



UNIVERSITÀ DEGLI STUDI DI PADOVA
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Second Cycle Degree (MSc)
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DIFFICULTIES IMPLEMENTING HACCP IN
SMALL-SIZED COMPANIES IN GERMANY AND
ITALY

Supervisor
Luca Fasolato
Co-Supervisor
Prof. Dr. Katharina Riehn

Submitted by
IŞIN AZAZİ
Student n. 2005858

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Abstract

Online questionnaire research was done among Small and Medium-Sized companies in Germany and Italy. The Likert-Type scale was used in the questionnaire to discuss the difficulties of applying Hazard Critical Control Points. The research discussed food safety evaluation In E.U and gives an idea about the difficulties of HACCP in small-medium Companies located in Germany and Italy. In total,13 Italian companies and 15 German Companies attend to survey. The Differences between the two countries and differences in between the company's size were analyzed. Non-parametric median test and Mann-Whitney U test were used as statistical analysis. There was a statistical difference in the statement that discuss the necessity of HACCP opinion on both statistical tests. The companies belonging to Germany disagreed with the statement (Mean Score 1,6, Median Score 1). Nevertheless, the result also similar in comparison between micro and small companies. Therefore; the reason may be because of there are more Italian micro-companies attending survey to the research. There was no statistical difference between countries among other statements. There is high awareness in both countries on understanding the role of HACCP. Also, respondents from both counties trust that HACCP benefits are higher than its costs. Trust in food public controls systems and understanding of regulatory aspects are the first problems found in both Countries while the answers close to section 'Not Sure'. Additionally, respondents claimed that there is a waste of time to record the procedure on paper as well as be updated. In conclusion, it is has been founded that the micro companies tend to be less aware about food safety culture and the trust on legal authorities is weak. The research could give an idea for further research. It should be considered that the survey was done online with small number of attendees. Yet, the research may give an introduction ideas for further research

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1. Introduction

1.1 Food Safety Definition and Food Safety Importance

Safety is defined as, an intrinsic quality attribute of foods and it is strictly related to their suitability for human consumption. On another hand, food safety is defined as a concept that deals with the action to reduce microbial contamination as well as considering other hazards that during handling, storing, and preparing food may determine loss of nutrients making foods of low importance in our diet or cause the formation of unhealthy compounds. (Abu Al-Rub et al., 2020). Moreover, food safety also defined by Article 14 and 15 in Regulation 17802 EC . Food defined as unsafe in Article 14, if the food injurious to health and unfit for human consumption. Food determinate injures to the health if the food has probable toxic effect, particular health sensitiveness of a specific category of consumers and also if the food has short-term, long-term effect on consumers after consumption and also subsequent generations. Furthermore, additional to Article 14, Article 15 discussed the feed safety which include the animal health. According to Article 15 the feed cannot placed in the market if the food have an adverse effect on human or animal health and if it is considered to make the food derived from food-producing animals unsafe for human consumption(EC, 2002)

Food Safety failures can cause serious effects on consumer health. The worst-case scheme happens when thread leads to deaths or illness (Trienekens & Zuurbier, 2008). In Europe, 5,175 foodborne outbreaks were recorded in 2019 with 49,463 illnesses, 3,859 hospitalizations, and 60 deaths. A summary of food the most important outbreaks is given in Table 1.

Food Safety failures also may cause harmful economic damages (Thomsen & McKenzie, 2001) to companies involved as well as consumer perception changes on products (Henson & Reardon, 2005). A study in New York determined that a recall may reduce the shareholder

wealth in a firm between 1.5-3% and this loss may continue at least for a period exceeding one month after the recall announcement. (Thomsen & McKenzie, 2001)

Table 1 Summary of Food Outbreaks in E.U

Year	Incident	Description
Between May and July 2011	<i>E. coli</i> (EHEC) O104:H4	The outbreak occurred in Germany and France. Overall, 855 cases of hemolytic uremic syndrome (HUS) and 2,987 cases of bloody diarrhea, including 53 fatalities, were reported in Germany. Meanwhile, in France, a total of 24 cases, were reported. It is declared that the outbreak was the ever-largest outbreak that happened in Europe. ((European Centre for Disease Prevention and Control, 2011)). The Source was Contaminating Sprouted Seeds
Between 2015-2018	<i>L. monocytogenes</i>	Occurred as a Multistate Outbreak happened in Austria, Denmark, Finland, Sweden, and United Kingdom. 47 cases of listeriosis with 9 subsequent deaths recorded. Source Frozen Vegetables mainly Corn (Sarno et al., 2021)
Between 2016 and 2020	<i>Salmonella enterica</i>	A multi-country outbreak of Salmonella Enteritidis has been ongoing in the EU/EEA for several years. From 1 February 2017 to 14 January 2020, 15 EU/EEA countries reported 656 confirmed cases and 202 probable cases. Before February 2017, 385 historical-confirmed cases and 413 historical-probable cases were identified, resulting in 18 affected countries (EFSA, 2020)

1.2 EU Policies Evaluation and Their Role In Food Safety

Given that European consumers have a right to safe food, all stakeholders are in charge to ensure only safe food is placed on the market. Governments and state agencies have a promise to audit and enforce legislation on food safety. E.U policies have been developed, due to the number of unexpected food crises. (McEvoy, 2016)

It is stated that the worries about the use of hormonal growth and residues of stilbenes may be the main operators of the evolution of EU legislation in the 1980s and 1990s. (McEvoy, 2016). The legislation discusses monitoring plans for residues of illegal items, veterinary medicines, and contamination of animal origin. (EC, 1986, 1997) By 2000, the European commission reconstructs EU Food Safety by the European Commission's White Paper food. The document contains an action plan on food safety with the aim of farm to fork approach for food safety. The white paper defines the framework for new and more risk-based approaches to food safety. (EC, 2000). The general law Regulation 18 (EC, 2002) also discussed the principles and requirement food law the procedures of food safety that establishing the European Food Safety Authority. The series of Legislation continued by Food Hygiene package, the feed hygiene regulation (EC, 2004, 2005), and the official feed and food control regulation.

1.3 Ensuring Food Safety

Authors stated that ensuring the best food quality and safety is a challenging and competitive task while there are potential food safety hazards at every stage of the food production process. It is a prerequisite for firms to establish satisfactory risk control procedures throughout the process(Liu et al., 2021) The Codex Alimentarius HACCP principles are regarded worldwide as the most effective tool for ensuring food safety (EC, 2005)

1.3.1 HACCP: Evaluation by Time

It has been declared that the origin of Hazard Critical Points is stretch back to the American space program of the late 1950s and 1960. Nevertheless, it is developed by Pillsbury

Company in 1971. (Wallace & Mortimore, 2016; Mayes & Mortimore, 2001). WHO/FAO advocated as an effective way to control foodborne disease in 1983. (WHO, 1983). HACCP in the 1990s focuses on the basis rather than practical details on operation or implementation. The first authoritative internationally agreed HACCP document was released in 1997, which discusses the guidelines and principles of HACCP implementation. (CAC, 1997; Mayes & Mortimore, 2001). (CAC, 2009), updated a document that discuss HACCP system guidelines for its application. Today HACCP application is obligatory for food factories by Regulation (EC) No 853/2004 in EU countries (EC, 2004), and is accepted as a cornerstone of the Food Safety Management Systems (FSMS)(Wallace & Mortimore, 2016).

