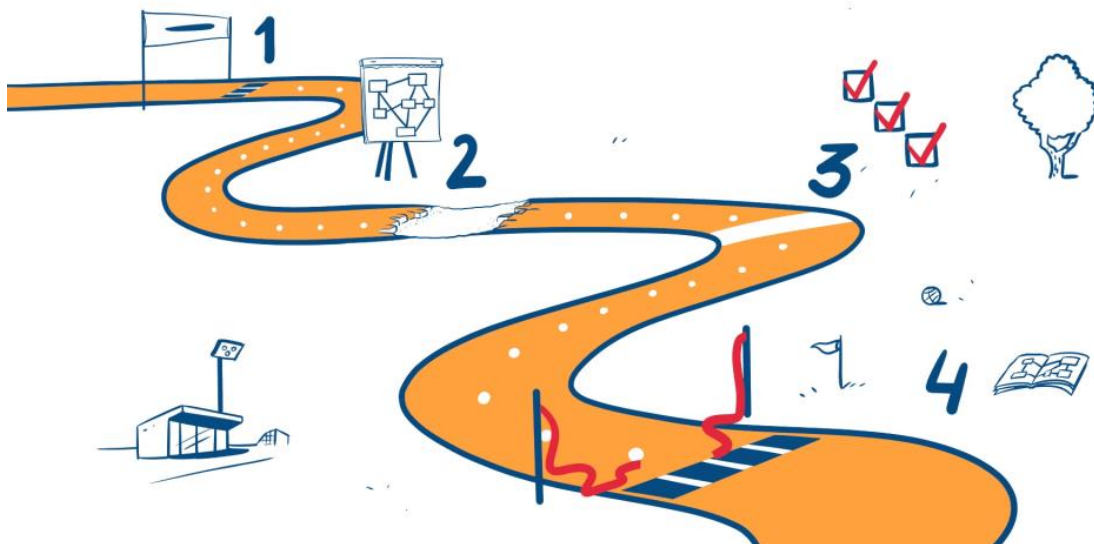


# Making the right decision for Enterprise Quality Management Software

*A practical tool for food businesses*



Kenniscentrum, 2016

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## PREFACE AND ACKNOWLEDGEMENTS

This research has been initiated to find out how quality departments at food businesses can professionalize their data management.

The interest of the student in both quality management and management systems was the biggest motivation to find out more about this topic. Next to that Uniekaas Holland BV, the company where the student works for her internship, is currently busy with the professionalizing of the quality department.

During writing the thesis, several minor details were changed in chapter 1.2.2, 1.3, 2.1 and the layout of the list of references, which were a part of the research proposal.

I would like to thank my coach of Aeres University, Cynthia Akkermans, for her help and especially her feedback. This supported in a better structure and outcome of the research.

I hope you, the reader, enjoys reading the research and can implement elements of the outcomes for your food business.

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## SUMMARY

As regulations for the food industry become more strict, more data needs to be processed at the quality department of food businesses. Next to that food businesses are expanding and growing in size. Therefore, food businesses are looking for a system to process, organize and file the data in a clear way. A system that is popular is Enterprise Quality Management Software (EQMS). EQMS is a software that gathers, manages and analyses all data related to food quality & safety management.

Many options for these software are available on the market, all similar but specialized in different areas. This diversity makes it difficult for businesses to choose a suitable software. To help food businesses in the Netherlands choosing a software to professionalize the quality department, this research focused on answering the following research question:

*What should businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?*

Eight Dutch food businesses and two software providers were interviewed about their experiences with implementing a quality management software. A questionnaire guided the conversation about all critical factors, points to consider and experiences.

All businesses stated that small businesses start processing and documenting data with the use of Microsoft tools, but that at one point businesses grow. Then a software is required to keep overview. During the interviews different types of software were identified and categorized into modules: product specification management, document control, risk control, laboratory data administration, complaint management and process control. For these modules, different software is available.

Identified reasons to implement a quality management software are: more reliable data, accessibility of data and efficiency. Reasons not to implement a software are: costs, dependency on supplier and the investment time needed.

To simplify the identified critical factors needed to consider before decision making, they were converted into a decision-making model. This model will help food businesses deciding upon a quality management software. The model forces the businesses to start with describing their current situation and clearly defining the problem and helps to gather the rest of the information in a structured way.

After using the model, Uniekaas Holland concluded that it helps to identify the real problem for professionalizing the quality department and emphasizes on focusing on the right solutions. Further validation of the model is advised, but businesses can already use this decision-making model when they want to professionalize the quality department.

# 1. INTRODUCTION

## 1.1 Food safety & quality management

Being a food business in the European Union, more and more regulations apply to food businesses. Especially regulations regarding tracking & tracing, food safety and consumer protection are increasing in importance (EU Regulation, 2016). In order to keep up with all legal and customers' requirements, businesses need to document a lot of data. Procedures must be written, employee training has to be conducted and filed, work instructions need updates, suppliers should be evaluated... the list could continue (EU Regulation, 2016). Businesses in the Netherlands are obligated to comply to the 'hygiene code' of the NVWA. This requires document and data control (NVWA, 2018). Often, smaller businesses organize their data and control measures by themselves. Microsoft tools are being used for both production and Quality Control/ Assurance. Once a business starts to grow, an Enterprise Resource Planning system is often being implemented to manage production, sales and inventory (Littlefield, 2012). Becoming a business with an extensive Quality Management System, Microsoft tools are not enough to process all quality related data. This is the moment Enterprise Quality Management Software should be introduced to the business.

Enterprise Quality Management Software (EQMS) is a software that gathers, manages and analyses all data related to quality (and food safety) management in a business. The software works closely together with the existing Enterprise Resource Planning software in the business (Littlefield, 2012). It is an internal platform/ program in which data is entered by employees, production machines and laboratories (Littlefield, 2012). Therefore, quality related documents such as specifications, pest control or audit reports, as well as production information (quantities and production times) and laboratory results are all easily accessible. Several functions can be implemented to review this data, to manage different versions of the documents or to analyze the lab results and link them to production data.

EQMS could be a solution for businesses to simplify and organize their quality related data management. Having all data at one place, going through the same procedures and the real time data accessibility are factors that make the administrative part of Quality Assurance and Control more efficient and trustworthy. On the other hand, implementing an EQMS is costly, requires training of the employees and can be too extensive for specific businesses.

As a business, knowing some of these benefits and limitations, it can be a hard question to decide whether to implement an EQMS or not. Once that question has been answered, a second question arises. Which EQMS offered by which company suits the business the best?

Companies offering the various software packages do present benefits, efficiency targets and business cases calculating return on investment. But how does a business know which factors are important to consider? When is the software profitable? What are the specific needs for quality management? Analyses have been made for the health care industry and for educational institutes. Reports describe the competitive advantage of implementing an ERP system, or quality management system. But no practical guideline or information is available for businesses during their decision making process regarding implementing an (and which) EQMS, or not.

## 1.2 Theoretical framework

### 1.2.1 Food safety & quality management

Within the food industry the aim to ensure food safety has become an obligation with specific requirements rather than a simple strive (Bilska & Kowalski, 2014). Because of these requirements and regulations set by the European Union a systematic approach to food safety and quality has become a standard (Bilska & Kowalski, 2014). These systematic approaches are partly included in obligatory law, as EC 2072/2005, EC 1441/2007, EC 365/2010, EC 1086/2011 and EC 209/2013, but could also be integrated in the voluntary certification as BRC, IFS, FSSC22000 or ISO22000.

As can be seen in figure 1, the base of the EU regulation for Food Safety Management Systems are the Prerequisite Programs (PRPs) (EU Regulation, 2016). These are built upon Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP) (EU Regulation, 2016). Examples of PRPs are infrastructure (building, equipment), cleaning & disinfection, pest control, raw material (supplier selection, specifications), personnel (hygiene, training, work instructions) (EU Regulation, 2016).

