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# Evaluation of traceability systems in fish supply chains: A case study of Tanzania

John T. Mgonja[1*] and Jamal B. Kussaga[2]

[1]Sokoine University of Agriculture (SUA) P. O. BOX 3073, Tel +255 23-2601376/255. Morogoro, Tanzania. (john.thomasmg@yahoo.com or jmgonja@clemson.edu)

[2]Sokoine University of Agriculture (SUA) P. O. BOX 3006, Tel +255 23260 3511-4 Morogoro, Tanzania. Email: kussaga@suanet.ac.tz or kussaga15@yahoo.com

*Correspondence author: John.thomasmg@yahoo.com

**ABSTRACT**

The European General Food Law, EC 178/2002 requires each stage in the supply chain to have access in its upstream and downstream trading partners. The regulation seeks to ensure that at each stage of food production, processing and movement through the supply chain steps are taken to maintain safety of the products intended for human consumption, at its highest quality. While the literature recognises the importance of food processing companies to have efficient traceability systems, there has been shortage of actual involvement of researchers in assessing the actual execution and performance of traceability systems in food processing companies, especially in developing countries. Using a qualitative approach, this study evaluates the performance of traceability systems in Tanzanian context using a case study of four fish processing companies. It explores how fish processing companies under given contextual situations (e.g. product complexity, production process complexity, supply chain complexity and organisation complexity) design and execute their traceability systems. The findings showed that despite high degree of complexity of contextual situations, all companies used paper based traceability system with minimum computer applications. Paper based traceability system is associated with several limitations, and may lead to poor performance given higher level of complexities of contextual situations.

**Key words**: Traceability, contextual factors; fish processing, Tanzania

## 1. Introduction

Over the past decades, quality assurance (QA) has become fundamental to food safety policy in the food industry. Much focus has been on integral quality management systems. These systems cover all stages in the food supply chain including training, research and development (Beulens *et al.* 2003). The need for QA systems is now clear due to several crises like BSE, dioxin contamination, foot and mouth disease that occurred in the last decade. Consumers and government requirements are basic driving forces beyond QA systems to guarantee food safety that comply with consumers' (customer) demands. In anticipation to this situation various national and international acknowledged certification standards like BRC, SQF, Global G.A.P and ISO22000 have been developed ( Huss, Reilly, & Ben Embarek, 2000; Neeliah & Goburdhun, 2007; Ropkins & Beck, 2003). Most of these QA systems consist of quality management (e.g. ISO 9001) and food safety aspects (e.g. HACCP principles). Systems that are linked to quality assurance such as traceability and Ecolabeling, have received much attention in the food industry and agribusiness (FSA, 2002; Moe, 1998; Tall, 2001; Trienekens and Van der Vorst, 2006). Food legislation like European General Food law (EC 178/2002) demands traceability systems to be developed in all food sectors. Moreover, consumers would like to know how and where the products they purchase/consume are produced, processed, stored and transported (Van der Vorst, 2006). The European general food law seeks to ensure that at each stage of food production, processing and movement along the supply chain steps are taken to maintain safety of the products intended for human consumption, at its highest quality (EC 178/2002). However, the ability to consistently trace consignments of food through the supply chain is currently inadequate. Traceability systems have been developed at company level, however, these systems provide limited traceability, and they are fragmented, uncoordinated and inconsistent in approach (Tracefish, 2001). Van der Vorst (2003) argued that the basic idea of tracking and tracing is the possibility to determine where a certain item is located and to trace the history of that item. On the basis of that information, it should also be possible to determine the source of any problem of an item, and it should be possible to find out where the other items with the same problem are located in the supply chain. In many literatures, the concept of traceability is often used as synonym to tracking and tracing (Wilson and Clarke, 1998; Van Twillert, 1999; Van Dorp, 2002), and is used interchangeably in many studies. *Tracking* refers to the determination of the on-going location of items during their way through the supply chain (figure I). *Tracing* aims at defining the composition and the treatments an item received during the various stages in the production life cycle. Chain upstream (backward) tracing aims at determining the history of items and is used to determine the source of a problem of a defective item. The chain downstream (forward) tracing, aims at the determination of the location of items that were produced using for example a contaminated batch of raw materials.