1.3.2 HACCP: Principles and Main Tasks

HACCP is described as a multidisciplinary system that uses integrative teams to assure food safety hazards and use the abilities and experience to minimize the health risk of customers. (Wallace & Mortimore, 2016) A logic sequence of the Hazard Control Points was released by (CAC, 2009), which consists 12 Tasks (Table 2) and 7 principles Table 3. Besides those tasks, a set of so-called Prerequisite Programs (PRP), is needed prior to and during the implementation of HACCP even though PRPs are not well defined on Codex. Nonetheless, the General specifications of PRPs agreed upon internationally (CAC, 2009).European Commission Notice published on 2016 and well discussed the essential characteristic of implementation of food safety management programs. The notice discussed the program in terms of : Purpose, links between food safety management systems (FSMS) , PRP, good hygiene programs (GHP), good manufacturing programs (GMP) and HACCP, the flexibility in applying PRP and HACCP, guides to hygiene practice, the relation with international standards, and training (EC, 2016a)

Table 2 Haccp Task Definations

	Definition
Task 1	Assemble the HACCP team
Task 2	Describe product
Task 3	Identify intended use
Task 4	Construct flow diagram
Task 5	On-site verification of flow diagram
Task 6	List all potential hazards, conduct a hazard analysis, determine control measures
Task 7	Determine CCPs
Task 8	Establish critical limits for each CCP
Task 9	Establish a monitoring system for each CCP
Task 10	Establish corrective action for deviations that may occur
Task 11	Establish verification procedures
Task 12	Establish record-keeping and documentation

Table 3 7 Principles of HACCP

Seven Principles of the HAACP system	
Principle 1	Conduct a hazard analysis
Principle 2	Determine the critical control points (CCPs)
Principle 3	Establish critical limit(s)
Principle 4	Establish a system to monitor control of the CCP
Principle 5	Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under the control
Principle 6	Establish procedures for verification to confirm that the HACCP system is working effectively
Principle 7	Establish documentation concerning all procedures and records appropriate to these principles and their application

1.4 Small-Medium Enterprises (SMEs): Definitions and Their Position in Food

Industry

A micro business has defined an enterprise with an annual turnover and/or total annual balance of up to €2 million (EC, 2016b). Nevertheless, the classification may differ by also the number of employees and profit level. SMEs are defined as “Small-to-medium sized enterprises (SMEs) are businesses with 250 employees or less. That definition encloses everything from family-run corner shops to technology startups working on the latest blockchain innovation.” (EC, 2016b). Even though SMEs have low turnover, their effect and position on the national economy should not be underestimated. According to (ISTAT, 2011) 99% of agricultural and food firms are SMEs and micro firms in Italy. Besides the SME’s position in the national economy, SMEs also outline European business structure and have decisive aspects for social growth and keeping the cultural identity and locality of a territory (de Martino & Magnotti, 2018). Also, European Union’s rural development policy increased the attention on a local food production systems and short food supply chains. It is claimed that local food chains may give consumers an opportunity to gather fresh and local products and reduce environmental impact. (Kneafsey et al., 2013; Törmä et al., 2019). In conclusion, it is indisputable that a considerable proportion of food is produced, processed, and sold by SMEs and the safety of their operations influences the entire food chain. Therefore, the concession of this issue has led many authorities to spotlight attention on the control of food safety in SMEs.

Although HACCP application is a prerequisite in EU food companies, requirements for very small enterprises are considered flexible, as laid down in Regulation 853/2004/EC (EC, 2004), to avoid undue burdens for such businesses. However, flexibility should not compromise food hygiene objectives (WHO,1999).

2. Literature Review

HACCP barriers should be clearly defined, their importance assessed, and their impact evaluated over HACCP implementation (Panisello & Quantick, 2001.). The company's size is a significant factor concerning quality management implementation, as medium-sized companies were more mature in Food Quality Management Systems implementation than their small and micro counterparts. (Dor et al., 2013). Nevertheless, studies found that small businesses are less likely to have HACCP correctly implemented than larger ones as reported also by (Conter et al., 2007a; Walker et al., 2002)

The potential barriers to applying HACCP in the small food businesses have been discussed by several researchers ((Chernova et al., 2020; Dzwolak, 2019a; Semos & Kontogeorgos, 2007a; Yapp & Fairman, 2006a). Author stated that the main obstacles and barriers to effective implementation HACCP is financial, technical, managerial, organizational, educational and psychological constraints ((Dzwolak, 2019a; Gilling et al., 2001; Yapp & Fairman, 2006a);

A study that includes 47 small-size companies in Poland, (Dzwolak, 2019b)discussed the Weaknesses in HACCP/food safety system documentation, and showed that the highest cumulative percentages of non-compliances occurred in areas of documentation, hazard identification and hazard assessment, process flow diagrams, and verification of the system. Based on researcher Pareto Analysis (Dzwolak, 2019b) stated that the largest number of weaknesses were identified in the area of documentation and record-keeping. (Chen et al., 2015)declared that the time needed for implementation of the HACCP process is also a barrier. Use of product cost after implementing HACCP, according to the increase in laboratory tests record keeping, and training may also be a barrier to implementing HACCP procedure. Questionary-based research carried out in Northern Greece concluded that reduced production flexibility because of excessive documenting is a common perception among food companies.

It is believed that HACCP record-keeping procedures sometimes obstruct production. (Semos & Kontogeorgos, 2007b). (Ball et al., 2009) stated, that having written procedures is common-sense among the workers however the documentation and record-keeping can be hard to handle because even in a small plant there can be considerable documentation for a set of sanitation standard operating procedures.

Based on a questionnaire done on medium-sized and micro-sized companies (Dora et al., 2013) showed that The top three barriers reported by the respondents were inadequate process control techniques, lack of training, and lack of resources. Yapp and Fairman, (2006) stated that, lack of time, lack of experience, lack of access to information (main problems with overprovision of information confusing relevance, lack of support (small-sized companies perceive that support is biased towards larger companies and is too generic to be useful), lack of interest (small-sized companies focus upon business survival rather than compliance with regulations. (Baş et al., 2007) stated that training is may increase the knowledge about food safety however that may not be a positive change in food handling. In another study, researchers stated that because of lack of time or poor knowledge such as training that is not carried out as intended by the law, SMEs, where owners of a company are usually at the same time responsible persons for food safety programs haw a problem (Jevšnik et al., 2008)

(Yapp & Fairman, 2006b) shows that, 20% of small-sized companies perceived financial considerations on investment structure equipment and staff training. Many SMEs proprietors did not send staff on food hygiene courses because of the cost and high staff turnover. Companies that understood the HACCP concept of time acting as a barrier to exceeding minimum standards stated that those companies had insufficient time to document their practices and control processes. (Herath and Henson.,2010), stated that, the main barrier is access to finance constraints. The same study concluded that SMEs have difficulty accessing

the required capital to fund investments and there may be a few spare resources within the firm as well as financial institutions are reluctant to lend money for investments that might yield little or no improvement in business performance. A survey among meat and dairy companies in Piedmont one region of Italy showed that carrying out the procedures is the time taken away from production and results in a cost in terms of minor potential profit. The same authors stated that, in both food supply chains, the microbiological analysis procedure is the one that most clearly represented a cost problem for food safety managers (Ceballos et al., 2020).

(Gilling et al., 2001) stated that agreement, outcome expectancy, motivation, and guidelines were the main barriers experienced by interviewees in micro and small companies. Interviewees evoked statements such as ‘ It is just bureaucratic stamp or excessive paperwork. That statement shows that a thin barrier to successful guidelines comes from disagreement with the principles of HACCP. Responders show a lack of expectancy with a response ‘ I am sure HACCP works in the real world but in my business, it probably won’t make difference. The researchers added that without sufficient motivation people will continue to perform past behaviors since they get responded with statements such as ‘ ‘ I know what I am supposed to do but I cannot be bothered and have never poisoned anyone yet’’. Furthermore, a common complaint among responders was the guidelines did not provide an exact framework for every product within every business. Motivation is also discussed by (Yapp & Fairman, 2006b) as an example of an SME who did not understand that they handled high-risk foods, they were less motivated to implement temperature controls and hazard analysis requirements because they felt these were irrelevant to the business operation. In some cases, SMEs do not realize that they are breaking the law and often do not understand what is required of them. A study done among 27 HACCP team members from micro to small companies in the Philippines shows that the main barrier is the awareness of respondents of the HACCP guidelines adherence. However, it has been found that respondents have an optimistic attitude toward HACCP guideline

implementation even their low HACCP knowledge competence level (Azanza & Zamora-Luna, 2005).