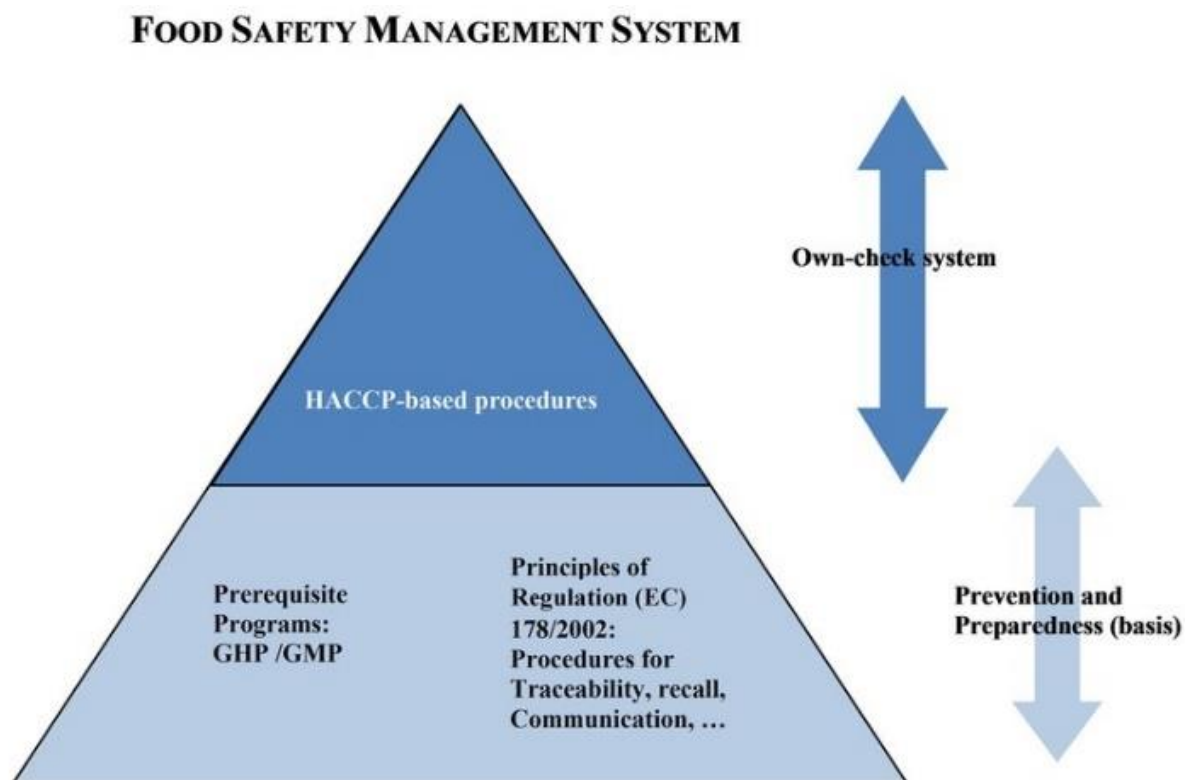


Figure 1, Elements of a Food Safety Management System (EU Regulation, 2016).

Managing this systematic food safety approach involves procedures, documents and (analytical) data control. During implementing a food management system, these requirements need to be translated into core activities, according to Ren, He & Luning two categories can be recognized: control activities and assurance activities (Sauvée & Abdirahman, 2012). Control activities are the activities that evaluate the production process according to the set standards, and include taking corrective actions when necessary (He, Ren, & Luning, 2016). Assurance activities are activities related to validation and verification of the procedures and documentation in place (He, Ren, & Luning, 2016). Examples of core control - & assurance activities translated in day-to-day activities are: (CCP) parameter control, product sample control, complaint filing, document control, hygiene management and regulatory affairs (Andjelković, Šrajer Gajdošik, Gašo-Sokač, Martinović, & Josić, 2017; Bilska & Kowalski, 2014; He, Ren, & Luning, 2016; Skjerdal, T., Gefferth, A., Spajic, M. et al, 2017).

### 1.2.2 How does (E)QMS work? Functions & features

In order to manage these control - & assurance activities, comply to the law and requirements of certification organizations, an internal system needs to be developed. This can be done in several ways: 'from scratch', within an Enterprise Resource Planning system or with an external Quality Management Software.

An Enterprise Quality Management Software (EQMS) is a software that gathers, manages and analyses all data related to quality (and food safety) management in a business (Littlefield, 2012). The software works closely together with the existing Enterprise Resource Planning (ERP) software in the business (Littlefield, 2012). It is an internal platform/ program in which data is entered by employees, production machines and laboratories (Littlefield, 2012).

These functions cover core control - & assurance activities as: regulatory compliance, RCA/CAPA, document control, audit management, personnel training, reporting and customer complaints management (Hrgarek, 2008; Littlefield, 2012). The ERP software will stay the primary platform, which makes EQMS and additional platform monitoring and focusing on product quality & safety (Littlefield, 2012).

The purpose of a quality management software is to ensure that the products meet the set requirements. In the process of supporting quality control & - assurance, a quality management software should focus on: replace paper-based quality management, automate and improve quality related processes, provide better product/ raw material traceability, real-time data to picture workflows in production, escalation notification, reduce risk of non-compliance and reduce the potential for human made errors (Hrgarek, 2008).

### 1.2.3 Benefits and disadvantages implementing EQMS

Implementing a software brings both benefits and disadvantages. It costs money, but could increase the efficiency and reduce labor hours. Implementing an EQMS is comparable with implementing an ERP. Studies show that major advantages of integrated software systems are:

- **Secure access to quality information.** Database Management System controls all data and converts it standardized 'language'. Because the system converts the data, no time is wasted by employees and the risk on making mistakes is reduced. Because of the uniformed data, analysis are made easily and are representative (Adrian-Cosmin, C, 2015).
- **Operational benefits.** Standardization of the business process, improve interaction with customers, lower inventory level (Yussof, Al-Dhaafri, & Bin, 2012).
- **Easy adaptability.** Because all data is stored in the same way at the same place, changes in documents, procedures or processes are easily made.
- **Reduce of costs.** Time savings (labor hours) and better control of the process will cause a decrease in costs.
- **Collaborative dimensions.** There are options to let the ERP collaborate and interface with other management software. This makes it possible to combine different software to create the perfect situation for individual businesses.

Integrated software systems do have some disadvantages as well:

- **Financial investment.** In order to buy and implement the integrated software, a financial investment has to be made.
- **Long periods of deployment.** Employees working with the (new) software need to be trained. In the beginning tasks and activities might take more time with the software than with the old fashioned way.



- **Difficult and complex implementation.** Installing the software, customizing it to the business, entering all necessary data, teach and train employees to work with the software are all factors that can delay the implementation up to months.
- **Inflexibility and dependency on software organization.** Once the software is implemented, it is difficult to make major changes in the software and structure of the business.
- **Existence of hidden costs.** During the implementation phase of the software, unexpected costs could arise because of further customizing of the software, or other related problems that need to be solved first.
- **The need for expansion and further development of the software.** When the business implementing the software grows, develops or changes in structure, the software has to have to capability to develop as well (Adrian-Cosmin, C. 2015).

Implementing an ERP software influences the competitive position through the interaction with other resources and it increases the contact about the supplier's quality improvement system (Lafromboise, 2015). According to Adrian Cosmin an integrated software is a soft roadmap, which automates various steps along the process to achieve the end goal (Adrian-Cosmin, C. 2015). For an EQMS that would be quality.

Al-Dhaafri, Bin & Yusoff have identified several critical success factors for implementing an ERP, which will be comparable for an EQMS: Information quality, users' satisfaction, system efficiency, system functions, use attitude, and system quality (Yussof, Al-Dhaafri, & Bin, 2012). Next to that the changes in structure & culture (e.g. having to communicate differently, being more bureaucratic), training and education of employees, and having a clear understanding of the strategic goals of the end result with implemented software (Yussof, Al-Dhaafri, & Bin, 2012).

#### 1.2.4 Decision-making process

The University of Massachusetts Dartmouth has identified the 7 steps of general decision making. These steps have an important chronological order for decision-making (UMassDartmouth, 2018). The steps are as follows:

1. Identify problem/ decision
2. Gather relevant information
3. Identify alternatives
4. Weigh the evidence
5. Choose among alternatives
6. Take action
7. Review decision & consequences

Hrgarek has summarized these steps and developed an evaluation framework for Quality Management Software within the health industry, existing of four phases (Hrgarek, 2008).

- 1. Requirements acquisition and evaluation planning phase**
  - a. Identification needs and scope of business, get management support, consider alternatives, make cost and benefits analysis, identify user requirements and prioritize them.
- 2. Product identification phase**
  - a. Market availability, gather information about potential software.
- 3. Product evaluation phase**
  - a. Execution of detail evaluation, on-site demonstration of selected software organizations.
- 4. Product selection phase**

- a. Define contract requirements, perform gap analysis, sign the contract and after implementing: provide feedback.

In the evaluation phase it is important to compare the potential software in the right way. Several methods are being advised for multi-criteria decision making: elimination by aspects, linear assignment method, additive weight method, weighted product, analytic hierarchy process (AHP) (Kahraman, 2008). Other options for evaluating alternatives are a confrontation matrix, based on a SWOT analysis, or creating an evaluation matrix.

This evaluation framework is focused on quality management in the health care. And while such a framework is helpful for decision-making, no similar framework has been created for the food industry.

### 1.3 Knowledge Gap

As can be read, information about quality and food safety management is widely available. Critical factors in food quality and safety management are known and considered in daily management. Knowledge about Enterprise Quality Management Software is present, as well as information about decision making for integrated software systems.

But a combination of these information flows has not been researched for food businesses yet, that is where this research will focus on. A practical view will be used, so businesses can use each other's experiences for their own decision making on professionalizing the quality department.

No practical benchmark, analysis or guideline regarding EQMS for businesses operating in the food industry has been made before. That is why this research will focus on the following research question:

*What should businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?*

In order to answer this research question, there are several steps to be taken. First of all the current situation needs to get analyzed. Which software systems are used by businesses today. Next to that the core activities of the quality department need to get identified, in order to determine what required functions for an EQMS are. After that benefits or disadvantages need to be known, together with which factors are to be considered when making a decision regarding different software available. To get a practical and realistic idea, several businesses will be interviewed about their decision-making process of implementing the EQMS. These interviews will be analyzed and to help other businesses in the future, a decision-making model/ tool will be developed.

Targeted for the research are: businesses, operating in the food industry, located in the Netherlands. Businesses in the food industry are expanding as processed foods are becoming increasingly popular (Kearney, 2010), this combined with the legal requirements and regulations becoming more strict every year (FoodHolland, 2017), these businesses are challenged to have a professional and extended quality and food safety management. Therefore a Quality Management System should be in place, and implementing a software for this is a logical next step. Although software producing companies are often large, international companies, this research is limited to SME's operating in the food industry in the Netherlands.

