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A Delphi-based approach to developing and validating a farm food safety risk assessment tool by experts

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ABSTRACT

A farm food safety risk assessment tool for fresh produce and salmon farms were developed and the Delphi-based approach was utilised to identify and aggregate the opinions of experts on the food safety hazards and diseases faced in the farms while simultaneously certifying the scientific contents of the tool. The expert panels also serve to validate the methodology used in the farm food safety risk assessment tool as well as to suggest for improvements. Three rounds of Delphi questionnaire were carried out and the process managed to solicit experts' agreement on the food safety hazards and diseases associated with UK's fresh produce and salmon farms and the topics used in the farm food safety risk assessment tool. The results and suggestions obtained from Delphi process were reviewed and subsequently adapted into the risk assessment tool. The Delphi-based technique has proven to be a valuable approach to aggregate multiple experts' opinions across diverse locations and achieves a wider distribution of experts.

1. Introduction

A farm food safety risk assessment may be one of the many intervention strategies in reducing or preventing food safety and disease risks from occurring. With better scientific knowledge of the hazards that cause food borne disease, the risks these hazards pose to consumers and the capacity to take appropriate interventions should enable governments and industries to significantly reduce food-related risks (FAO/WHO, 2006). Delphi has been proven to be a useful method for eliciting expert opinions within the food safety domain (Wentholt, Fischer, Rowe, Marvin, & Frewer, 2010; Wentholt, Rowe, König, Marvin, & Frewer, 2009). It is a method which allows a group of individuals, as a whole, to deal with a complex problem (Linstone & Murray, 2002, p. 3). It could also be used to seek out information which may generate a consensus from the respondent group or to explore underlying assumptions or information leading to different judgements (Hsu & Sandford, 2007; Linstone & Murray, 2002, p. 3). The Delphi technique is essentially a series of structured questionnaires (commonly referred to as rounds) (Henson, 1997) where answers are used as feedback in subsequent sessions or rounds. By providing feedback, Delphi creates interactivity and dialogue but without the pressure of conforming to group's decisions or from influential respondents (i.e. the group's position being overly swayed by dogmatic or high-powered individuals). Nonprobability sampling technique (i.e. purposive sampling or criterion sampling) is generally accepted as appropriate in Delphi studies as the opinion of experts is sought (Powell, 2003). Gordon (1994) notes that most panels range from 15 to 35 respondents; however there are studies with groups ranging from seven (Chu & Hwang, 2008) to 115 experts (Grundy & Ghazi, 2009). From a practical perspective, Delphi reduces cost and allows access to more individuals across diverse locations and a wider distribution of panellists (Wentholt et al., 2010). The aim of Delphi technique in this study is twofold. The first aim was to identify and aggregate the opinions of the experts regarding the food safety hazards and diseases faced in fresh produce and salmon farms in UK. Secondly, the experts also serve to validate the methodology used in the FRAM tool as well as to suggest for improvements.

2. Materials and methods

2.1. Development of Farm Food Safety-Risk Assessment (FRAM) tool

This section describes the design and development of the Farm Food Safety-Risk Assessment (FRAM) tool. Two FRAM tools were designed: (i) Farm Food Safety-Risk Assessment for Fresh Produce

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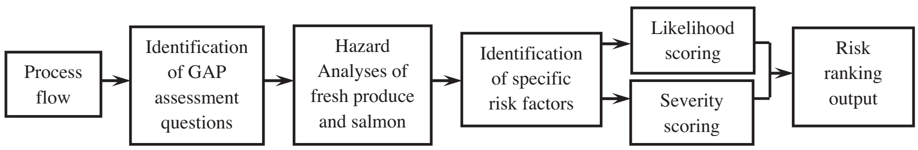

Fig. 1. Process used for methodology development, from process flow to risk ranking output.