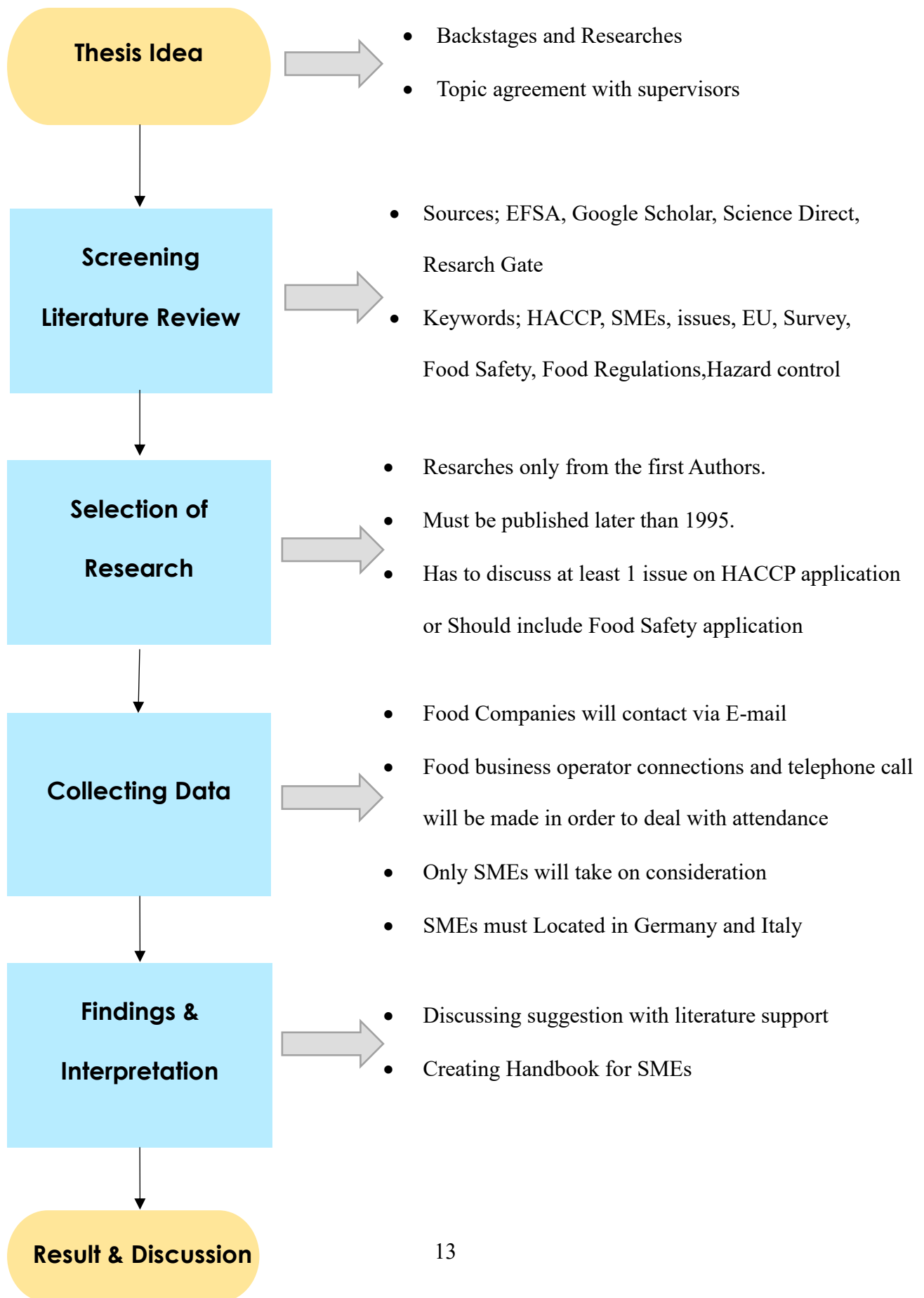
3. Material Methods

A questionnaire developed to reach the Small-Medium sized companies. Questions applied to Food Business Managers and general manager. The survey done online. Before conducting the survey a short e-mail written to the companies if they wish to attend. The companies selected from Germany and Italy and difference between production type is not considered.

3.1 Literature Search Strategy and Selection Criteria

The summary of the strategy is given in Figure 1. Elsevier, research gate, and google scholar will be the main sources for the publications. The sources searched according to the terms HACCP, hazard control, SME, effectiveness, and problems traceability. The first step in the research will be on novel studies which are published later than 2000 to find ongoing problems on application HACCP and create questionnaire according to problems that are continued.

Nevertheless, to increase the data, knowledge, and historical evaluation of HACCP, publications later than the year 2000 will be investigated. Besides, the research that will be discussed has to be original articles (from the first author). For the second step, according to data derived from the questionnaire made the main issues will be highlighted. Literature research will be made according to terms, HACCP, solutions, new approach, small companies, awareness, economic solution HACCP, and food traceability. Full-text screening of text will be made on publications that offer solutions to HACCP problems that occur in small and medium-sized companies.



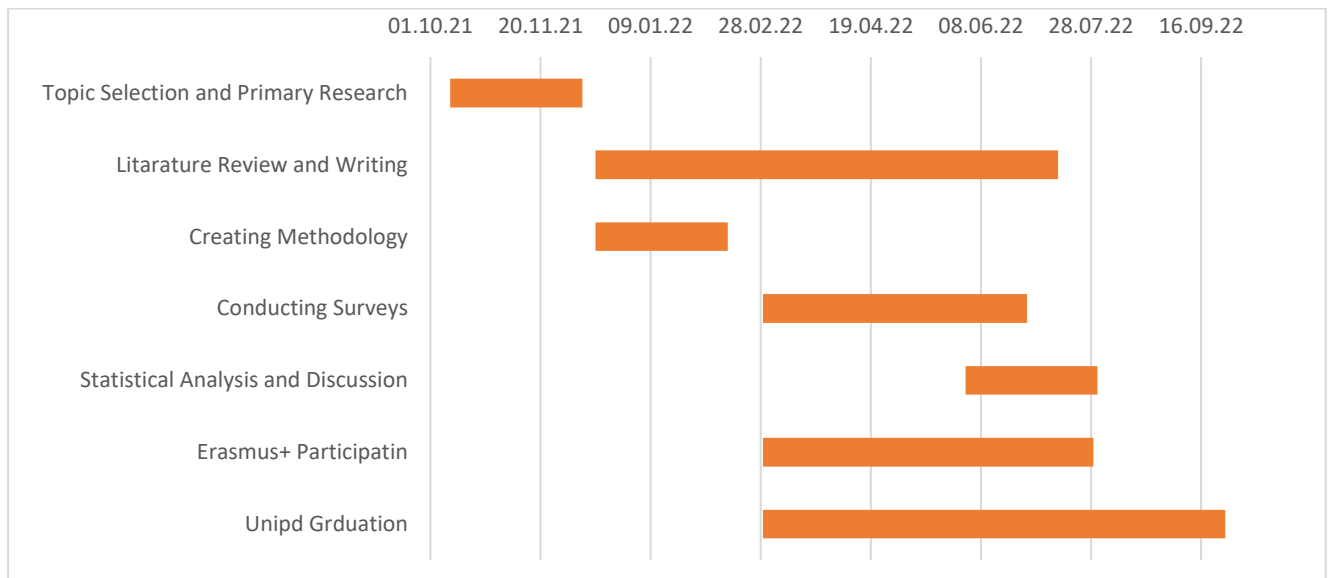
3.2 Study Plan and Steps

Study plan Table 4, and gannt chart Figure 1 given below.