Answering the research question the following sub questions need to be answered first.

1. Which software systems are currently used by food businesses to manage the quality/ food safety?
2. Which specific functions are needed in the software to support the core activities of the quality department?
3. What are critical factors in the decision-making process of implementing an EQMS?
4. What are experiences of businesses in the food industry with implementing an EQMS and which of these factors should be considered in the decision making model?

The final outcome of the research will be a decision-making model/ or tool, which will be a guideline for comparable businesses to decide upon implementing an EQMS or not.

## 1.4 Objectives

This research was written to help food businesses professionalize the quality department by using advanced systems and software designed for quality management. The main objective of this research was to develop a practical guideline/ decision-making model for food businesses to support the implementation decision making for implementing an Enterprise Quality Management Software.

This was done by identifying most important factors of an EQMs and by investigating the decision making process of businesses who have implemented an EQMS. Several quality department employees of 12 businesses were interviewed about their experiences and specific needs for a quality management software. These experiences were categorized and translated into a decision making model.

## 1.5 Outline of the report

First the methodology of the research is described, in which the materials and methods are discussed. After that the results of the research are presented, categorized per sub-questions. In chapter 4 the results of the report are being compared with the outcomes of the literature review. In chapter 5 a conclusion is made and recommendations are given. At the very end of the report a list with references can be found, as well as all appendices including the interviews, the study case and the to the point instruction.

## 2. METHODOLOGY

The following materials and methods were used to answer the research questions and create the decision-making model.

### 2.1 Materials

Literature available on the web, a computer with Microsoft Word, Excel and PowerPoint were used to process data and write the report. Next to that, 10 companies were interviewed with a prepared questionnaire (appendix 1).

### 2.2 Methods

The sub questions were answered by conducting a qualitative exploratory research. Several businesses within the scope were interviewed about their experiences and reasoning behind certain choices. The scope of this research is limited to businesses operating in the food industry in the Netherlands. Businesses from different production expertise were interviewed. This to hear different opinions, so that a model applicable for the whole food industry could be made.

Eight food businesses were targeted to take part in the interviews, each of them providing mostly one employee, except for Uniekaas (two employees). All these interviews were analyzed and the experiences compared.. The companies chosen are a representation of the different major food industries of the Netherlands: fresh produce, bakeries, dairy industry, meat processing, potato processing. Regular quality department employees were not directly active in implementing a new quality management software, therefore the choice for 1-2 employees has been made. Preferably the quality manager and when applicable a second employee active in the decision-making. To look at the decision-making with different perspectives, two software suppliers were interviewed as well.

The guideline for the interviews is attached to this report in appendix 1. To make it a qualitative research, all questions asked are open questions. A 'listening' strategy was applied. In this way the experiences with the software are represented best.

The following companies were interviewed:

1. **Vergeer Kaas** – Qesh Manager – Cheese processor in Reeuwijk, 550 employees.
2. **Nice to Meat** – Quality Manager – Meat processor in Almere, 70 employees.
3. **Fresh Care Convenience** – Quality Manager – Fresh produce in Almere, 150 employees.
4. **Perfetti van Melle** – Coordinator Management Systems & Auditing Benelux – Confectionary producer, in the Netherlands three locations with 550 employees.
5. **Bolletje** – Manager Kwaliteit & Procestechnologie – Bakery in Rotterdam, 500 employees.
6. **Uniekaas** – Qesh Manager – Cheese processor in Kaatsheuvel.
7. **Uniekaas** – Quality Department Employee – Cheese processor in Kaatsheuvel.
8. **Ben & Jerry's** – QA officer – Ice cream producer in Vathorst, 180 employees.
9. **Avebe** – Quality Management Specialist – Potato processor in Veendam, three production plants in the Netherlands.
10. **Manual Master** – Sales Manager – Software supplier QMS
11. **QiSoft** – Sales Manager & Programmer – Software supplier QMS

In week 14 the companies were contacted and asked if they were willing to participate in the research in May/June. In May/ June the companies were interviewed according to the guideline in appendix 1. Where possible the businesses were interviewed during a visit. If this was not possible due to the limited timeframe, the interviews took place by telephone. This division was made after the first contact with the companies in week 14. The proposed time planning for the thesis can be found in appendix 12.

The questionnaire was sent to the interviewees prior to the interview. In this way the businesses could prepare the questions. Notes of the answers were made during the interviews. After all interviews were conducted, the notes and results were summarized and analyzed. This was done with Microsoft Word. The answers of the interviews were categorized and those categories were used for the decision-making tool.

The conducted interviews were analyzed and based upon that information the research questions were answered. The answers on the research questions showed the decision making process, and based upon that information the model could be made.

The different stages in the decision-making process described by the University of Massachusetts Dartmouth, were used to form the base of the decision-making model. The boxes in the model represent the different stages. With the answers of the interviews, the critical factors and important aspects were identified and linked to the stages in the model. In this way, the general decision-making model was transferred to a food industry specific decision-making model.

As a first verification, the decision-making model was used by Uniekaas, one of the interviewed companies.

### 3. RESULTS

To answer the main research question, results of the interviews are presented in this chapter. Quality managers and employees of eight food businesses and two software companies were interviewed. During the interviews a questionnaire was used as guideline for the conversation, the guideline can be found in appendix 1. All interviews conducted can be found in appendices 1-11. In this chapter, the results of the interviews are being discussed per sub-question.

#### 3.1 Software systems used to manage quality and food safety

This paragraph answers the first sub-questions: *Which software systems are currently used by food businesses to manage the quality/ food safety?*. First the reasons why food businesses decided to implement a quality management software are discussed. After that different software systems used by the interviewed businesses are listed and described.

##### Reasons to implement a quality management software

In table 1, the reasons why food business decided to implement a software for quality management are presented. Reasons to implement a software are indicated as: *reliable data* (because the data in the software is less sensitive to faults), *easy accessibility of data*, *better organized data* and a *higher efficiency*. A higher efficiency is obtained because less typing work is needed according to the experiences of Fresh Care Convenience and Avebe. Vergeer Kaas, Ben and Jerry and Nice to Meat are more skeptical towards the benefits of software. First of all the costs related to implementation of the software, and the time investment required of the employees. Vergeer Kaas highlights the dependency on the software supplier and questions the real added value of software.

**Table 1 Summary question 6-7 of questionnaire (Appendices 1-11)**

Main reason to implement	Main reason not to implement
Reliable data (less sensitive to faults)	Costs
Easy accessibility of data	Dependence on software supplier
Better overview/ organized & centralized data	Time investment of employees
Efficiency (less typing work)	Does the software actually add value

##### Different methods of data administration

Several methods of data administration are mentioned by the interviewed food businesses. Two companies (Fresh Care Convenience and Uniekaas) indicated that they process their data apart from the ERP software by creating spreadsheets in Excel, writing procedures in Microsoft Word and realizing document control by creating another Excel sheet. Perfetti van Melle and Avebe do not use Excel sheets and only use software for data processing. A combination of the two methods (manually administration by Microsoft and administration via software modules) is a possibility and is being used by Ben & Jerry's, Uniekaas and Bolletje.

Different ERP software recognize the importance of quality management in a production facility. These ERP software have integrated modules regarding the administration of quality management. As indicated by Avebe and Bolletje, most popular modules in ERP by the interviewed businesses are complaint administration and specification management. These modules will be further described in paragraph 3.2.

SAP, Navision, Microsoft Dynamics and M3 are popular examples of ERP software with integrated quality management modules. These are used by Vergeer Kaas, Bolletje and Avebe. Nice to Meat uses REFLEX, which is an example of a very basic production planning system created for the food industry. According to Nice to Meat, REFLEX is not much focused on quality management and only has a limited

module for recipe control. Bolletje, Avebe, Fresh Care Convenience and Perfetti van Melle bought an external software because the separate modules of the ERP did not offer enough functionality and were not adequately specialized for the daily activities of the quality department.

So, in addition to the ERP, different software could be bought and implemented to support the professionalizing of the quality department. Manual Master states that most of the software would work without the businesses having an ERP software, but that situation does not happen often. When a business is able to invest in a quality management software, it has such a high production an ERP is necessary for planning (Nice to Meat, 2018).

### **Different types of software being used**

In table 2 a clear overview of the software used by the interviewed businesses can be found. The software mentioned in the table are not all software available for food businesses in the Netherlands, but represent popular software along the interviewed businesses.

Looking at the software mentioned by the interviewed businesses, six types of software modules are implemented most often. These six main modules are:

1. Product specification management
2. Document control
3. Risk control
4. Laboratory data administration
5. Complaint management
6. Process control

Most software available is specialized in one of the six sections. That would suggest, a well-developed businesses has more than one software system next to the operating ERP software. Table 1 summarizes the different quality management software used by the interviewed food businesses and indicates in which section the software is specialized.

The software is categorized and an indication is made whether a link (information stream) between the software and ERP exists. Most of the interviewed food businesses emphasized the importance of that link. When information is transferred automatically, the system is less sensitive for faults and it saves labor hours. Vergeer Kaas expressed to be skeptical towards the link, as they experienced trouble with the information streams. The information stream can only be a one-way-communication stream, this means one software is seen as master data source. Changing/ entering information in that sources, it automatically transfers it to the second software. But changing/ entering information in the second software, it does not automatically transfers to the master data source. This could cause impurities in the different software (Vergeer Kaas, 2018).