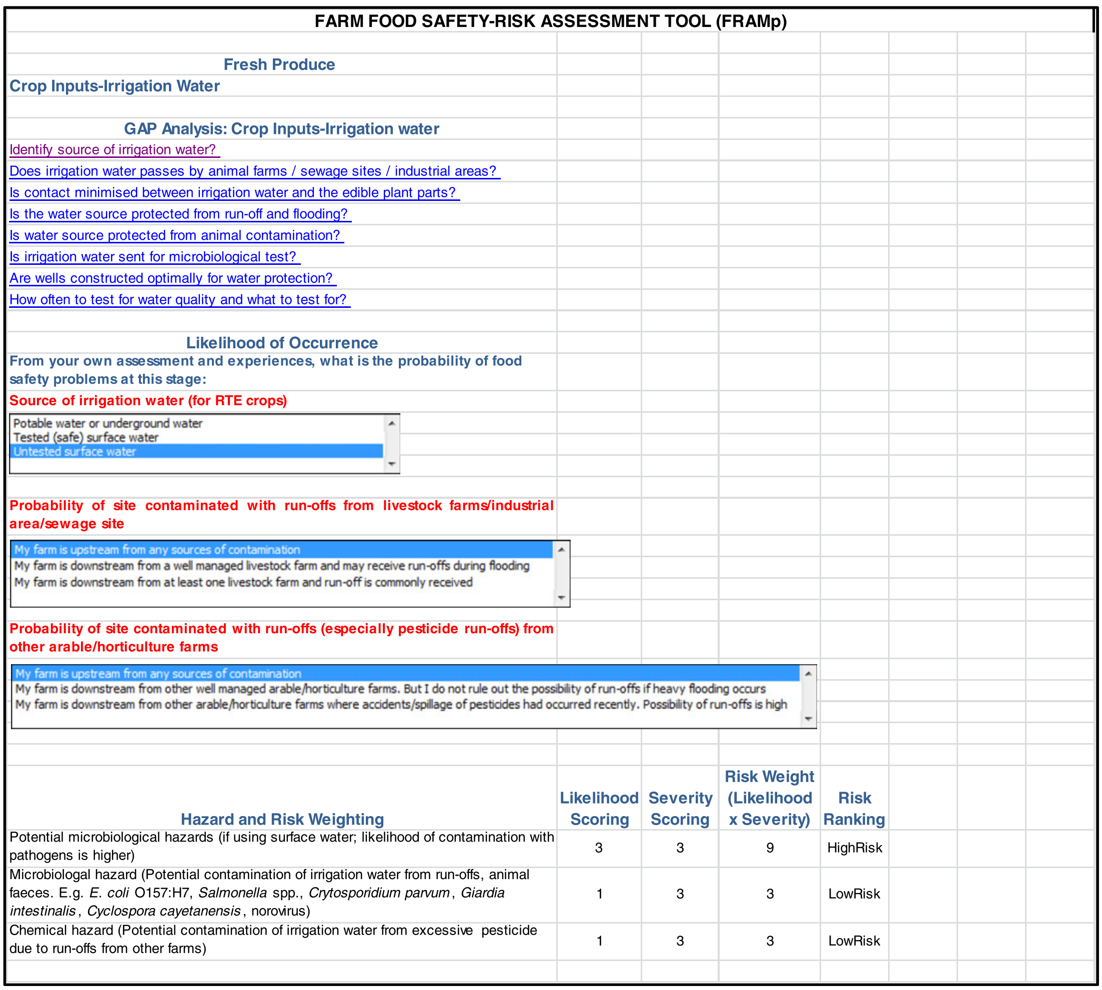

Fig. 2. FRAMp model user interface – likelihood of occurrence × severity scoring.

– FRAMp (small letter p represents fresh produce) and (ii) Farm Food Safety and Diseases Risk Assessment for Aquaculture – AquaFRAM. Both tools were based on the generic process flow for fresh produce (Knight, 2009) and salmon production (Stead & Laird, 2002). A copy of FRAMp tool or AquaFRAM in Microsoft® Excel format is available from the first author upon request.

2.1.1. User interface

The model was developed in Microsoft® Excel spreadsheet software using standard mathematical and logical functions. The "Check Box", "Option Button" and "List Box" macro tools available on the "Forms Control" toolbar under the Developer menu were used to automate the conversion from qualitative inputs to quantities for use in risk scoring. The macro tools allow users to select from the options by clicking on their choices (Ross & Sumner, 2002). The software then converts the qualitative example into the likelihood scoring (probability) of 1 (low), 2 (med) or 3 (high). The logical formula =IF (logical_test, value_if_true, value_if_false) was also used to ensure that the entered scores = output (risk ranking results).

The Good Agricultural Practices (GAP) Analysis Self-Assessment questions were developed for fresh produce and salmon production to encourage farmers to assess specific points (process) during the primary production. A check-list containing 38 questions was drawn up according to Good Agricultural Practice (with an emphasis on food safety) and distributed under eight sections according to the production process and inputs: (1) Process – Site selection; (2) Process – Seed/transplants; (3) Process – Sowing/planting; (4) Process – Crop harvest; (5) Process – Post-harvest handling; (6) Input – Irrigation water; (7) Input – Fertilizers and (8) Input – Pesticides (Knight, 2009; Rangarajan, Bihn, Pritts, & Gravani, 2001). The GAqP Analysis Self-Assessment questions were developed for salmon production to encourage farmers to assess specific points (process) during the primary production. The Good Aquacultural Practices (GAqP) checklist contains 53 questions under 12 sections according to the production process and inputs: (1) Process – Site