Table 4 Study Plan

Task	Start Day	Day to complete
Topic Selection and Primary Research	10.10.2021	60
Literature Review and Writing	15.12.2021	210
Creating Methodology	15.12.2021	60
Conducting Surveys	1.03.2022	120
Statistical Analysis and Discussion	1.06.2022	60
Erasmus+ Participation	1.03.2022	150
Unipd Graduation	1.03.2022	210

Figure 1: Gantt Chart of Study Plan



3.3 Survey Design

Questionary designed based on the previous survey conducted by (Casolani & del Signore, 2016). The researchers stated the reason for non-attending business was lack of time (Conter et al., 2007a)). To use less time during the survey, the questions were structured to the statement for the Likert Scale, and questions that referred to a similar problem were eliminated.

To obtain insights into the possible factors influencing HACCP implementation questions were designed into three structured sections. Section Table 5 refers to the general statement on HACCP difficulties.

Table 5 Questions Section A

Question	Statements
No	
QA1	The requirements of a HACCP system are easily achievable.
QA2	Regulatory aspects of the law are easy to understand
QA3	I always know who I must refer to for food safety issues
QA4	I have sufficient and adequate resources to keep personal and workplace hygiene
QA5	I trust Food Public Control systems

Detailed aims of questions on Section A given in Table 6

Table 6 Aims for Section A

Question	Aims
No	
QA1	Statement try to understand if the responsible person has adequate knowledge about the complexity of the HACCP requirement
QA2	The statement will give an idea about the connection between managers and law
QA3	The statement refers to their adequate knowledge of the HACCP team
QA4	The statement give an idea company resources for HACPP
QA4	the statement tries to measure managers' opinions on the reliability of Public Control Systems

The second structured section, named section B, is mainly on statements linked to the awareness of the manager. Statements belong to Section B given in Table 7.

Table 7 Questions Section B

Question	Statements
No	
QB1	The benefits of HACCP are significantly higher than the costs
QB2	HACCP ensures Food Safety (B)
QB3	How would you rate your understanding of 'HACCP'? (B)
QB4	HACCP procedures are a major priority of my business (B)
QB5	There should be more food safety checks by the authorities(B)
QB6	There is no real incentive for having a HACCP/food safety system (B)
QB7	Food Public Control systems have increased my awareness of the importance of HACCP (B)
QB8	Hygiene and food safety are frequently discussed among colleagues (B)
QB9	On an average working day, I feel I'm using the notions I learned in the HACCP courses(B)

The detailed aims of section B are given in Table 8.

Table 8 Aims on Questions Section B

Question	Aims
No	
QB1	The statement will compare the manager's opinion regarding the economic benefits
QB2	The statement refers to the awareness of managers about HACCP
QB3	The statement is linked with QA1 and measures the understanding of a manager
QB4	Statement measures the priority of food safety produced on the manager's opinion
QB5	The statement linked to QA4, and measure the necessity of public food control system in the manager's opinion
QB6	Statement measure the necessity of HACCP on manager opinion
QB7	Statement measure the effect of the Food Public Control System on increasing awareness of managers
QB8	Statement measure the general awareness between the colleagues in the same working area
QB9	Statement measure the effect of educational activities that are given to the manager

The survey last section C is generally designed according to technical difficulties that may occur on application. Additionally, the statement QC6 will try to find difficult to track the system. The statements will answer differently from easy to hard scale, while the first sections (A, B) will be answered according to the agreement (Disagree to Agree). Statements of section C are given in Table 9.

Table 9 Statement section C

Question No	Statements
QC1	Identifying risks and hazards in food
QC2	Developing a HACCP plan.
QC3	Updating legislative aspects.
QC4	Identifying Critical Control Points.
QC5	Monitoring and verification of Critical Control Points.
QC6	It is hard to track my system and observe traceability

The aims of Section C are shown in Table 10.

Table 10 Aims of Statements Section C

Question No	Aims
QC1	Statement measure the difficulty of application of the 1st step HACCP
QC2	Statement measure the difficulty of making a HACCP plan
QC3	Statement measure the difficulty of updating new legislative aspects
QC4	Statement measure the difficulty of application 2nd core point of HACCP
QC5	Statement measure the difficulty of application 4th core point of HACCP
QC6	Statement measure the difficulty to have an observation of the tracking system

3.4 Likert-Type Scale

Likert scale is a psychometric scale that involved the research-based level of agreement or disagreement of respondents on a symmetric scale. Also, the range may give the intensity of respondents' feelings toward a given item. A Likert rating scale is described as a decent method for measuring self-efficiency (Maurer & Pierce, 1998) It is developed by [Rensis Likert](#) for the estimation of perspective. There are beneficial features using the Likert Scale in questionnaire-based research. For example, easy to apply, easy to measure, easy to understand by respondents, and gives freedom to respondents to choose among answers. (Tavakoli, 2012) On another hand, the Likert scale method can have limitations, such as, there is no equal intervals between choices (Tavakoli, 2012), attendees may choose the positive answer without reading the statement carefully, also it is stated that the respondents tend to be more chose the answer in the middle. (Baumgartner & Steenkamp, 2001; Javaras & Ripley, 2007)

There are different ideas to range the Likert scale among researchers. Ray 1980 stated that increasing the number of scales from 3 to 5 increases the internal reliability Nonetheless, (Matell & Jacoby, 1971), determined that the reliability and validity of a statement are not affected by the number of scale points used for the items. (Preston & Colman, 2001) stated that using a 5-point Likert scale has higher validity than a 2,3,4 point Likert Scale but less validity than a 7-10 point Likert scale. also, he stated that there were no significant differences between the 5 -point Likert scale and 10 points. In this study, the Likert scale A Likert-Type scale from 1 to 5 (1=strongly disagree; 2= disagree; 3=not sure; 4=agree; 5= strongly agree) was the form used to agree/disagree with a statement ((Henson & Holt, 2000a; Herath & Henson, 2010). Only one negative worded statements were used in that study survey.

The internal consistency reliability can be measured by Cronbach's alpha coefficient. Internal consistency reliability means that, extent to which items in an instrument are consistent

among themselves and with the overall instrument; Cronbach's alpha estimates the internal consistency reliability of an instrument by determining how all items in the instrument relate to all other items and to the total instrument.

3.5 Data Collection

The structured survey was transformed in the Google Docs and translated from English to German and Italian and sent by e-mail to the food technologist or responsible person for production in case the company is so small and does not have a food technologist. Varieties of different SMEs were chosen and the only criteria were the number of employees (up to 250) in order to the SMEs definition. Companies that have more than 250 employees were eliminated and not included in the statistical analysis.

However, it has been stated it may challenge to get a high response rate. For instance, (Herath & Henson, 2010) reported 12.8% in a study carried out in Ontario Canada. Another study that was performed on dairy farms in the U.K reported that questionnaire was mailed to 1196 plants and only 240 questionnaires are returned which 192 (16%) of them were completed (Henson & Holt, 2000b)

3.6 Statistical Analysis

Results were analyzed by IBM SPSS STATISTIC 27 package individually in both countries.

(Tavakoli, 2012) stated that, the Likert scale data is defined as an ordinal data because of the no equal interval between scores. For many respondents the space between agree and totally agree is less than the space between not sure and do not agree. Due to the fact that, the Likert scale-type surveys the ordinal data, is suggested that to use non-parametric tests to compare the different group (Boone et al., 2012). Comparison of reliability between using non-parametric tests and parametric tests discussed by many authors. (Kaptein et al., 2010), found that it was more reliable to use a non-parametric test a 7-scale Likert-type questionnaire if the

number of respondents less than 50. Also (Nanna & Sawilowsky, 1998) compared the Mann-Whitney-Willcoxon test and t-test and found that the non-parametric Mann-Whitney-Willcoxon is more reliable.