**Table 2, Summary question 1 of questionnaires (Appendices 1-11)**

Company	Quality management software	Category software module	Link Quality management software & ERP?
Fresh Care Convenience	Eclarion	Product specifications	No
	Fresh NB	Process control	Yes
Nice to Meat	iMIS	Document control	No
	Reflex	Product specifications	Yes
Perfetti van Melle	SharePoint applications	Product specifications, document control, risk analysis, process control	Yes
Vergeer Kaas	Manual Master	Document control	Yes
	QAonline	Risk analysis	No
	Navision (ERP)	Product specifications	
Avebe	ARIS	Process control, document control	No
	Pimpcode	product specifications	Yes
Bolletje	EXB	Document control	No
	Bestmix	Product specifications	No
	Microsoft Dynamics	Process control	Yes
Ben & Jerry's	QiSoft	Process control	No
	VisPro	Process control	Yes
Uniekaas Holland	None	-	-

As can be seen in table 2, examples of software specialized in product specification management are Eclarion, BESTMIX, iMis. Manual Master, EMX and SharePoint are often used for document control. Vergeer Kaas mentions the increasing importance of risk control and state that software to do so, help a lot. According to them QAonline is a well-known software in the food industry, often used by businesses to analyze and control risk in a food production environment.

Process control is often seen integrated in the ERP system, or linked to document control. EXB is linking production flow charts, document control, with production data (Bolletje, 2018). QiSoft is a software specialized in gathering real time production data and presenting this in a clear way.



Perfetti van Melle, a global company with an extensive IT department, creates their own software modules. Based on Microsoft SharePoint, modules are created and designed especially by and for the business. *'Creating your own software modules needs investment, but creates flexibility once the software is implemented and working. Minor changes can be made easily, without having to discuss the changes with the software supplier first. Software suppliers work with a standard module, our software not. Therefore requests specific to the business are easier to realize'* (Perfetti van Melle, 2018).

Looking at these methods of data administration and the different software identified, six main different types of software are being implemented to organize the data administration of the quality department.

### 3.2 Specific functions needed to support the quality department

The second sub-question, *Which specific functions are needed in the software to support the core activities of the quality department?*, is answered in this paragraph. This paragraph focusses on identifying the activities needed to organize the data administration at the quality department.

As stated before, the software systems available for quality management can be divided into multiple specializations. Table 3 shows the modules and functions indicated as most important by the interviewed food businesses. An explanation of these modules and functions is given below table 3.

**Table 3 Summary question 3 of questionnaire (Appendices 1-11)**

Module/ function	Number of times indicated as important by the businesses
Specification management	8
Document control	6
Risk management	3
Process control	3
Laboratory administration	2
Complaint management	2
Search tool	3

#### **Product specification management**

During the interviews Perfetti van Melle, Vergeer Kaas and Fresh Care Convenience emphasized on the importance of monitoring the product specifications in the food industry. As producer it is obligated to provide certain information about the products being produced. Legal name, content, ingredient declaration, nutritious values, allergens are needed to be mentioned on the label of the product, and therefore on the product specification (Nice to Meat, 2018). Managing this information could be a challenge, especially when the business produces several products. For example a mix bag of eight different type of sweets, cheese that matures or a limited edition salad with new dressings, toppings and greens in it (Perfetti van Melle, 2018; Vergeer Kaas, 2018, Fresh Care Convenience, 2018). That is why those businesses decided to implement a software for specification management.

The data on the product specification is derived from various sources: recipe, production data, law & regulations, raw material specifications (Avebe, 2018). Combining this information, managing it, updating when necessary and forwarding it to customers when asked is a task which requires time. Avebe states that at one point businesses are not able to organize this manually. In their opinion it is then essential to implement a software which is managing this information.

Implementing such a software, Bolletje and Avebe experienced several advantages. First of all the data and document storage. Having all data stored at the same place, all employees can find most up to date information easily. Next to the businesses experienced that uniformity of the data, created more reliable and consistent information on the specifications. According to Fresh Care Convenience there is less risk for incomplete or faulty information, simply because of the fact that several fields need to be filled in obligatory.

## **Document control**

According to all interviewed businesses, an internal handbook should be the core of documents for businesses operating in the food industry. In the internal handbook all work instructions, procedures and production lists are being saved. As explained by Manual Master and Vergeer Kaas, all these documents have a document owner, that person responsible for the document. This person has to assure the truth of the document: changes in text, updates in version and validation date.

Avebe mentions that it is important employees have access to the right documents needed for their work activities, managing the internal handbook is a serious requirement. Using Microsoft Word or Excel to keep an overview of validity of the documents in the handbook can become complicated for businesses. Especially when several production processes / lines all with different employees and supervisors are being described in the handbook. At that point, too many information streams are flowing. Bolletje and Manual master state that a software could help organizing these streams.

In order to create a clear information stream for new or revised documents, the software has determined a specific route for the documents. When an employee has written a new work instruction, the employee can upload the document. Then, several employees need to check and accept the new work instruction. Once that has happened, a notification is sent to all employees working with this document. References made to this document are automatically highlighted and the old version of the document moves to the archive (Bolletje, 2018; Vergeer Kaas, 2018, Manual Master, 2018).

## **Risk control**

According to Vergeer Kaas, controlling the internal and external risks for food businesses is essential. This involves having an overview of all raw materials used in production and knowing which risks there are associated with these raw materials. Next to that, understanding the level of these risks and know how to control them. Perfetti van Melle emphasizes the importance of managing raw materials. Secondly, Ben and Jerry's state that managing all suppliers and their documentation is an important part too. *'Think about certification validity, past performance or their origin/ source of raw materials'* (Ben & Jerry's, 2018).

These external factors need to be controlled, and so does the internal environment. Risk and hazards need to be identified, documented and controlled. Results of internal audits should be managed, preferably according the plan-do-check-act method (Vergeer Kaas, 2018; Perfetti van Melle, 2018).

As can be read, multiple documents are required to control internal and external risks. Vergeer Kaas explained that software created for risk control have different modules to manage the parts of risk control: supplier management, raw material management, internal audit management. For the quality department it can be a challenge to manage all these parts. Besides, the expertise needed for controlling the hazards and risks is specific and it requires time investment to keep up to date with changing external factors. Therefore some software have links to external databases. In these databases (e.g. RASFF or RiskPlaza) information regarding all different types of raw materials and their risks is gathered (RASFF, 2018; RiskPlaza, 2018). All together that helps business greatly to have the right document structure with the right information.

## **Laboratory data administration**

In order to comply to laws and regulations obligated for the food business, microbiological analysis are conducted regularly in food businesses. Uniekaas does not have the luxury to have an inhouse laboratory, as many other food businesses (Nice to Meat, Bolletje and Ben and Jerry's). Therefore the products to be analyzed are sent to an external laboratory. When the tests are done, results of these tests are sent back to the food business. The food business needs to have a clear and structured overview of these analytical results.

Uniekaas administrates the analytical results manually, by entering the analytical results in an Excel document. That way of processing takes lots of time, is sensitive for faults (type errors) and is hard to keep clear (different naming of the samples makes it hard to analyze all results in the end).

Software for the link to laboratory does not exist to the awareness of the interviewees. But Laboratory Management Information Systems (LIMS) do. These are systems designed for laboratories to manage their data. Preferably a link between this LIMS and the food business its software is made.

## **Complaint management**

Uniekaas explains that an (by law) obligatory activity is complaint management. After receiving a complaint, the complaints needs to be registered and a root-cause analysis needs to be done. Then the problem needs to be solved, preventative measures need to be implement and the complaint needs to be settled. At Uniekaas and Ben & Jerry's the complaints are divided into internal complaints and external complaints. The external complaints are classified into: consumer complaints, customer/retail complaints and supplier complaints.

Though a spreadsheet in Microsoft Excel can be used for complaint management, using software is preferable according to Avebe and Perfetti van Melle. This because multiple employees from different departments need to have access to the complaint registration and need to add information. Customer service registers the complaint, the Quality department conducts a root cause analysis, the Finance department makes a credit note and production needs to implement the preventative measures (Ben & Jerry's, 2018).

## **Process control**

In the end, all procedures written, all steps in management of risks, of complaints, of product specifications are invented to control 'the process'. In QiSoft's opinion having control over the production process is the final desired result of all different implementations a food business conducts.

But looking to the most basic meaning of the word process control, it is controlling the process on the production floor. All parameters of production, analyzed and presented in a clear way. This part of process control starts with flow charts of the different production lines. In those flow charts each production step is listed and critical points are indicated. These critical points must be converted to measurable parameters. The parameters then can be controlled (QiSoft, 2018).

Most software made for product specification control or document control have a module for process control integrated. If not, Ben & Jerry's state that it is certainly a point to consider.

## Search Tool

Bolletje, Avebe and Nice to Meat indicated to use the 'search tool' to find different products or documents in the software most of all features.

*'Being a food business processing, analyzing and archiving lots of data, it is very important to easily find information. Our previous software could not realize that, but ARIS does. It has a full text search ability, which can scan documents on content base'* (Avebe, 2018). Avebe considers accessibility of data as one of the most important requirement for a software.