Between 1997 and 1999 the East African Countries (i.e. Tanzania, Kenya and Uganda) experienced two export bans of fish and fishery products from Lake Victoria due to outbreak of cholera and pesticide contamination. The European Union (EU) requested these countries to demonstrate beyond any doubt that fish from Lake Victoria did not contain pesticides residues and microbiological contamination above tolerable levels (FAO/WHO, 2002). Unfortunately, the countries failed (at that time) to respond immediately to EU request due to lack of appropriate traceability systems in place. Timely response to emerging or suspected hazards is very important if the extents of dangers as well as devastating economic losses are to be minimized. Availability of effective traceability systems would have greatly minimized colossal economic losses incurred as a result of the ban (FAO/WHO, 2002). Therefore, the aim of this paper is to analyse the contextual situation and evaluate performance of traceability systems in fish processing companies in Tanzania and propose measures for improvement.

## 2.0. Methodology

### 2.1. Characteristics of the companies

To evaluate performance of traceability systems in fish processing companies, four companies were analysed. All companies have EU approval number and their major export markets are the EU, Japan and the Middle East. Also, they have validated HACCP, GMP and traceability systems; and are regulated by the Ministry of Livestock and Fisheries Development, which is the competent authority in Tanzania. Company 'A' is a medium sized company with 120 employees, 277 suppliers and deals with sea fish processing. Company 'B' is large sized company with 600 employees, 25 suppliers and specialises in Nile perch processing. Company 'C' is also large sized company with 500 employees, 49 suppliers and specialises in Nile perch processing. Company 'D' is a large sized company with 500 employees, 12 suppliers and specialises in Nile perch processing.

### 2.2. Evaluation of performance of traceability systems

The evaluation consisted of two parts. Part I involved analysis of traceability system with respect to contextual factors, whereas part II analysed traceability system with respect to traceability information requirements in fish supply chain (Table 1). Contextual factors are described as the environment in which an organization operates that affect the level of performance of traceability system. Contextual factors include product complexity, production process complexity, supply chain complexity and organisation complexity/characteristics (Kousta, 2006; Luning et al., 2009; Mgonja et al., in press; Van der Spiegel, 2004). High levels of complexity of the contextual factors are assumed to put high requirements/demands on the performance of the traceability system. High requirement/demands in traceability system refers to requiring more information collection points, more detailed information, more data processing, collection of more samples, collection of samples at a higher level e.g. at ingredient level. However, organisation complexity/characteristic is considered to be somehow different from the rest of the contextual factors. Organisation complexity or characteristics contribute either positively or negatively on the design and execution of the T&T system, but does not put high/low demands. For instance high level of employee involvement (as an indicator of organisation complexity) does not put a higher requirement/demand on the T & T system but will result into proper design and execution of the traceability system.

In order to obtain an indication of the traceability system performance we selected indicators to judge how traceability systems have been appreciated and discussed by various experts in literature. The assumption behind the performance of traceability system is that food processors which evaluate performance of their traceability systems in a more structured way and according to very specific criteria will have a better insight in their situation and stand a better chance of preventing food safety problems from occurring in their companies (Jacxsens et al., 2010; Mgonja, 2007)

For each contextual factor several indicators were derived from literature (Table 1). The indicators measure the complexity of contextual factors. Typical for a performance indicator is that it includes a certain judgment (is it high or moderate or low). An indicator can provide information about or can be indicative for an overall situation (Luning et al., 2008). For each indicator three description levels were derived, low level (1), medium level (2) and high level (3). Low level refers to e.g. slight loss of flavour, not likely to occur, 1-2 species, 1-5 processing steps/lines, less than 20% supplied fish is from wild sources, ad-hoc exchange of information, no T& T system stated and reviewed, employee not involved. Medium level corresponds to e.g. unpleasant smell, likely to occur, 2-10 species, 6-10 processing steps/lines, 20-50% supplied from wild sources, regular exchange of information, T& T system stated but not reviewed, employee partly involved etc. High level refers to e.g. putrid smell, high likely to occur, more than 10 species, more than 10 processing steps/lines, more than 50% supplied fish come from wild sources, joint planning and regular exchange of information, T& T system clearly stated and reviewed, employees completely involved etc.

