) quality assurance focused on providing confidence that requirements will be met (Luning & Marcelis, 2006). Both activities contribute to the overall performance of a FSQMS. SMEs have difficulty in realizing the specific differences between various FSQMSs and judging the possible consequences of implementation, because they do not always have the necessary expertise, experience, and resources as mentioned above.

Organizations in fresh-cut produce sector had tried to apply optional or compulsory FSQMS in their premises. The most common are:

a. ISO 22000 a standard containing requirements for the food safety management systems relating to the entire food supply chain (ISO, 2005).
b. The FSSC 22000 Food Safety Management System scheme is intended for the audit and certification of the food safety system of organizations in the food supply chain (FSSC 22000, 2015).
c. BRC Global Standard for Food Safety has been developed to specify the safety, quality and operational criteria required to be in place within a food manufacturing organisation to fulfil obligations with regard to legal compliance and protection of the consumer (BRC, 2015).
d. HACCP (Hazard Analysis and Critical Control Points) is a system that identifies, evaluates and controls hazards that are significant for food safety (CAC, 2009).
e. IFS International Food Standard is a quality and food safety standard for retailer (and wholesaler) branded food products, which is intended to assess suppliers' food safety and quality systems, with a uniform approach that harmonizes both elements (IFS, 2014).
f. The SQF Code is a HACCP – based supplier assurance code for the food industry from farm to fork (SQFI, 2014).
g. AGRO 2.1-2.2 Greek standards for the Integrated Management System for agricultural production, which describe the requirements that a farm must comply with in order to be certified for implementation of Integrated Management System in the primary production (AGROCERT, 2008).
h. GlobalGAP was introduced by FoodPLUS GmbH, derivative of GLOBALGAP, to raise standards in the production of fresh fruit and vegetables. Certification to the Standard ensures a level playing field in terms of food safety and quality, and proves that growers are prepared to constantly improve systems to raise standards (GlobalGAP, 2013).

The performance of such systems in practice is variable. A number of studies highlighted positive effects on the implementation of such systems (Khatry & Collins, 2007; Nanyunja et al., 2015; Naugle, Barlow, Eblen, Teter, & Umholtz, 2006). On the other hand other studies specify that inappropriate implementation of such systems is a reason for customer complaints, product recall and even foodborne diseases (Luning & Marcelis, 2006; Naugle et al., 2006; Sun & Ockerman, 2005).

In the present study, in the framework of the European Union project QUAFETY (www.quafety.eu), an effort was made to develop a tool to provide a 'best practice score' independent of the commonly used standards and schemes, compiling a questionnaire based on factors influencing the implementation of such systems. Although such assessment tools have been developed in other sectors including the fresh produce sector (Kirezieva, Jacxsens, Uyttendaele, Van Boekel, & Luning, 2013) in the fresh-cut produce sector there is no such tool and QUAFETY tried to fill in this gap. Therefore, this work was carried out in order to describe risk factors and corresponding indicators. Based on these indicators a questionnaire was constructed to assess organizations in the fresh-cut produce sector in order to obtain their 'best practice score'.

2. Materials and methods

2.1. Risk factors and indicators selection

To develop a specific conceptual framework for the fresh-cut produce sector, it was necessary to identify which product and process characteristics (technological elements) are crucial for product safety and quality, as well as which organizational factors and characteristics of the food chain (managerial elements) affect food quality and safety. In order to identify both the technological and managerial parameters that play an important role for the safety and quality of the fresh-cut produce sector, an extensive literature research for fresh-cut produce sector was conducted. Based on the information acquired from the literature, risk factors were related to the internal and external environment of the organization, and the actual FSQMS. The overall methodology of the research is shown in Fig. 1. It encompasses three steps. In step 1 an extensive literature review to obtain a list of generic measurement indicators was conducted. In step 2, selection and identification of indicators obtained in step 1 relevant and/or can be modified into specific ones for the fresh-cut produce sector was performed. The selection phase was based on discussions with experts of the fresh-cut produce sector. Finally, in step 3 validation was conducted to check the relevance, comprehensibility and availability of the selected indicators at the fresh-cut produce sector.

2.2. Development of the instrument – questionnaire

The proposed tool consisted of the following sections: (i) Background information for SME (size, sector and usage of FSQMSs), (ii) and (iii) Risk factors ascertainment of the SME (Table 2), (iv) General effects from the implementation of FSQMSs, giving the opportunity to provide opinions about the effects of the implementation of FSQMSs in organizations, and (v) quantitative assessment of the organization.

Section 5 of the tool contained 107 questions that evaluated