Looking over the paragraph, the interviewed businesses identified the seven most important functions for data administration at the quality department as: Specification management, Document control, Risk management, Process control, Laboratory administration, Complaint management and the Search tool.

### 3.3 Critical factors in the decision-making process of implementing an EQMS

In this part of the results, the third sub-question is being answered: *What are critical factors in the decision-making process of implementing an EQMS?* This paragraph presents the critical factors identified by the interviewed food businesses.

During the interviews lots of opinions about different software were discussed. From all these opinions the factors mentioned in figure 3 were mentioned most often and considered as most important. The different critical factors identified by businesses are explained in the following paragraph.

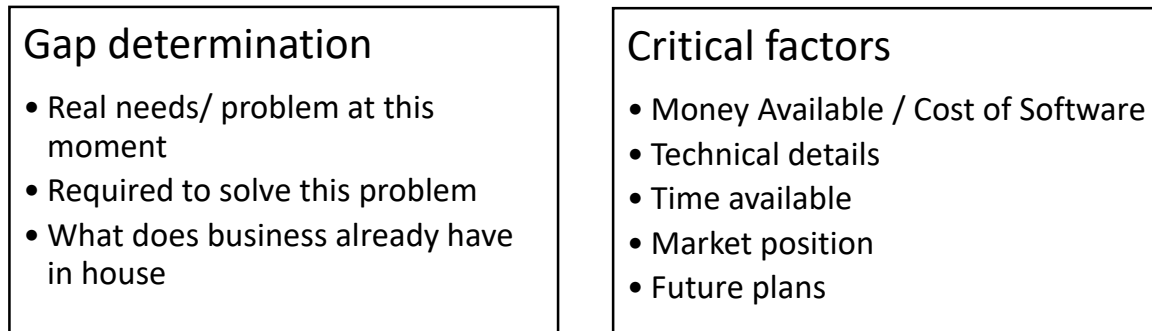


Figure 2, Critical factors and aspects in decision-making of a quality management software (Appendices 1-11)

Vergeer Kaas, Bolletje, Perfetti van Melle and Avebe indicated different critical factors. But the four businesses emphasized on discovering the 'real' problem/ *the gap determination* first. What the four businesses meant with defining this 'gap' is explained in the paragraph below.

#### Gap determination

The interviewed businesses advise to create a team to implement the software (Quality manger, member of board of directors, ICT department). Together with this team, the scope of requirements of the food business needs to be defined. Vergeer Kaas, Bolletje, Perfetti van Melle and Avebe emphasized on the questions below and explained it in the following way:

#### ➔ What is the real need/ problem of the quality department at this moment?

Describing the current situation of the food business/ quality department and the difficulties faced during daily activities should identify the real need for software. Interviewed businesses tell that often the wrong modules of software are being bought. The real problem of the business is not recognized correctly, especially when the promotional speeches of the software companies are sounding promising enough.

#### ➔ What is needed to solve this problem?

For the problem identified as most important, the business should think about solutions which would improve the situation. Requirements of the business to improve the administrative activities of the quality department have to be listed. Requirements can be classified according the seven functions mentioned in the previous chapter: Specification management, Document control, Risk management, Process control, Laboratory administration, Complaint management and the Search tool.

### ➔ What does the business already have in house? And what can still be used from that?

After defining what the potential solutions are, the business should analyze which systems and software modules it already has. Interviewed businesses have the experience that often businesses buy a whole new software, while the problem can be solved with adding or reinventing a module within the existing ERP or software.

The interviewed businesses explain, that after those questions are answered, the food business should do market research while it considers the following critical factors.

Critical factors

#### **Money available and costs of software**

According to Nice to Meat, money is often the biggest deal breaker. Therefore Nice to Meat and Uniekaas advice to discuss the budget with the board of directors first thoroughly. In that way there is a clear picture of the amount available for implementing a software. Vergeer Kaas points out that when analyzing the costs, businesses should not forget to think about network/ server changes, labor hours during implementation, (external) training sessions after updates and changes in hardware needed.

Table 4, shows the answers of the food businesses regarding the questions whether they had the feeling implementing a quality management software was cost saving at the end. Several reasons were given: time/ labor hours saving, less mistakes are being made, data is more reliable, data indicates improvements to make process more efficient, and structure within the business is created. Only Ben & Jerry's expressed negatively towards the costs saving of implementing a quality management software. The quality employee stated that side costs were bigger than expected. Next to that he said the software created work in terms of documentation. The software requires the employees to always document and administrate all activities done, while sometimes it is faster to just conduct the activity.

**Table 4, Summary question 9 of questionnaire (Appendices 1-11)**

<b>Was the implementation of a quality management software cost saving at the end?</b>		
<i>Yes/ no</i>	<i>Reason</i>	<i>Amount of times indicated</i>
Yes	Saves time/ labor hours	3
	Data is more reliable	3
	Less mistakes	2
	Data indicates improvements to make process more efficient	2
	Creates structure	2
	Easier to share data with sister/ mother company	1
No	Side costs are big	1

#### **Technical details (server, licensees, updates needed)**

Manual Master and Vergeer Kaas explain the complexity of the IT side of implementing the software. They advise that the method of implementation needs to be discussed with the IT department. There needs to be discussed how accounts will be arranged. If the software company works with licensees, a lumpsum or a standard fee per month/ year. If the software works with licensees, the amount of employees who need an account need to be set.

### Time available

Although a software saves time once it is implemented, time needs to be invested first. Perfetti van Melle and Manual Master state that time is a big influencer in the implementation of a software. Time is required from the Quality Manager, Board of directors and IT department to define the scope needed to change the situation. Time is needed to explore the market and to make the decision. After that time of employees is needed to convert the current data to the new software, and to get trained in using the new software. Table 5 shows the time needed by the interviewed businesses, to implemented the software.

**Table 5 Summary question 8 of questionnaires, time needed to implement software (Appendices 1-11)**

Business	Implemented software	Time needed
Bolletje	EXB	2,5 year
Vergeer Kaas	Microsoft Dynamics	4 months
Perfetti van Melle	SharePoint	1 year (incl developing own software)
Fresh Care Convenience	Eclarion	4 months
Avebe	ARIS	4 years

### Market position / experience software

According to Vergeer Kaas and Avebe it is wise to look at the market position and experiences of the software companies. Is the software supplier operating internationally or in the Netherlands? If it is operating internationally, does it have service and support in the Netherlands? Has the software experience with suppling/ designing software for the food industry?

### Future plans

Uniekaas states that they have to consider the future plans of the business. Expansion plans, possible mergers or take overs can change thoughts on different software as well. If a food business is being taken over by another business, this other food business often prefers/ requires that the same software is being used.

So, food businesses should have a clear idea of their needs, before implementing a software. This image can be created by the questions asked above. Once the needs are specified, the food business should consider the following critical factors: Money available and costs of software, Technical details (server, licensees, updates needed), Time available, Market position / experience software and the Future plans.



### 3.4 Experiences of food businesses that should be considered in the decision making model

The last sub-question: *What are experiences of businesses in the food industry with implementing an EQMS and which of these factors should be considered in the decision making model?* This paragraph presents the experiences with implementing software the interviewed businesses had. The experiences are categorized in seven categories.

After asking the interviewed businesses about their experiences with implementing software, the following points were highlighted to consider. In table 6, most popular points to consider are listed. Further below the table these points are explained.

**Table 6 Summary question 12 of questionnaires, experiences to consider (Appendices 1-11)**

<b>What should other businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?</b>	
Keep it simple	4
Conduct reference visit	4
Level of implementation	3
Continuous implementation	2
Market position of supplier	2
Implementation costs time	2
Excel use after implementation	1

#### **Keep it simple**

Bolletje and Vergeer Kaas experienced that often too many features are sold by the software suppliers. Then the core problem of the quality management is not solved, while the extra features are keeping the focus away from the problem.

Implementing a software, the modules always need to be designed and tailored to the food business (QiSoft, 2018). Bolletje and Avebe point out the importance of keeping the software features as simple and clear as possible. When buying or implementing a software businesses should not be misled by extraordinary features and possibilities which do not add value to the quality management activities.

#### **Does not take away all work, software will need a continuous investment**

According to Manual Master, Vergeer Kaas and Avebe businesses should not forget the software does not take over all the work regarding the feature of the software. Documents, work instructions, procedures still need to be written by employees, employees still need to enter data in the product specification software and still need to update certain data. Next to that the software needs continuous investment. After every update there is a possibility that employees need a training, new employees need to be trained. The software needs maintenance and support, old files need to be removed and information needs to be updated continuously.

#### **Dependence on software and their knowledge**

After implementing the software the food business is dependent on the software supplier. If the software disfunctions or has an error, the food business has to wait until the software company solves the problem. Perfetti van Melle experienced that when they would like to have seen certain aspects different, they could not change those aspects. There had to be contact with the software supplier, which always took time and money.

### **How do you go back to the old system if new software does not work?**

Avebe mentions that the fact that the software is being implemented to work for a long time is covering the relatively large time investment implementing it. That does mean if the software does not work as expected, or misfunctions it is difficult to switch back to the old situation or a new alternative. This emphasizes the importance on making the right choice directly. A note from Bolletje and Avebe is to start small and simple, in case certain aspects do not work it is easy to fix, or take a step back. Vergeer Kaas states that businesses need to consider it is not easy to go back once a software is implemented.