**Table 1: Grid to Assess Contextual Factors**

| Product Complexity | | | | |
|---|---|---|---|---|
| Indicator | Assumed mechanism | Low level | Medium level | High level |
| Spoilage rate of fish. (Dalgaard *et al.*, (1994), FDA (2001), FAO (1997), and Gupta and Misra (1997)) | When processing fish with high spoilage rate you need to collect more information to be able to judge the safety level of fish. Thus, fish with high spoilage rate put higher demand on the design and execution of T&T system | Slight loss of natural flavour and odour when fish stored in ice for > 11 days. | Unpleasant smell when fish stored in ice for 7-10 days | Putrid smell and regarded not fit for consumption when fish kept in ice for 0-6 days |
| Risk level of RM/Product for safety (Based on FSA (2002), NACMCF (1998), Kousta (2006) and Van der Vorst (2004)) | If the risk level of the product is high, then detailed information is required to judge safety level of the product, which put more requirements /demands on the design and execution of the T&T system. | The incident is not likely to occur once in 10 years and once it occurs, it is simply about a product being out of specification | When there is a possibility of a repeated incident i.e. once in a year and which may result to customer ill health | There is a chance of a repeated incident i.e. several times per year and which result to customer fatality |
| Degree of diversity of raw material with potential hazards. Based on FDA (2001) and Luten e*t al*., (2003) | Different species e.g. of fish have different Hazards. The more varied species processed the more detailed information needed to be collected. This situation puts higher requirements on T&T system | Only 1 or 2 fish species with potential hazards are processed throughout the chain | Between 2 and 10 fish species with potential hazards are processed | More than 10 species of fish with potential hazards are processed throughout the chain |
| Production Process Complexity | | | | |
| Indicator | Assumed mechanism | Low level | Medium level | High level |
| Number of processing steps/lines Based on Moe, 1998; Vernède et al., 2003; Golan et al., 2005 | Many production steps/lines means more points for data collection need to be included in the T&T system. This puts higher demand on the design and execution of T&T system | Between 1and 5 processing steps/lines | Between 6 and 10 processing steps/lines | More than 10 processing steps/lines |
| Production process structure (convergence and divergence process) Based on (Moe, 1998; Vernède *et al*., 2003; Golan *et al*., 2005 and FDA, 2001 | Diverging and converging product streams make it difficult to follow the different raw materials that go into the product and all the end products. This puts high demands on the design and execution of the T&T system | Divergence/ Convergence process occurs within the company | Divergence /Convergence process occurs outside the company | Divergence/ Convergence process occurs inside and outside the company |
| Sources of raw materials (RM) supply. (Based on Trienekens and Van der Vorst 2006) | Having RM from wild sources (e.g. Ocean, lake) you need to do many analyses so as to judge the safety level of the RM. This situation put a higher demand on the design and execution of the T&T system | Less than 20% of raw materials are supplied from wild sources | 20 - 50% of the raw materials are supplied from wild sources | More than 50% of the raw materials are supplied from wild sources |
| Supply Chain Complexity | | | | |
| Indicator | Assumed mechanism | Low level | Medium level | High level |
| Degree of diversity of the chain actors (Based on Lazzarini et al., (2001), Van der Vorst (2006)) | Having many actors in the chain is associated with receiving and sending more information than when there are only few actors. This situation puts a high demand on the design and execution of the T&T system. | Supply chain consists of one RM supplier, one fish processor and one buyer | Supply chain consists of multiple RM suppliers, one fish processor and one buyer or its vice versa | Supply chain consists of multiple RM suppliers, one fish processors and multiple buyers |
| Level of chain partnership (Based on Spekman et al., (1998) | High level of chain partnership is associated with high level of chain collaboration and sharing of all | Partners exchange bits of information (e.g. product | Partners exchange product and | Partners carry out joint planning of all activities and |

