

# Is food safety climate impacting safety and quality? Case study of meat distribution

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## INTRODUCTION

Up to now scientific research focused on analytical methods, food processing technology and product formulations as technological solutions and Food Safety Management Systems (FSMS) as managerial solution to improve the safety status of food products along the food supply chain (Figure 1). However, in practice, a well elaborated and 'fit for purpose' FSMS, does not always guarantee the highest level of food safety and hygiene and a stable system output. Human behavior (e.g. the actual execution of procedures), and decision making is influenced by the perceived food safety climate in an organization (Yiannas, 2009). The aim of this work was to set a definition for food safety culture/climate and to develop and validate a tool to measure the food safety climate in food companies. The terms safety culture and safety climate are often used interchangeably in literature (Wiegmann et al., 2012). In our research food safety climate is considered as a measured perception of the food safety culture present in a company (Table 1 and Table 2). These concepts are further demonstrated via a case study linking food safety culture and microbiological output between micro scale short chain farm butcheries, having a basic FSMS, and large conventional chain butcheries, having a more fit-for-purpose FSMS. The hypothesis underneath is that micro scale companies can have a good microbiological output, despite the less elaborated/fit-for-purpose food safety management system, compensated by their food safety culture.

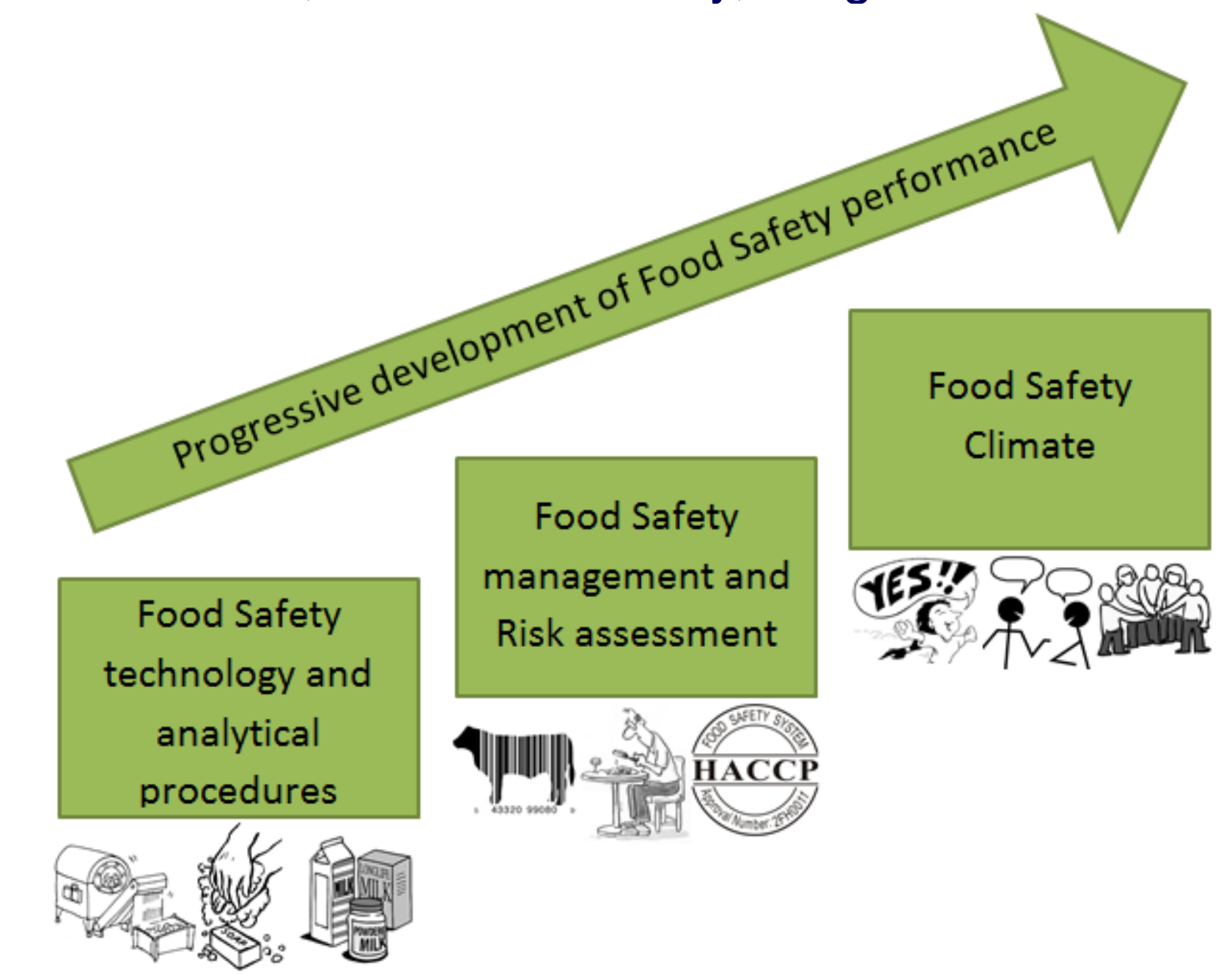


Figure 1: Evolution of research focus towards food safety climate (Wright et al. 2012)