### **Full transition to new software system**

Another aspect that Bolletje advises is investing in employee training for using the software. Next to that managers need to supervise the use of the software, and make sure that employees use the software to its full extent. There should not be made use of external Excel sheets. According to Bolletje employees tempt to do this out of habit, but this slows down the implementation process.

Keeping that in mind, the business should think through the design of the software very carefully. Analyze the current workflow of information and the way of administration, combine that with the features of the software. Though the business should keep the software as simple as possible, it should contain all information streams needed. So that employees do not have to have the need to create the external Excel lists (Bolletje, 2018).

### **Level of implementation**

Perfetti van Melle indicates that before implementing a software the business needs think about the level of implementation. How the software will get implemented on technical/ servers base, but also about whom has to work with the software. Bolletje and Vergeer Kaas list that the following questions need to be considered: How far the software is implemented to the production line? Is it too difficult to realize data gets entered in the production line by production staff, or can the software create a paperless system? If a paperless system is not realizable, how will paperwork from the production get connected to the software?

### Conduct a reference visit!

After conducting market research and attending demos of software suppliers, the best thing to do, is making reference visits according to Vergeer Kaas and Manual Master. Comparable food businesses which already have the software implemented and working. In that way the food businesses wanting to implement can get a better idea of the practical side of the software and can get a feeling of the experiences of the business already working with the software (Vergeer Kaas, 2018; Manual Master, 2018; Perfetti van Melle, 2018) .

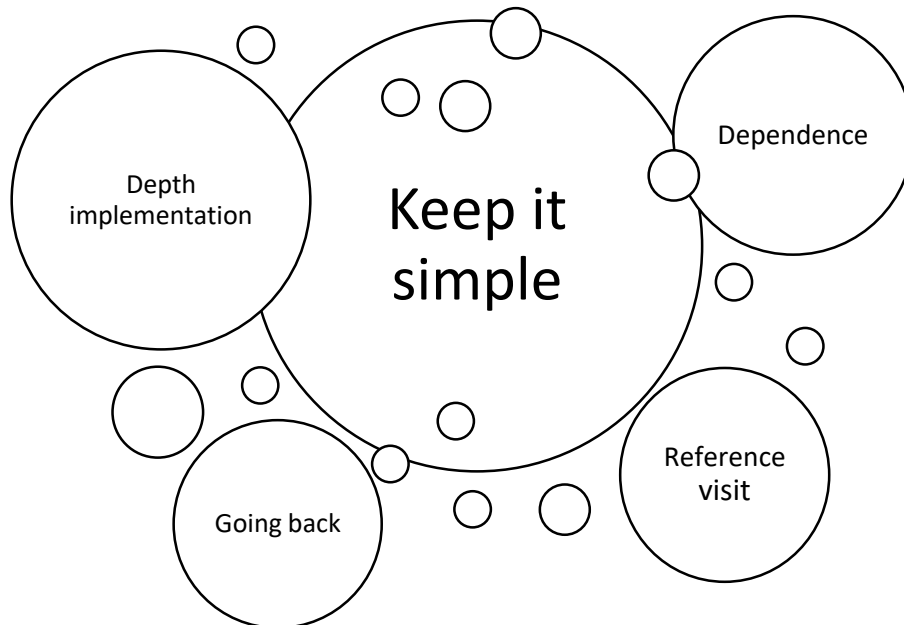


Figure 3 Summary experiences implementation software (Appendices 1-11)

Based upon experiences, the interviewed businesses advise food business, which looking to implement a software, to consider the following aspects: Keep it simple, Does not take away all work, software will need a continuous investment, Dependence on software and their knowledge, How do you go back to the old system if new software does not work?, Full transition to new software system, Level of implementation and Conduct a reference visit!

### 3.5 Decision-making model

In this part of the results all sub-questions are summarized into one practical model, which answers the main research question: *What should businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?*

#### Explanation of the model

The critical factors, questions and points to consider were converted into a decision-making tool, shown in figure 4. This model is created to let the businesses walk through the right decision-making process. All factors discovered by the literature research and interviews were taken into consideration.

Because of the importance of starting at the right track and asking the right questions, first the business needs to find 'the gap'. This is box 1 in the decision-making tool and can be answered by describing its current situation and asking itself why that needs to be changed.

Once it is clear that there is a gap, the scope of the solutions needs to be determined. This should be done based upon the three questions formed in chapter 3.3. As the first question (*What is the problem with current situation*) is already answered, just the two questions left should be answered: *What is needed to solve this problem?* And *What does the business already have in house? & what can still be used from that?* Answering those questions can be done with the help of boxes 2 and 3 in the model.

Solutions to solve the gap have to be specified in box 2. After all solutions are specific, they need to be ranked according impact (importance) x urgency. This can be done with the do it now/later/never graph. The solution in the 'do it now' box should be focused on first.

Several options to solve the gap are possible. In box 3 the options within the scope are evaluated. First, the possibilities within the already bought modules/ ERP system should be analyzed. Does the business not already have a similar module? If this is the case, the business should start using this module and can stop using the model.

When the business does not have anything in house yet to solve the gap, it should explore the options to add a module to the existing ERP system or to buy an external software. Comparing these options, and exploring the market should be done in box 4.

In this stage the business explores several options and thinks about multiple solutions. Once the business thinks it found a solution, it is important to do the 'check' of box 5. The business should review its gap and needs again, and check if the new solution is actually solving the gap. This check should be made upon the gathered information in box 1+2 & 3. Whenever the answer on that question is not 100% yes, the business should start at box 1 again.

If the answer in box 5 was yes, further contact with interesting parties is the next step in box 6. During the contact with different parties, the objectives of chapter 3.3 and subjective points to consider of chapter 3.4 should still be used as indicators. When the business has a clear overview of parties, the decision can be made in box 7.

An important step in all decision-making models is evaluation. This should be done in box 8. Businesses have to review whether the gap from box 1 is really answered. If not, the business fills in the model again.

In appendix 14, a letter with a to the point instruction can be found for food businesses wanting to use the decision-making model.

The created decision-making model summarized all important steps for deciding upon a quality management software. The different steps/ boxes in the model are a guide to the food business during the decision-making phase and let the process flow in a structured way.

<b>Explore MARKET of software suppliers</b> <i>For options in box2 &amp; 3, compare possible software suppliers against following factors:</i> <ul style="list-style-type: none"> <li>- Money</li> <li>- Technical details</li> <li>- Time available</li> <li>- Future plans</li> </ul>	<div>4</div> <div>1</div> <div><b>GAP</b></div> <i>Evaluate your current situation of processing data at the quality department, and answer the following question: Why does this need to change?</i>	<div>6</div> <div><b>CONTACT</b></div> <i>Further contact with most interesting software suppliers and discuss following factors:</i> <ul style="list-style-type: none"> <li>- Keep it simple</li> <li>- Dependence on software and their knowledge</li> <li>- Level of implementation</li> <li>- Conduct a reference visit!</li> </ul>								
	<div>2</div> <div><b>SOLUTION</b></div> <i>Identify specific activities of QA for your business that need improvement and prioritize by urgency x impact (importance).</i> <ul style="list-style-type: none"> <li><input type="checkbox"/> Product specification management</li> <li><input type="checkbox"/> Document control</li> <li><input type="checkbox"/> Risk control</li> <li><input type="checkbox"/> Laboratory data admin.</li> <li><input type="checkbox"/> Process control</li> <li><input type="checkbox"/> Complaint management</li> <li><input type="checkbox"/> Other activities...</li> </ul> <table border="1" data-bbox="1176 742 1467 1034"> <tr> <td></td> <td>High Urgency</td> <td>Low Urgency</td> </tr> <tr> <td>High Impact</td> <td>Do it Now!</td> <td>Do it later</td> </tr> <tr> <td>Low Impact</td> <td>Do it later</td> <td>Never do it</td> </tr> </table>		High Urgency	Low Urgency	High Impact	Do it Now!	Do it later	Low Impact	Do it later	Never do it
	High Urgency	Low Urgency								
High Impact	Do it Now!	Do it later								
Low Impact	Do it later	Never do it								
<div>5</div> <div><b>CHECK</b></div> <i>CHECK, whether possibilities found in box 4 are solutions to problem determined in box 1</i> <p>YES → continue box 6</p> <p>NO → <u>reformulate GAP in box 1</u></p>	<div>3</div> <div><b>OPTIONS for solutions</b></div> <i>Evaluate listed options for needs with High Urgency &amp; High impact</i> <ol style="list-style-type: none"> <li>1. Implement non-used but already bought module from ERP system → <u>STOP MODEL &amp; START IMPLEMENTING</u></li> <li>2. Add module to existing ERP system → COMPARE MARKET IN BOX 4</li> <li>3. Buy secondary software → COMPARE MARKET IN BOX 4</li> </ol>	<div>8</div> <div><b>EVALUATION</b></div> <i>Evaluate choice and implementation</i>								

Figure 4, Decision Making Model Quality Management Software

### 3.6 Decision-Making model study case Uniekaas

To validate the answer to the main research question, which was given in paragraph 3.6, a study case with the model was done. Results of this study case can be found in this paragraph, and appendix 13.