| | | | | |
|---|---|---|---|---|
| and ECR Europe (2004)) | business information on regular basis, which contribute positively on the T&T system design and execution and hence T&T system performance. | information, quantity, price etc.) only upon request | process information on a regular basis e.g. prices, quantity, production method etc. | exchange all information about product, process and customers on regular bases. |
| Organisation Complexity/characteristics | | | | |
| Indicator | Assumed mechanism | Low level | Medium level | High level |
| Degree of employees involvement Ivancevich (1994), and Luning et al., (2002)) | Early inclusion of workers in designing T&T system will lead to a better understanding of its purpose and importance. This may contribute to a more positive attitude and a more desirable intention to execute T&T system at a high level. | Employees are just informed and instructed about how to work with T&T system during execution | Employees suggestions and opinions are taken into account during designing stage | Employees are completely involved in T&T system from the moment of conceptualization, throughout the execution process |
| Working conditions of employees (Based on Luning *et al.*, (2002) and US Bureau of labour statistics, 2006) | Good working conditions such as good ventilation, good smell and provision of feedback information is highly motivating and positively contribute to the design and execution of the T & T system | Poor ventilation, bad smell and no feedback information | Good ventilation but no provision of feedback information | Good ventilation, good smell and provision of feedback information |
| Top management commitment (Based on ISO 9001:2000) | Management commitment and support is essential for T&T system. High commitment of the top management is associated with a clear policy about the T&T system design and execution, clear statement regarding the T&T system reviews and personnel responsible for the implementation of the T&T system at the managerial level | T&T system is not stated in the organisations' policy, there is no T&T system reviews and is not stated who is responsible for the implementation of the T&T system | T&T system is stated in the organisations' policy but there is no T&T system reviews and is not stated who is responsible for the implementation of the T&T system | T&T system is clearly stated in the organisations' policy, presence of T&T system reviews and it is clearly stated who is responsible for the T&T system implementation |
| Rate of temporary workers (Based on Foote, 2004) | Temporary workers lack; motivation, commitment, proper training, proper working skills and work experience. Large number of temporary workers will negatively contribute on the T&T system | Less than 30% of all employees are temporary employees | Between 30 and 60% of all employees are temporary employees | More than 60% of all employees are temporary employees |
| Traceability Information requirements | | | | |
| Indicator | Assumed mechanism | Low level | Medium level | High level |
| Level of T & T registrations (Based on Perez *et al*., 2003, Tracefish (2001) and Regulation 2065/2001 of EU) | More extended/ comprehensive registration of traceability information contributes positively to a higher level of T&T system design and execution because it enables a more precise tracking and tracing of a problem and therefore contributes positively on the overall performance of the T&T system | Only information about method of processing, quantity, price, handling method and time/temperature | Only information about, packaging , time/temperature , appearance, expiry dates, landing dates, fishing gear and landing date | All information as required by regulation |

Three indicators were developed for product complexity (i.e. spoilage rate of fish, risk level of fish product, and diversity of fish species); and four indicators were formulated for production process complexity (i.e. number of processing lines, number of processing steps, nature of production process structure, and sources of raw material supply). Also, two indicators for supply chain complexity (i.e. level of supply chain partnership and diversity of chain actors), and four indicators for organisation complexity/characteristics (i.e. employees involvement, working conditions of employees, rate of temporary workers and extent of top management commitment) were derived.

Traceability information requirements refers to information that is required by law to be registered and made available to competent authority any time whenever need arises (Perez *et al*., 2003; Regulation 2065/2001 of EU; Tracefish, 2001). Traceability information requirements is mainly composed by one indicator, namely T&T system registrations. It is assumed that the extent of implementation of the traceability system requirements can be measured by checking the degree of data registrations in the company. The evaluation of the performance of traceability systems was conducted through documents analysis, face to face interviews with QA personnel and directors (1-2 hours), and direct observations.

### 3. Results and Discussion

Table 2 shows the scores for the individual context indicator and the overall score for that contextual factor for all studied fish processing companies. For all companies, contextual factors had similar indicator scores, except one indicator of product complexity, (i.e. the degree of diversity of fish species). Most indicators of contextual factors scored 1 and 3, while the indicator for traceability information requirements scored 3 for all companies. Score 1 puts low demand in the T&T system, while score 3 puts higher demands on the system.

For product complexity, all analysed companies scored 1 (low score) in all indicators except one company (CI), which scored 3 (high score) with respect to degree of diversity of fish species (Table 2). More traceability information is required when dealing with many species of fish because different species of fish have different potential hazards (FDA, 2001). So a profound knowledge on specie related hazards, product reactions and synergistic effects in fish is required during processing, and designing and execution of T&T system. In general, fish industry trades globally in a vast range of fish species which have different hazards (Luten *et al*., 2003). When dealing with many species of fish with potential hazards (such as parasites, natural toxins, histamine/scombrotoxins, pesticides, antibiotics, drugs and methyl mercury), one needs to collect more samples (detailed samples) for analysis so as to precisely judge the safety level of the final product. This situation generates a large volume of data and puts higher demand/requirement on the T&T system, which may affect the overall system performance.

For production process complexity, all analysed companies had high score (score 3) in three indicators except in one indicator (number of processing lines) which had a low score (score 1). The score for the indicator “number of processing steps” was high for all companies. This indicates that the companies had more than 10 processing steps. Having many production lines/steps means also having many data generation points, which implies that more points for information collection needs to be included in the traceability system. A large volume of data put a higher demand on the design and execution of traceability system than when dealing with low volume. Moreover, generating a large volume of data is a tedious work and may be susceptible to errors (FDA, 2001), which may also affect performance of the traceability system. Therefore, a company with many processing lines/steps requires a more robust system for data capturing, storage, processing and retrieval.