A descriptive analysis was made on demographic data and for each question individually for each statement on a country base. In order to compare the mean rank score of the statements and validity of ranks examined by using Mann Whitney-U test which is the synonym of Mann-Whitney Willcoxon test in IBM SPSS STATISTIC 27.

4. Results

4.1 Demographic Characteristics of German Companies and Attendees

The summary of demographic Characteristics of German companies and attendees is given in Table 11 The attendees only the employees that responsible and working in QA management of companies.

Table 11 Demographic Characteristics of German Companies and Attendees

Characteristics	N
Main Product	
Honey	1
Food Additives	1
Sauce	1
Nutritional Supplements	1
Meat and Meat Product	3
Oil and fat	1
Fruit	3
Dried food	3
Fruit Concentrtion	1
Career Company	
Up to 5 Years	8
Between 6 to 10 years	4
More than 10 years	3
Company Type	
Micro	1
Small	8
Medium	6

The total number of German Companies is 15. The main product of companies is widely distributed. The company's main products were mostly Fruit, dried food , and meat (23%). Additionally, there are 1 honey, 1 food additive, 1 sauce, 1 nutritional supplement, and one oil

and fat product company. The QA managers mostly have a working history in the company for up to 5 years There is only 4 QA manager has a working history of between 6 to 10 years and 3 QA manager has a working history of more than 15 years.

4.2 Opinions of German Companies on General Statements

The descriptive analysis of the first group of questions (QA1) is given in Table 12.

Table 12 Responds of German Companies to the First Group

Response	n(%)				
	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
QA1	0 (0)	1 (6.7)	3 (20)	8 (53.3)	3 (20.0)
QA2	0 (0)	0 (0)	8 (53.3)	5 (46.7)	0 (0)
QA3	1 (6.7)	1(6.7)	3 (20.0)	5 (33.3)	5 (33.3)
QA4	1 (6.7)	0(0)	2 (13.3)	9(60)	3 (20.0)
QA5	0 (0)	6 (40.0)	4 (26.7)	2 (13.3)	3(20.0)

Most quality assurance managers agreed (73.3%) that they easily achieve the requirements of HACCP however still there are 20% of quality assurance managers that are not sure if they can achieve the requirements easily. Similarly, most of the responders (80%) declared that they have sufficient and adequate resources to keep personal and workplace hygiene. Controversially, 66.7% of respondents disagreed with trust food public control systems while 13.3% are not sure and only %20 respondents agreed. On a contrary, 46.7% QA managers found that the regulatory aspects of the law are easy to understand however most QA managers (53.3%) were not sure. Even though, Many QA managers (16%) disagreed or to not know (20%) to who must refer when a food safety issue occurs, most QA managers (66.6%) know who must refer when a food safety issue occurs.

4.3 Opinions of German Companies on awareness-based Questions

The descriptive analysis of the second group of questions (QB) is given in Table 13

Table 13 Opinions of German Companies on awareness-based Questions

Response	n(%)				
	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
QB1	0 (0)	0 (0)	2(13.3)	5(33.3)	8(53.3)
QB2	0 (0)	0 (0)	1(6.7)	8(53.3)	6(40)
QB3	0 (0)	0 (0)	0 (0)	10(66.7)	5(33.3)
QB4	1 (6.7)	1 (6.7)	5(33.3)	4(26.7)	4(26.7)
QB5	0 (0)	3(20)	3(20)	8(53.3)	1(6.7)
QB6	8(53.3)	6(40.0)	0 (0)	1 (6.7)	0 (0)
QB7	3 (20.0)	4 (26.7)	5(33.3)	3(20.0)	0 (0)
QB8	1(6.7)	4 (26.7)	7(46.7)	3(20.0)	0 (0)
QB9	0 (0)	3 (20)	2(13.3)	10(66.7)	0 (0)

It is observed that attendees have a high awareness of the HACCP procedure. The 86,6% of respondents agreed that the cost of HACCP is less than the benefits that they can have. Similarly, 93.3% of QA managers trust that HACCP ensures food safety. All of the QA managers rated their understanding of HACCP at a high level and most QA managers (53.3%) take HACCP as a priority in their job. On the contrary, most of the managers (56.7%) disagreed on the effect of food control systems on increasing awareness and 33.3% of respondents are not sure about the statement. Moreover, the respondents were not sure (46.7%) or disagreed if the Hygiene and Food Safety were discussed among colleagues. Furthermore, 60% of QA managers agreed to more checks by the food authorities.

4.4 Opinions of German Companies on Technical Issues of HACCP

The descriptive analysis of the third group of questions (QC) is given in Table 14.

Table 14 Technical Difficulties for German Companies

Response	n(%)				
	Strongly Hard	Hard	Not Sure	Easy	Strongly Easy
QC1	0 (0)	1 (6.7)	2(13.3)	9(60)	3(20)
QC2	0 (0)	2 (13,3)	4(26.7)	6(40)	3(20)
QC3	1 (6.7)	3 (20)	5(33.3)	6(40)	0 (0)
QC4	0 (0)	1(6.7)	2(13.3)	9(60)	3(20)
QC5	0 (0)	1(6.7)	4(26.7)	7 (46.7)	3(20)
QC6	3(20)	2(13.3)	3(20)	4 (26.7)	3(20)

Data shows that most of the QA managers found it easy to apply HACCP principles. Most respondents found it easy to identify risks and hazards in food (80%), develop a HACCP plan (60%), identify CCP (80%), and monitor and verification of CCP (66.7%). Nevertheless, many QA managers are not sure (33.3%) or found it easy (40%) to update legislative aspects. Moreover, most of the respondents found it easy (46.7%) or they are not sure (20%) to track their system and observe traceability.

4.5 Demographic Characteristics of Italian Companies and Attendees

The summary of demographic Characteristics of Italian companies and attendees is given in. The attendees are only the employees who are responsible and working in QA management of companies.

Table 15 Demographic Characteristics of Italian Companies and Attendees

Characteristics	N
Main Product	
Meat and Meat Product	3
Bread and Patisserie	7
Olive Oil	1
Nuts	1
Pasta Production	1
Career	
Up to 5 years	2
More than 10 years	11
Company Size	
Micro Size	6
Small Size	7

The total number of Italian Companies is 13. Controversially to German companies, there are only 5 main production types (Bread and patisserie, meat and meat product, olive oil, nuts,, pasta) . Differently, from German attendees, the QA managers mostly have a working history in the company of more than 10 years. There is only 2 QA manager has a working history of fewer than 5 years. Also, the company sizes differ while there are 6 micro sizes which means they have less than 10 people working in the company and 7 small size companies which have labor between 10 to 50 persons. Additionally, some QA managers do other jobs such as, management and marketing.

4.6 Opinions of Italian Companies on General Statements

The descriptive analysis of the first group of questions (QA1) is given in

Table 16 Responds of Italian Companies to the First Group

Response	n(%)				
	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
QA1	0 (0)	3(23.1)	4(30.8)	3(23.1)	3(23.1)
QA2	0 (0)	3(23.1)	3 (23.1)	5(38.5)	2(15.4)
QA3	0(0)	2(15.4)	4 (30.8)	5(38.5)	2(15.4)
QA4	0(0)	3(23.1)	1(7.7)	8(61.5)	1(7.7)
QA5	0 (0)	1(7.7)	4(30.8)	5(38.5)	3(23.1)

Most QA managers agreed (56.2%) that they easily achieve the requirements of HACCP however still there are 30.8% of QA managers that are not sure if they can achieve the requirements easily. Similarly, 69.2% of the responders declared that they have sufficient and adequate resources to keep personal and workplace hygiene. Furthermore, 61.6% of respondents agreement with trust in food public control systems. Also, 53.9% QA managers found that the regulatory aspects of the law are easy to understand while 3 companies (23.1%) disagreed with the statement. Even though 23.1% of QA managers do not know who must refer when a food safety issue occurs, most QA managers (53.9 %) know who must refer when a food safety issue occurs.