So, to evaluate the model, it was being used by Uniekaas. Uniekaas is a fast expanding Small-Medium Enterprise, and needs structure in documents and processes. Uniekaas already had a few conversations with software suppliers, but did not succeed in deciding about the most suitable option. The main focus of Uniekaas was on document control.

After reading chapter 3, Uniekaas decided to implement the model. The model completed by Uniekaas can be found in appendix 13. Filling in the first two boxes, Uniekaas realized that the urgency and importance of a product specification control is higher than the need for document control. Product specifications are not controlled at Uniekaas at all right now, while product specifications are outgoing documents, for the customer. Therefore it received the highest urgency x impact in the decision model. The internal handbook (document control) already exists and is effective, just not efficient. Which means a solution could wait a little longer.

Filling in box 3, Uniekaas realized that they already have a module within their ERP software (Navision) for specifications in house. That is where they should focus on first. Realizing that there is a problem at Uniekaas, while there is a solution (being paid for but not being used), was helpful. It will save Uniekaas lots of time and money. After finding this out, Uniekaas started to contact the ERP software, asking for instruction on how to use the specification module.

For Uniekaas, the answer on the question in box 4 is: *'Implement non-used but already bought module from ERP system → STOP MODEL & START IMPLEMENTING'*. This means the model can be stopped and the specification module should be implemented.

To show the working of the rest of the model, the study case was further continued with the module. *Structure in documents*.

Going further to box 4 with point 1. Structure in document, the market needed to be explored. Several software suppliers were reviewed (considering the points of chapter 3.3) with the following outcomes:

- Manual master: Money wise OK. Online platform, not much server space, per 5 licensees: OK. Dutch HQ.
- SharePoint Application: Not enough knowledge/ expertise/ time to design one at Uniekaas
- Master Control: Expensive. Located in UK, international corporate clients.
- SafeFood360: Expensive. Located in Ireland, SME clients, download on server.

Future plans: DOC is the sister company of Uniekaas and is using Manual Master. This should be taken in to consideration, as it is easier to communicate if both businesses have same software.

After the market exploration, in box 5 a check needs to be done whether the software suppliers (Manual Master, SharePoint Application, Master Control, SafeFood360) can solve the problems described in box 1,2,3. After a demo of Manual Master, Uniekaas decided that Manual Master can solve Uniekaas problems regarding document control. Uniekaas thought that this step 'CHECK', was important to not rush into the processes and be misled by all promising (not relevant) features.

So, in box 6 Uniekaas asked Manual Master for a second demo and decided to make an appointment for a reference visit. This is the point Uniekaas is currently (June 2018) working on.

After this step, Uniekaas follows the model as described in chapter 3.5.

By using the decision-making model the following findings were discovered:

- The realization that Uniekaas did not have its scope/ problem definition clear
- That a lot of money is saved by focusing on the solution Uniekaas had already in-house.

The model helped Uniekaas in discovering these aspects and focusing on the right solution for the right problem.

The validation of the model was conducted by a study case with Uniekaas. The results of this study case showed that Uniekaas had a better overview of information after using the decision-making model. Because of the model, Uniekaas followed a more structured process and was better informed before making final decisions.



## 4. DISCUSSION OF RESULTS

In this chapter the results of chapter 3 are discussed against the literature studies of chapter 1. Next to that a critical reflection on the research is given.

### 4.1 General discussion of results

The objective of this research is to help food businesses professionalize the quality department by using advanced systems and software designed for quality management. The main goal of this research was to develop a decision-making model for food businesses to support the implementation of an Quality Management Software. Four sub questions were answered by interviews held with food businesses. These sub questions are the key stones of the decision making model.

The growth of businesses described in the literature studies, was verified during the interviews. Interviewed businesses explained that the picture sketched in the literature review is realistic. As discussed in chapter 1, businesses often start organizing their business with the help of Microsoft tools (Word, Excel). Once businesses start expanding, these systems are not comprehensive enough, and an Enterprise Resource Planning software is bought to do so. As the business is expanding, the Quality department needs professionalizing of the systems to keep up with the growth. All interviewed business agree that implementing a software is the best method to do so (Avebe, 2018; Bolletje, 2018; Uniekaas, 2018; Perfetti van Melle, 2018; Fresh Care Convenience, 2018; Nice to Meat, 2018; Ben & Jerry's, 2018, Vergeer Kaas, 2018).

He, Ren & Luning (2016) identified quality assurance activities as: activities related to validation and verification of the procedures and documentation within the business. . Andjelković & all (2017); Bilška & Kowalski (2014); Skjerdal & all (2017), identified quality control activities as: parameter control, product sample control and hygiene management. The interviews indicated the following functions and modules as most important for a quality department.

1. Product specification management
2. Document control
3. Risk control
4. Laboratory data administration
5. Complaint management
6. Process control

As stated by the interviewed businesses, each of the following functions are possible to conduct without software. But at one point businesses expand and information passing the quality department is too much to organize without a software. Assuring data control, improved reliability and less sensitive to faults are seen as the most important reasons to buy a software.

Software for product specifications is seen as most critical in the food industry. Interviewed businesses emphasize on the importance of knowing exactly what is in the product and what has to be claimed to the customer.

Then a software implemented for document control of the internal handbook is considered as second most helpful. Version control and saving the data in such a way all employees needed to find the document can find them. Process control could be seen as a part of document control.

Controlling risk of the internal and external environment is seen as difficult by quality employees, lots of specific knowledge needs to be present to conduct a good risk analysis. Therefore having a software which retrieves this information and performs the analysis is helpful.

In chapter 3.3 a separation is made between *gap determination* and *critical factors*. Gap determination can be done by answering three questions:

- What is the real need/ problem of the quality department at this moment?
- What is needed to solve this problem?
- What does the business already have in house? And what can still be used from that?

Comparing these questions with the literature of Hrgarek (2015), the steps to define a gap are similar. Hrgarek (2015) mentions similar aspects: Identification needs and scope of business, get management support, consider alternatives, make cost and benefits analysis, identify user requirements and prioritize them. This confirms that these questions have to be implemented in the decision-making model.

Adrian-Cosmin (2015) & Yussof, Al-Dhaafri, & Bin (2012) researched the reasons to implement a quality management software and identified the following aspects: Secure access to quality information, Operational benefits, Easy adaptability, Reduce of costs and Collaborative dimensions. Reasons not to implement a software were identified as follows: financial investment, deployment, dependency on software supplier, hidden costs and the need for updates in the future.

Interviewed businesses indicate the same reasons, except for one reason: *reduce of costs*. Though efficiency (which means less labor hours), was seen as a reason to implement a software. During the interviews costs reduction was not identified as a direct reason to implement a software.

The fact that reasons identified in both the literature research and the interviews were so similar, proofs these factors all should be considered for the decision-making model. To make the model to the point, all together these reasons were converted into these *critical factors*:

- Money available and costs of software
- Technical details (server, licensees, updates needed)
- Time available
- Market position / experience software
- Future plans

The last sub question in the research creates a more subjective reference for food businesses to consider. These are experiences of the interviewed businesses. By sharing these experiences, the interviewed businesses indicated points and critical factors to consider during the decision-making phase. Especially the reference visit was pointed out by many businesses and seems to be important. Because no literature was written on this topic before, no comparison can be made.

The final result, the decision-making model, combines all these above mentioned factors and indicators. Though the model needs an explanation, it gives businesses the chance to walk through the decision-making process in a clear way. As can be seen in the study case with Uniekaas (chapter 3.6), the model helps to organize the information gathered by the businesses. The decision-making model guides the food business in such a way that the real problems become clear, which helps focusing on the right solutions.

## 4.2 Critical reflection on research

Looking at the main question of the research and how it was answered the following can be concluded.

*What should businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?*

For answering this main question, a qualitative exploratory research was conducted. In order to find the opinion based factors, on or two employees of eleven businesses were targeted to take part of this research. A questionnaire was written as guideline during the interviews. Interviews were partly conducted by a company visit, partly by telephone.

In the end, 11 businesses were interviewed. During most interviews only one employee per business was interviewed (except for Uniekaas, for which two employees were interviewed). This because either there was only one QA/QC employee working in the business, or only one employee had the knowledge of actually implementing the software. Employees using the software did not feel knowledgeable enough to answer the question, therefore these were mainly answered by Quality managers or software specialists.

Less interviews than expected were conducted, which cause a potential impact on the reliability of the findings. But the employees interviewed all had experience with implementing a quality management software, either within their current job or a previous job. This has a possible impact on the reliability of the findings.

Next to that a very broad target group was interviewed. Within the food industry several types of businesses with different sizes were interviewed: cheese processor, meat processor, fresh produce processor, confectionary producer, bakery, ice cream producer and software suppliers. Because of the broad vision of the research, the final outcome (the decision-making tool) is applicable for multiple businesses within the food industry.

Answers from the interviews were in line with the literature study, but more specific for food industry and more related to food related quality management software.

## 5. CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Conclusions

Although information about food quality & food safety management and technical information about quality management software is widely available, food businesses struggle with the decision-making process upon what type of software is needed and which supplier suits best to the food business. Therefore the following question was researched:

*What should businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?*

The following core activities of the quality department in food businesses were identified to be required in the software:

1. Product specification management
2. Document control
3. Risk control
4. Laboratory data administration
5. Complaint management
6. Process control

Several methods of data administration at the quality department are used. Manually administration (Excel/ Word), software administration (ERP/ EQMS) or a combination of the two methods. A quality management software is often specialized in one of the above mentioned activities. Therefore a combination of these different methods is often made: ERP + EQMS.