Also, Table 2 denotes that the score for the indicator “production process structure” was high for all analysed companies. This implies that the companies experience both divergence and convergence processes, inside and outside of their companies. Production process structure can be a straight line, divergent and/or convergent. Diverging and converging product streams make it difficult to follow the different raw materials that go into the product and all the end products. Divergent process (where product flows diverge into a larger number of products) and convergent process (where a large number of product flows converge into a single product) are common practices during fish processing. Divergence of materials into more products generates a track of numerous different lots (e.g. brined fillet, brined loin, chilled loin, frozen log and frozen block) and therefore, more information is required to be registered in the traceability system (Moe, 1998; Golan *et al*., 2004). Vernède *et al.*, (2003) also supported the idea that registering information about the product identity is especially required before and after convergent and divergent processes. It is assumed that if divergence and/or convergence process occurs outside the company, registration of the necessary information cannot be guaranteed. On the other hand, if convergence and/or divergence process occurs within the company, registration of the necessary information can be done correctly since the process is within the control of the processor. However, convergence and divergence process may occur both outside and inside the company and thus, put more demand on the T&T system.

**Table 2: Scores of indicators representing the contextual factors and traceability information requirements for fish processing companies**

| Factor and Indicator | C1 | C2 | C3 | C4 | Average score |
|---|---|---|---|---|---|
| **Product Complexity** | | | | | |
| Spoilage rate of fish | 1 | 1 | 1 | 1 | 1 |
| Risk level of fish product | 1 | 1 | 1 | 1 | 1 |
| Degree of diversity of fish species | 3 | 1 | 1 | 1 | 2 |
| **Production process complexity** | | | | | |
| Number of processing steps | 3 | 3 | 3 | 3 | 3 |
| Number of processing lines | 1 | 1 | 1 | 1 | 1 |
| Production process structure | 3 | 3 | 3 | 3 | 3 |
| Sources of raw material supply | 3 | 3 | 3 | 3 | 3 |
| **Fish Supply Chain Complexity** | | | | | |
| Degree of diversity of chain actors | 3 | 3 | 3 | 3 | 3 |
| Level of chain partnership | 3 | 3 | 3 | 3 | 3 |
| **Organisation Characteristics/Complexity** | | | | | |
| Degree of employee involvement | 1 | 1 | 1 | 1 | 1 |
| Working conditions of employees | 1 | 1 | 1 | 1 | 1 |
| Rate of temporary workers | 3 | 3 | 3 | 3 | 3 |
| Level of top management commitment | 2 | 2 | 2 | 2 | 2 |
| **Traceability System Requirements** | | | | | |
| Level of registration of traceability information | 3 | 3 | 3 | 3 | 3 |

C1=Company 1, C2=Company 2, C3=Company 3 and C4=Company 4

Table 2 indicates that the score for the indicator "Sources of raw material supply" was also found to be high in all analysed companies. This shows that 100% of the raw materials are supplied from wild sources (ocean and Lake). Wild sources of raw material supply make traceability system more complicated since the company will be obliged to do more tests (microbiological and chemical) to adequately judge the safety level of the raw material and the final product. In other words, if the company obtains its fish from a specific farm, which operates with clear specifications, then hazards can be well established/ predicted and the safety level can be determined. On the other hand, if the company obtains its fish from wild sources (ocean/lakes), then it is difficult to establish/ predict all the hazards. Thus, the raw material may have a higher chance of being associated with unknown hazards that would require more analysis. According to FSA (2005), fishes originating from wild sources have high chance of associated with higher level of toxicological contaminants (such as methyl mercury and dioxins and dioxins like PCBs) and thus, present a highest safety risk. Raw materials supplied from wild sources therefore, put a higher demand on the design and execution of the traceability system than farmed fish.