4.7 Opinions of Italian Companies on awareness-based Questions

The descriptive analysis of the second group of questions (QB) is given in **Error! Reference source not found.** It is observed that attendees have a high awareness of the HACCP procedure. The 61.6% of respondents agreed that the cost of HACCP is less than the benefits that they can have. Similarly, 69.3% of QA managers trust that HACCP ensures food safety however 23.3% of managers are still not sure about the statement. Most of the QA managers rated their understanding of HACCP at a high level (61.6%) however, QA managers (38.5%)

take HACCP as a priority in their job while there are also respondents that are still not sure (38.5%). On the contrary, most of the managers (43.2%) disagreed on the effect of food control systems on increasing awareness and 30.8% of respondents are not sure about the statement. Moreover, most respondents agreed (46.2%) that Food Safety is discussed among colleagues. Furthermore, 38.5% of QA managers disagreed with more checks by the food authorities, and 38.5% were not sure about the statement.

Table 17 Opinions of Italian Companies on awareness-based Questions

Response	n(%)				
	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
QB1	0(0)	2(15.4)	3(23.1)	6 (46.2)	2(15.4)
QB2	1 (7.7)	0(0)	3(23.3)	6(46.2)	3(23.1)
QB3	0(0)	1(7.7)	4(30.8)	5(38.5)	3(23.1)
QB4	0(0)	3(23.1)	5(38.5)	3(23.1)	2(15.4)
QB5	2(15.4)	3(23.1)	5(38.5)	2(15.4)	1(7.7)
QB6	1(7.7)	2(15.4)	3(23.1)	4(30.8)	3(23.1)
QB7	1(7.7)	5(38.5)	4(30.8)	2(15.4)	1 (7.7)
QB8	2(15.4)	3(23.1)	2(15.4)	4(30.8)	2(15.4)
QB9	1 (7.7)	2(15.4)	5(38.5)	4(3.8)	1(7.7)

4.8 Opinions of Italian Companies on Technical Issues of HACCP

The descriptive analysis of the third group of questions (QC) is given in Table 18 Data shows that most of the QA managers found it easy to apply HACCP principles. Most respondents found it easy to identify risks and hazards in food (61.6%) while 4 managers (30,8%) stated that is hard to identify risks. Identifying CCP was found easy to do (46.1%) while 3 of the companies it hard to identify CCP. Results development HACCP plan declared hard with 7 (53.8%). Similarly, many QA managers found it hard (53.8%) Moreover, most of

the respondents found it hard or they are not sure to track their system and observe traceability (46.2%).

Table 18 Technical Difficulties for Italian Companies

Response	n(%)				
	Strongly Hard	Hard	Not Sure	Easy	Strongly Easy
QC1	0(0)	4 (30.8)	1(7.7)	5(38.5)	3(23.1)
QC2.	0(0)	7 (53.8)	3 (23.1)	2 (15.4)	1(7.7)
QC3	1(7.7)	7 (53.8)	1(7.7)	4(30.8)	0(0)
QC4	0(0)	3 (23.1)	4(30.8)	5(38.5)	1(7.7)
QC5	0(0)	3 (23.1)	5(38.5)	4 (30.8)	1(7.7)
QC6	2(15.4)	2 (15.4)	6 (46.2)	3 (23.1)	0(0)

4.9 Comparison of two Countries

The comparison of mean values of the first group questions between 2 countries is given in Table 19.

Table 19 Mean and Median Values of First Group Question

Country	Germany			Italy		
	N	Mean	Median	N	Mean	Median
QA1	15	3.87	4.00	13	3.5	3
QA2	15	3.47	3.00	13	3.5	4
QA3	15	3.80	4.00	13	3.5	4
QA4	15	3.87	4.00	13	3.5	4
QA5	15	3.13	3.00	13	3.8	4

Firstly, the mean scores by items were calculated as well as the difference between the two country groups. Mann-Whitney independent sample U test was used to compare the scores taken by the countries as well as Median Test. Monitoring was held on a p=5% significant level in the whole analyzing process. According to in Table 19, there are no statistical differences between respondents for all questions. While all the mean scores are higher than 3, both countries agreed on statements. Figure 2 shows the scores of the ‘I trust Food Public Control

systems' statement from two countries; we can see that the attitude of Italian companies is more positive than the German companies ($p < 0.05$). Nevertheless, Italian attendees are still not sure about the statement while the mean score is close to 4.

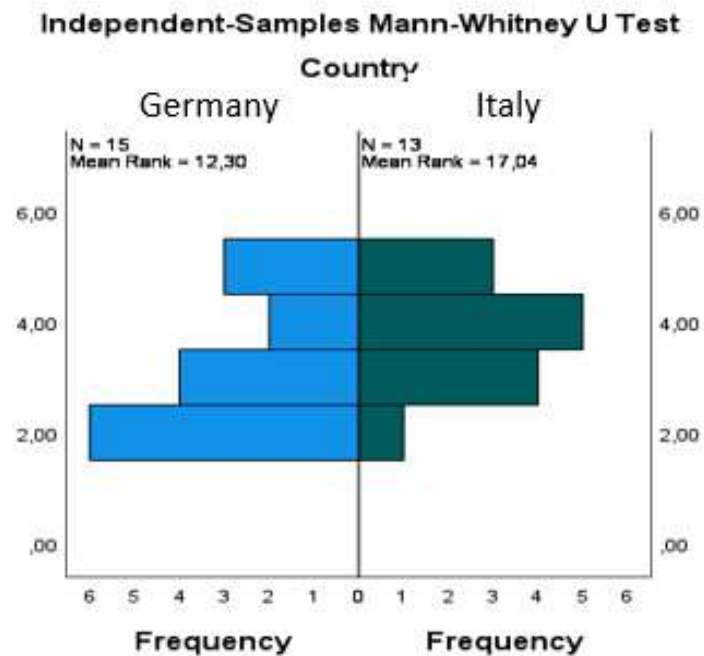


Figure 2 Frequency of Statement QA5 Between Countries

The comparison of mean values of the second group questions between 2 countries is given in. Table 20

Table 20 Comparison of Second Group Questions Between the Countries

Country	Germany			Italy		
	N	Mean	Median	N	Mean	Median
QB1	15	4.4 ^b	5.0	13	3.6 ^b	4
QB2	15	4.3	4.0	13	3.8	4
QB3	15	4.3	4.0	13	3.8	4
QB4	15	3.6	4.0	13	3.3	3
QB5	15	3.5	4.0	13	2.8	3
QB6	15	1.6 ^b	1.0 ^a	13	3.5 ^b	4 ^a
QB7	15	2.5	3.0	13	2.8	3
QB8	15	2.8	3.0	13	3.1	3
QB9	15	3.5	4.0	13	3.2	3

^aShows statistical difference for same statements according to median comparison test

^bShows there is significant differences on statements according to Mann-Whitney U test $p < 0.05$

Firstly, the mean scores by items were calculated as well as the difference between the two country groups.. Figure 3 shows the distribution of answers for the statement ‘There is no real incentive for having a HACCP/food safety system (QB6). There was a statistical difference on the statement QB6 on both statistical tests. The companies belonging to Germany disagreed with the statement (Mean Score 1.6, Median Score 1). Controversially, the Italian companies are not sure about statements with a mean score of 3.5 and a Median score of 4. Both respondents are not sure if the food public control systems increased their awareness of food safety, also they are not sure if the colleagues discuss or if they use the information that they learned from the food safety courses. However, the mean and median scores of statements 1,2,3,4 are more than 3.5 in both countries. Thus, it shows that there is a high level of food safety awareness in both countries. However, there is a statistical difference between countries

based on Mann-Whitney U Test, on the statement ‘‘The benefits of HACCP are significantly higher than the costs’’ (QB1). While Italian companies more agreed with the statement.