## MATERIALS AND METHODS

The development of the food safety climate assessment tool was executed by means of a comprehensive literature study and discussion with experts in the field. Next, twenty other experts with expertise concerning food safety/quality and FSMS, such as governmental agencies (n=4), third party certification bodies (n=3), sector associations (n=3), universities (n=1) and industry (big companies: n=6, small companies: n=3) from Belgium and the Netherlands, were asked to evaluate relevance, reliability and validity of our initial Food safety climate assessment tool. For the case study, microbiological samples were taken from raw minced beef meat (n=50) and production environment (food contact surfaces (knives, cutting boards and mincer swabs: n=120; *L. monocytogenes* swabs: n=120) and hands of workers (n=69)) and were analyzed for food safety, hygiene and quality parameters in order to gain information of the actual output of the 8 visited butcheries (4 conventional chain (CC1-CC4) and 4 short chain (SC1-SC4)). Also, the food safety climate assessment survey was completed by every employee of these companies (n=44).

Table 1: Definition food safety climate

Food safety climate
Employees' (shared) perception of the leadership, communication, commitment, resources and risk awareness concerning food safety and hygiene within their current work organization

Table 2: Definition food safety culture

Food safety culture
The interplay/combination of the company characteristics, its context in which it is operating, the performance of the current FSMS, the perceived Food safety climate and the psychology of the individual employees, resulting in a certain output (for microbiological output being results on food safety, hygiene and quality parameters)

## RESULTS

The definitions for food safety climate, food safety culture and the different components are given in Table 1, Table 2 and Figure 2. A self-assessment survey with 28 indicators was developed and adjusted based on the expert validation (Table 3).

Table 3: Example of an indicator for each component of Food safety climate

Component	Example indicator
Leadership	In my organization, the leaders are able to motivate their employees to work in a hygienic and food safe way.
Communication	In my organization, the leaders communicate in a clear way with the operators about hygiene and food safety.
Commitment	In my organization, employees are actively involved by the leaders in hygiene and food safety related matters.
Resources	In my organization, employees get sufficient time to work in a hygienic and food safe way.
Risk awareness	My colleagues are alert and attentive to potential problems and risks related to hygiene and food safety.

The overall results of the case study in the meat distribution sector are represented in Figure 3. It can be seen that the conventional chain butcheries are able to counter the risky context (high level of risk towards microbial contamination) by a well elaborated and fit-for-purpose FSMS, whilst the short chain farm butcheries have a more basic FSMS. For short chain butchery 2 (SC2) this situation is (partially) counteracted by a higher food safety climate score (than the other short chain butcheries), which enables SC2 to achieve a high microbiological output level. SC2 underestimates the butchery's own food safety climate, as the food safety climate score was more on a moderate level, whilst a very high microbiological output level is achieved. For SC1 and SC3 the microbiological output was on a lower level, but also the food safety climate score was on a lower level. SC4 was situated, both for the food safety climate and the output, somewhere in the middle.

Considering the conventional chain butcheries, it can be seen that CC2 and CC1 are on a higher microbiological output level, whilst the food safety climate score is not that high. CC4, however, overestimates the food safety climate in the butchery, as the microbiological output is not that high. Also CC3 slightly overestimates the food safety climate in the butchery.

## Conclusion

To go back to the research question, it can be concluded that the probability of achieving a high level of microbiological output, independent of the FSMS, can only be proven for SC2. Although SC2 scored their own food safety climate only moderate, this is a perception which can indicate that they are more critical and apply higher standards concerning food safety. The other short chain butcheries were on a lower microbiological output level, which is also reflected in their lower food safety climate scores. This indicates that the short chain butcheries have a good estimation of the level of hygiene and food safety in their butcheries, even though this level seems to be lower.

The conventional chain butcheries have in general a higher food safety climate score than the short chain butcheries, and also the microbiological output level was higher than most of the short chain butcheries. However, the conventional chain butcheries have a less good picture of their own situation, as two butcheries underestimate themselves and the other two butcheries overestimate themselves. Moreover, the management of the conventional chain butcheries scored the food safety climate lower than the affiliates did, which can indicate that it is more difficult for the conventional chain butcheries to get their personnel in the same direction.