With regards to fish supply chain complexity, all analysed companies had high score (score 3) in both indicators; degree of diversity of chain actors, and level of chain partnership (Table 2). High degree of diversity of chain actors implies that the processing companies have multiple suppliers and buyers. When the firm has many chain actors (Lazzarini *et al.*, 2001), then more information exchange is required. This puts more demand in the traceability system as more information would be required for exchange than when dealing with a few actors. Similarly, high level of chain partnership indicates that partners (e.g. fish suppliers, processors and buyers) carry out joint planning of all activities and exchange all information about products, processes and customers on regular basis. It is assumed that as the level of chain partnership increases partners dedicate more resources to sustain and further the goals of the supply chain; as a result information is more easily exchanged (Lazzarini *et al.*, 2001). Also, when the level of chain partnership is low, there is less information to be transferred since partners exchange bits of essential information only upon request. When the level of chain partnership is high, there is more information to be transferred because partners carry out joint planning of all activities and exchange all information on regular basis. Therefore, high level of chain partnership is associated with more/detailed information sharing, and thus positively contributes to the design, and execution of the traceability system

With regards to organization characteristics/complexity, all companies had a low score in degree of employees' involvement and working conditions; and high score in rate of temporary workers (Table 2). High score in rate of temporary workers means that temporary employees in these companies are more than 60%. Temporary employees are in a constant state of employment flux, and therefore, high turnover. This is due to the fact that they are neither guaranteed consistent employment nor assured of a solid start or finish date for their assignments. Temporary workers lack motivation and commitment, proper training, skills and experience (Foote, 2004). If the company is characterised by a large number of temporary workers, it is likely that many quality assurance activities including T&T will not be carried out perfectly. This situation may affect performance of the T&T system.

For the traceability information requirements, all companies had a high score in the level of registration of traceability information (Table 2). This is probably due to the fact that these companies are all regulated by the competent authority of Tanzania and are required to meet the EU regulation 2065/2001 on traceability information requirements. According to EU Regulation 2065/2001, the following traceability information should be made available to the competent authority: supplier name, origin of fish, boat registration number, quantity supplied, common name, scientific name, company name, company address, processing date, production method, expiry date, carton number, carton weight, code or grade, storage temperature, destination, source of packaging material and FAO fishing zone. Also, all suppliers to the EU should indicate their respective EU approval number. High level of registration indicates that all necessary information required for traceability purposes as demanded by the law was correctly registered by the companies. This enables a more precise tracking and tracing of food safety problems whenever they occur. However, it was observed that all companies used paper based registration system with limited computer application. Paper based registration system has several limitations including inadequate functionalities, time consuming, information cannot be easily retrieved, not fraud proof, and requires more space (Marshall, 2004; Petersen & Green 2005).

## 4. Conclusions

The evaluation of performance of traceability system in our study based on 14 indicators derived from four contextual factors (product complexity, production process complexity, and supply chain complexity and organisation characteristics/complexity) and traceability information requirements in fish supply chain. The study found that 7 indicators had high scores while 5 indicators had low score and 2 indicators had medium score. High score implies that the fish companies have high contextual complexity situations which put high demands on the T&T system. High levels of complexity of contextual situation require a robust system to effectively capture, store, process and retrieve information. On the other hand, a low level of complexity of contextual situation does not put high demand on the traceability system since a very simple traceability system (e.g. paper based) can be sufficient to realise a good food safety output.

The study found that all analysed companies rely on paper based traceability system with limited computer applications despite of high degree of complexity of their contextual situations. Although paper based traceability system is the simplest form of recording information and tends to be at least part of most traceability systems, it can only be appropriate for simple processes (low complexities). The paper system relies on the user to formulate effective recording templates that can be used to record the vital parameters associated with the product, so it is prone to human errors. The paper system can appear to be the most straightforward and least cost option for a small operation, however the operator must consider the time needed to record and maintain paper records and the ability to cross reference through records if a problem occurs (Marshall, 2004). Nevertheless, the disadvantages of paper based T&T system outweighs the advantages as the level of complexity of the contextual factors increases. For this case, a more advanced T&T system would be more appropriate in these companies if higher level of traceability system and hence food safety assurance is to be achieved.

Performance diagnosis can be a useful and cheap tool to obtain a quick impression on how fast and correctly companies can trace a food safety problem in their companies. The assumption behind the traceability system performance diagnosis is that processing companies that evaluate performance of their food safety management system in a more structured way and according to specific criteria will have a better insight in their actual performance and food safety problems can be more systematically detected (Jacxsens *et al*,. 2010). The self-assessment provides insight in the strong and weak points of the current system and supports a food business in identifying what/how to improve (Sampers et al., 2010). Besides the usefulness of this tool for an individual food processor, the traceability performance diagnosis tool can also be applied on the level of governments (e.g. Competent Authorities) to benchmark performance of implemented traceability systems in various other sectors in the country.

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