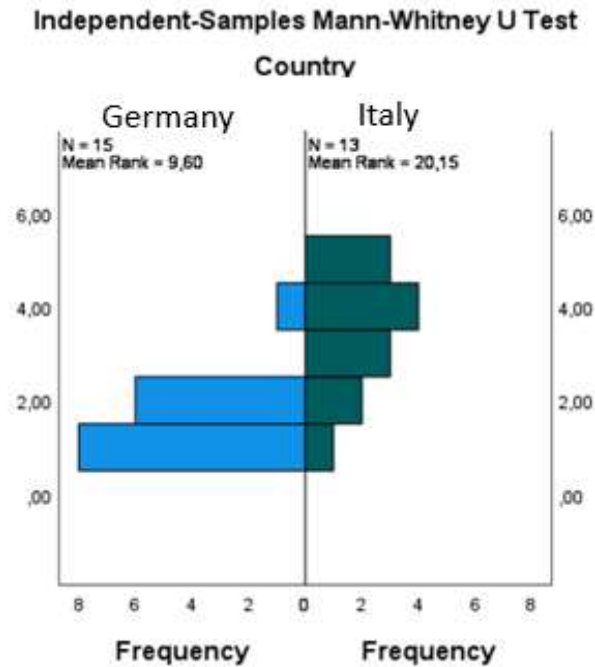


Figure 3 Frequency of Statement QB6 Between Countries

Table 21 Comparison of Third Group Questions Between the Countries

Country	Germany			Italy		
	N	Mean	Median	N	Mean	Median
QC1	15	3.9	4.0	13	3.5	4
QC2	15	3.7 ^b	4.0	13	2.8 ^b	2
QC3	15	3.1	3.0	13	2.6	2
QC4	15	3.9	4.0	13	3.3	3
QC5	15	3.8	4.0	13	3.2	3
QC6	15	3.1	3.0	13	2.8	3

^b Shows there is significant differences on statements according to Mann-Whitney U test.

The only statistical difference found by the Mann-Whitney U test is the statement ‘Developing a HACCP plan.’ It was harder to develop a HACCP plan for Italian companies

with a mean score of 2.8 and a median score of 2. Controversially, German companies stated that it is easy to develop a HACCP plan with a mean score of 3.7 and a median score of 4. The distribution shows statement QC2 in Figure ...

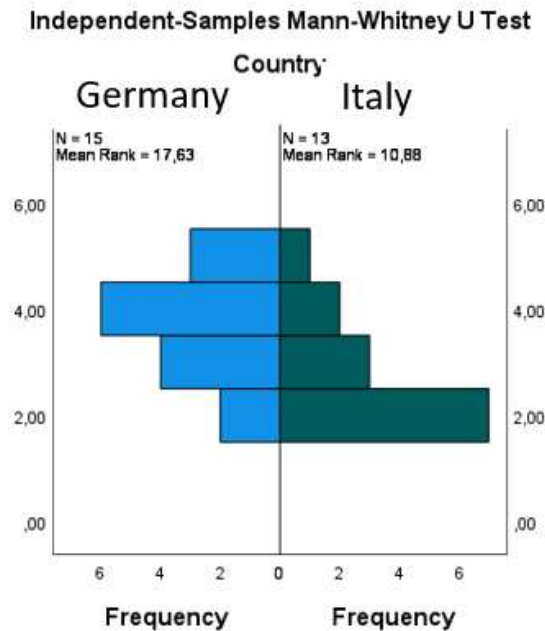


Figure 4 Frequency of Statement QC2 Between Countries

4.10 Comparison based on Company Size

Kruskal-Wallis Test was used to compare differences between company sizes. There were only significant differences in statements QB6 and QB8. There were no significant differences between other statements.

Table 22 Difference Between Company Size

	QB6	QB8
	Sig.	Sig.
Micro-Small	1.00	0.37
Micro-MEDIUM	0.04	0.78
Small-MEDIUM	0.11	0.04

According to the table, there were no significant differences in the statement 'there is no real incentive for having a HACCP/food safety system (QB6)' between micro and small

companies. Nevertheless, micro and small companies differ on the statement Hygiene and food safety are frequently discussed among colleagues (QB8). Pairwise comparison of companies for QB8 is given in Figure 5. The central tendency of statement QB8, represents micro sized companies differ from medium sized companies. Respondents of medium-sized companies trust that Hygiene and food safety are discussed among their colleagues while respondent of micro and small-sized companies are not sure about the statements.

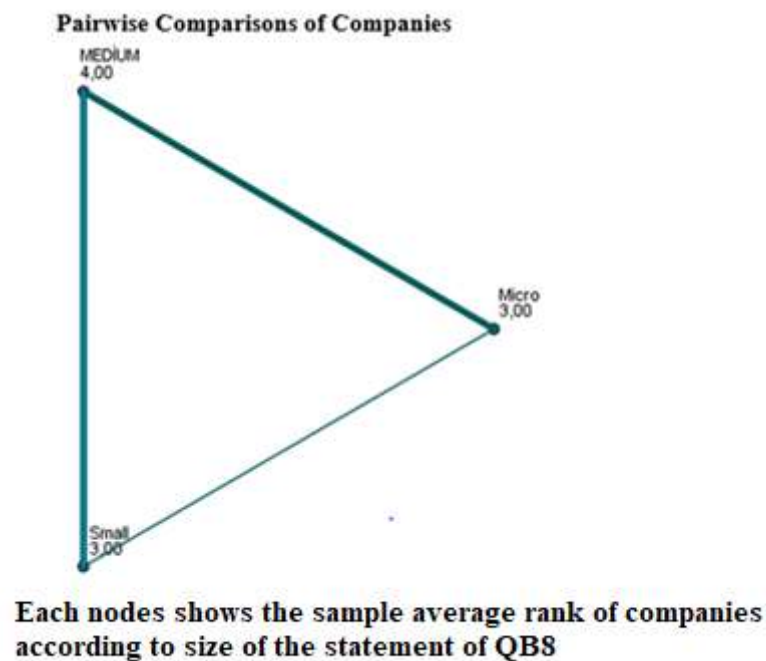


Figure 5 Pairwise Comparison Between Companies For Statement QB8

The pairwise Comparisons of companies for the (QB6) given in Pairwise Comparison Between Companies For Statement QB6.

Paiwise Comparisons of Companies

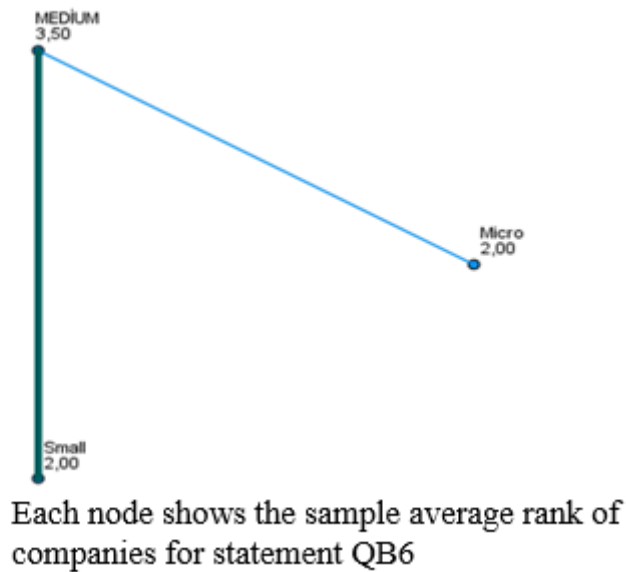


Figure 6 Pairwise Comparison Between Companies For Statement QB6

The central tendency in Figure 6 shows that there is significant differences between medium size and small size companies. However, there is no significant differences between small and micro size companies. Medium companies agreed with the statement There is no real incentive for having a HACCP/food safety system. While micro and small companies disagreed with the statement. Given that both questions are discussing the awareness of food safety comparison of 2 results is contradictory. More data should be collected to increase the reliability of the statements.