It can be said that the case study showed some interesting relations between food safety climate and the output. With the help of our food safety climate assessment tool companies are able to go beyond traditional food safety management and mirror the human dimension in food safety.



Figure 2: Components of Food safety climate (based on Griffith et al. 2010)

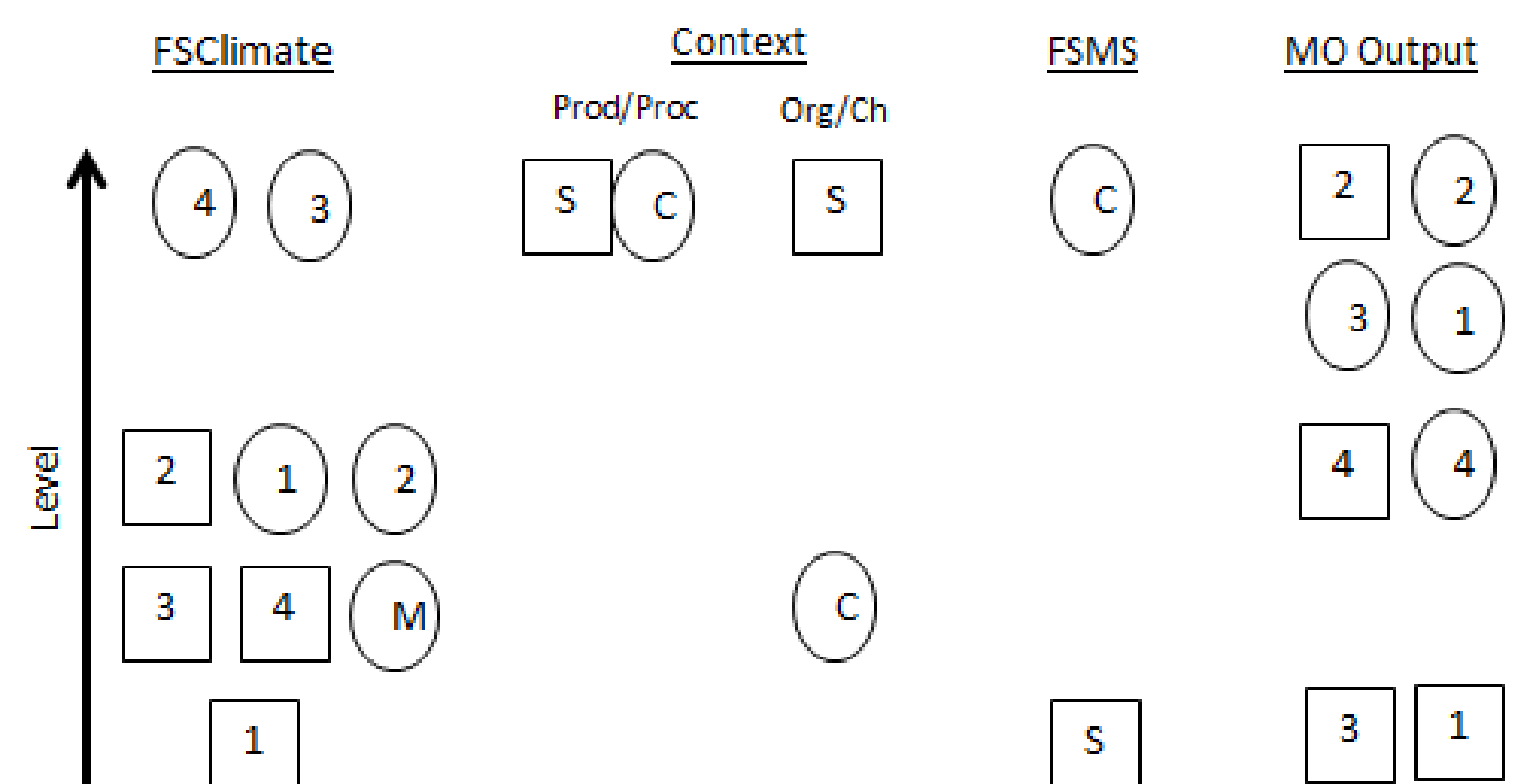


Figure 3: Relative ranking of the eight butcheries of the case study for their food safety climate, context riskiness, food safety management system and microbiological output. The butcheries were ranked relative to each other for different parameters. O: Conventional chain butcheries (1-4); □: Short chain farm butcheries (1-4); M: Management of the conventional chain butcheries; C: all conventional chain butcheries; S: all short chain farm butcheries. Prod/Proc: product and process related context characteristics; Org/Ch: organization and chain related context characteristics.

## References

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## Further research

In further research we want to test our tool on a larger scale and make a link to microbiological and/or chemical monitoring results and to psychological indicators of the personnel.

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