4.11 Comments On Open-Ended Question

Besides the Likert-scale Questions, an additional open question was asked to respondents to add their opinions. Time-consuming for the documenting and batching. For example, some respondents answered “Keeping records and always being updated takes time that you don’t always have.” Another respondent give a comment about time-consuming and authorities saying “We waste a lot of useless time on papers and bureaucracy, and then we neglect the really important things (I have never seen any inspector check the effective effectiveness of the registered cleaning but only on paper.” Also, there was a demand from

the local authorities for the annual check commenting that “It would be advisable to include an annual check with the association service”

5. Discussion

5.1 Reliability of The Analysis and Limits Of The Research

The Cronbach alfa coefficient shows reliability with a higher 0.5 in all statement groups.

There may high number of attendees in order to increase the reliability of the survey.

The research was conducted only with online method. Especially in micro-companies, it may be hard to reach the right person and the companies may ignore the mail since they do not find the research necessary. It is recommended to kindly ask and give a small introduction about the research before conducting the survey. Researchers may call the companies or make in-site visits to reach the right amount attendees.

Additionally, the number of statements that target one idea may increase the strength of opinion. Asking only positive worded statements in a survey may affect response bias making participants select agree more than disagree therefore it may have a score that overestimates of respondent's actual attitude(Roszkowski & Soven, 2010)

The questionnaire was designed with statements chosen only using current literature. It is recommended that to make a pre-survey in order to prepare the right amount statements and more precise statements for the new survey. The redesigned survey may conduct a second time with the same attendees.

Besides limitations, that research may an introduction idea about the HACCP problems between two countries, and the method may strengthen future research. Also, the design of the survey may use as a pre-survey for future research.

5.2 Main Difficulties Conducting HACCP in Small-Medium Companies

There is a high awareness of other statements in the group QA. Respondents stated that they can easily achieve HACCP requirements, they have enough researchers to keep food and personal space keep hygiene and they know who report the food safety issues. Nevertheless, the problem of keeping personal hygiene and clean still need to be discuss. Nonconformance

aspects related to HACCP and GMP also analyzed by (Noor Hasnan et al., 2022) Researchers concluded that, the main missing points are lack of cleaning, poor personal hygiene and operation control. However, problems mostly occur in developing countries.

There is high awareness in both countries on understanding HACCP. Also, respondents from both countries trust that HACCP benefits are higher than its costs. In another hand, when the priority of HACCP in their work was asked many respondents of both countries were still not sure if HACCP is the main priority in their job. The results have similarity with a interview based study that done in England. Most of the respondents believed that the system is beneficial and that would protect them from problems in their operations. Furthermore, manager trusted that the system is protecting them against consumer complaint and possible food poisoning. (Eves & Dervisi, 2005)

Countries differ on the statement 'There is no real incentive for having HACCP' while the Italian companies more agree with the statement and the result may show that there is less trust on the HACCP application in Italian companies. Nevertheless, there are also significant differences in the same statement and micro-companies agreed with the statement. Therefore; the reason for the result may be because of company size while there are more Italian micro-companies attending to the survey. A study in Italy that studied micro-sized companies, found that there is high awareness on of importance to evaluate the process and to ensure that they are adequate. However, the study concluded that the fully compliance of HACCP still hard to complete in small companies due to lack of knowledge and insufficient understanding of functions HACCP principles. (Conter et al., 2007b)

Trust in food public controls systems and understanding of regulatory aspects are the first problems found in both Countries while the answers close to section 'Not Sure'. Moreover, some respondents declared that he/she never seen any inspector check the effectiveness of the cleaning but only on paper. (Ababouch, 1999) suggested that, the food inspectors not only have

to trained but also should demonstrate knowledge and qualifications in different field of food science such as, food quality control methods, food microbiology and food process. Furthermore, respondents from both countries stated that there is no effect of public food control system on increasing awareness. Similarly, in one of research, a sheltered house manager stated that she didn't get help that she expected from officers and she believed that the officers should adopt the generic system in establishments and train the employees (Eves & Dervisi, 2005). (Karaman et al., 2012) found similar result among dairy companies in west Turkey. They stated that, when the desire of governmental consultation decreases with increasing level education. There are programs examples to fix the issue in some countries. For instance, in United Kingdom, the Food Standards Agency published a strategy for HACCP implementation. The strategy includes existing guidance materials, the suitability of HACCP training courses and method for optimum communication (Worsfold & Worsfold, 2005). Also, in Wales the Welsh development Agency have funded local authorities to promote the implementation and understanding of HACCP in catering business(Worsfold & Worsfold, 2005).

It found that one of the most technical issues that respondents find is tracking the system and updating legislative aspects. Furthermore, developing the HACCP plan was found a technical issue in Italian companies. Additionally, respondents claimed that there is a waste of time to record the procedure on paper as well as being updated. The amount of document found restraining factor and excessive documentation also reported my many research. (Engel, 1998; Motarjemi & K, 1999). Also (Eves & Dervisi, 2005) reported that, employees hotels, restaurants and catering companies, felt that documentation is too much work for them especially on busy days. However, the documentations are one of the important procedures and should not be neglected and have to done properly. It helps third parties that people know and how understand their operations. Documentations also help in food defense. Computer based

documentation may help to reduce time consuming on documentation. Also, simplified ready to use apps that ease documentation and HACCP development could be found. One of respondent of this research also stated that, the documentation and traceability of batches takes time and hard to apply however he/she was lucky he has a computer-based app that make every batch easy to control for whole process beginning from raw materials. The author of this research also checked possibilities to use apps for HACCP developing. The apps are wide-ranged based, also many apps offer solutions for SMEs. Some apps have draft data and examples of process controls. Use of apps, may help to reduce time consuming on documentation, may give an idea about different process also it may help to decrease amount of money spent for documentations.

6. Conclusion

In conclusion, the research may give an idea for the further researches and studies. It has been found that, here is high awareness in both countries on understanding HACCP. Nevertheless, it has to be reminded that the survey of the research conducted with food business managers and with company staff that were already mastered in their qualification. It is suggested that similar surveys can be done to the other staff who is in production side for a better result.

Companies in both countries stated that they do not have any difficulties to reach HACCP requirements and they have stated that there is enough company staff to achieve hygiene requirements. However, it should be considered that, the questionnaire held online, and the attendees may not aware that how the hygiene rules that should conducted internal. Before conducting the survey, an internal visits and observation may done by a researchers to increase level of significance.

The micro companies tend to be less aware about food safety culture and the trust on legal authorities is weak. It is proposed that, the legal authorities, may support to increase the food safety culture by funding the micro companies for training the staff. Also, managing the tracking system and documentation considered a difficulty in companies. However, the issue may fix by underline the food defense in staff training sessions, while the documentation the helpful way for food defense.

To have more significant results, the number attendees should increase, however, the reliability of the research is sufficient and the research can be used as an idea for the further researches. It should be also considered that the survey conducted online and there may some missing points to understood the statements. Nonetheless, the online surveys still an effective way to reach the attendees easily and faster way in comparison to on site surveys. Furthermore,

there was no specifications of production in the research. Further research can be done specifically to the products to have more significant result.

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