Several software is available to support the core activities. Decision-making phases are divided into two sections: *gap determination & critical factors*. The identified critical factors are: *money available and costs of software, technical details* (server, licensees, updates needed), *time available, market position / experience software & future plans*. These factors are an important part of the decision-making model.

Other factors, as time availability, reference visits, depth implementation, market position, were mentioned by the interviewed businesses and evaluated as crucial in decision-making. Therefore these factors were integrated into the decision-making model.

To simplify the information that business should consider before deciding upon a quality management software, all critical factors were converted into a decision-making model. By looking at this decision-making model (and using it), the main research question is answered. Factors mentioned in the decision-making model should be considered before choosing upon an quality management software.

In the model all critical factors identified were integrated together with the discussed theory. Using this model, businesses are forced to start at the gap determination of the quality department. After that the business has to follow certain steps, which helps them defining the real problem first and then gather more information. Because of this structured way of working, the businesses can make well-informed choices.

After using the model, Uniekaas discovered that they did not have a clear scope/ problem definition for their struggles, therefore they could not find the right solution. Using the model, Uniekaas discovered the real problem and the right solution for it. This saved lots of money and time.

## 5.2 Recommendations

Based upon the conclusions the following recommendations can be made.

As the process of implementing a software is experienced as difficult, it is advised to food businesses to use the model presented in figure 5 during the orientation phase of implementing a software.

The model follows the process for decision-making, which is based upon reviewed literature and interviews with food businesses having experience with implementing a software.

Although the model in figure 5 can already be used by food businesses on the short term, further research validate the model could be conducted. This current research mainly focusses on the decision-making process regarding the question whether to implement a software and which functions this software should have. A second research can conduct research into the second part of the decision-making: which supplier suits best? To answer this question, a market research needs to be conducted.

This market research should be conducted short term, as the market of software suppliers will change. With a market research, several software can be analyzed and compared. Doing this for major software in the Netherlands, food businesses considering implementing a software have some background information to focus on. The market research should be conducted keeping the critical factors of chapter 3.3 & 3.4 in mind. Elements of this market research could be integrated into box 4 of the model, this would create a better overview for the food businesses on deciding which particular software supplier.

On the long term the model should be validated more extensively. Validating the model should be done with a similar method as the original research. Interviewing 10-15 food businesses, and filling in the model together. The model should be sent prior to the interviews. In this way it can be checked whether the model is understandable and user friendly. Although it can be difficult to find food businesses in the particular stage of considering implementing a quality management software, it is essential to only interview such food businesses.

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## Appendix 1 – Interview Fresh Care Convenience

Date	6-6-18
Name company	Fresh Care Convenience
Function within company	QA employee
Size company (employees, turnover)	350-400 employees. 3 QA / 3 QC
Current ERP system	Fresh NB
Current quality management system	Eclarion

### General questions

Have you worked with different quality management software? What are your experiences with these software?	
<p>No, before Microsoft was used at the quality department to monitor everything. Since 4 months Eclarion is being used. Eclarion is a system designed to create specifications. So far it is helpful in having an overview regarding specifications.</p> <p>No other software is used by the quality department</p>	
Do you feel <i>positive/ negative</i> about the software? <i>Please mention some weak points and strong points of the software.</i>	
<p>Past months have mainly been about entering data in Eclarion. This was some extra work, but the results are already there. When one ingredient changes in the product, the software automatically changes all the final specification.</p> <p>When adding a new raw material, there can be made a hyper link to the specification of the supplier. Next to that supplier management (certificates) is also integrated.</p>	<p>Without having had the training, some functions are difficult and vague to understand. Coming weeks a training is planned to understand Eclarion better.</p> <p>A risk with Eclarion is losing the overview of the specifications. It could happen that the software duplicates or makes several copies</p>
What are functions you use most in your current ERP/ Quality management system?	
<p>Specification management.</p> <p>Fresh Care Convenience does not have a document control software for the internal handbook, as it is minimal work to do this by hand.</p>	
What are functions you miss in your current ERP/ quality management system when conducting your daily activities?	
<p>At this moment all changes in recipes are not automatically linked from the ERP system to Eclarion. For now (the implementation phase) that is fine because all data needs to be entered into the system anyway, but later on it would be helpful/ easier.</p>	
What are factors/ functions you would like to have seen different?	
<p>Eclarion is tailor-made for Fresh Care Convenience. The wishes of Fresh Care Convenience were integrated before implementing. Later on the layout of the final product specifications could be improved and other languages could be added to the software.</p>	
What were the main reasons to buy a software?	



Efficiency and accurate data. Less sensitive to faults.

What were the main reasons not to buy a software?

Next to the price, the investment of time/ employees was a hesitation as well.

### Implementation phase

How long did the implementation phase take before the quality management software could be fully used?

Eclarion was implemented at Fresh Care Convenience 4 months ago, and is still in the data enter phase. 2 Quality Assurance employees work on that project and are almost finished with the all 150 different products. Once this stage is finished, the optimizing of the software start (for example the layout). Though not all products are in the software yet, for the products which are, Eclarion is used when a product specification is needed.

Was the implementation of a quality management software costs saving at the end?

Yes, it saves time.

How much time does the quality management software save on day-to-day activities? *Please specify in minutes/ hours per day.*

The software costs could be seen as a curve, in the beginning there are a lot of start-up/ implementation costs. The price of the software, the server, the implementation costs, the training costs and the costs related to enter all data.  
Once all that is finished, the daily labor hour regarding administrative work decrease a bit.

What should other businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?

Having a software for specifications really helps in creating an overview about the products within a company. Remember implementing a software will costs more time and labor hours in the beginning phase, but after that it saved you time.

## Appendix 2 – Interview Nice to Meat

Date	6-6-2018
Name company	Nice to Meat
Function within company	Quality manager
Size company (employees, turnover)	70 (of which 15 office related)
Current ERP system	Reflex
Current quality management system	iMIS Foods

### General questions

Have you worked with different quality management software? What are your experiences with these software?	
<p>Reflex → software for production, supply, sales, inventory and quality control. Opportunity for more custom made modules</p> <p>iMIS Foods → Digital internal handbook. Document monitoring and quality control data management (daily checks and non-conformities). Online program on external server. Does not communicate with Reflex.</p>	
Do you feel <i>positive/ negative</i> about the software? <i>Please mention some weak points and strong points of the software.</i>	
User friendly Clear overview of data	Information on final product label created by both iMIS and Reflex is not legally sufficient. Regulatory aspects are missing and microbiological information is not shown on product specification, every time an employee needs to fix this by hand.
What are functions you use most in your current ERP/ Quality management system?	
<p>Reflex: research information about production planning and information about the product which is not quality related (sales price, order quantities, article numbers).</p> <p>iMIS: document control of internal handbook and quality control data management (for example daily checks and found non-conformities).</p>	
What are functions you miss in your current ERP/ quality management system when conducting your daily activities?	
<p>Pest control included in iMIS (modules could be added).</p> <p>Reflex makes product specification, but these do not contain all legal obligatory information (only product information as: names, contact information, seizures, ingredient declaration, nutritional values and allergens. Not microbiological information, product characteristics, chemical information.</p> <p>iMIS could include this information, but does not have the decent information stream with Reflex. Information stream between Reflex and iMIS. At the moment there is no communication between the two systems. Having the software communicate, less administrative work has to be completed.</p>	
What are factors/ functions you would like to have seen different?	
The layout of the specifications. The information stream between the two different software.	

What were the main reasons to buy a software?
<p>More user friendly, it is easy to have an overview of the internal data.</p> <p>Depending on the bought software, it could be cheaper, document control/ management takes up a lot of labor hours and is fault sensitive. With a software this is prevented better.</p> <p>Next to that, businesses reach a point they have grown to a size the administrative work/ planning is undoable without a software.</p>
What were the main reasons not to buy a software?
<p>Investment could be expensive.</p> <p>Listen carefully the customers of the business. If they do not require an extensive product specification (for example in the Dutch restaurant sector), it would be a waste to invest in a software.</p>

### Implementation phase

How long did the implementation phase take before the quality management software could be fully used?
<p>For iMIS it was 4 months. Reflex is already being used for over 20 years. Updates for both software need to happen yearly and take around 3 hours. Employees need training afterwards for the new functions. A risk associated with these updates is that old features do not work as good anymore. But because majority of the clients of the software business likes to see the change, it happens.</p>
Was the implementation of a quality management software costs saving at the end?
Yes. Less labor hours and less mistakes.
How much time does the quality management software save on day-to-day activities? <i>Please specify in minutes/ hours per day.</i>
<p>The ERP system Reflex saves the most time per day. For the quality manager the Reflex brings up more work, as he has to double check everything.</p> <p>iMIS could save the quality manager work, but he still prints everything and saves his documents twice.</p>
What should other businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?
<p>Think about the strategy of the business. What does the business want, what does the customer wants. Next to that take the size of the business into consideration and the knowledge present about technology and processes. Add real time data analyses value if the business cannot change the parameters in the process, or when nobody knows how to read the data?</p> <p>Thinks about what you want, what you do, and what you need.</p>

## Appendix 3 – Interview Perfetti van Melle

Date	6-6-18
Name company	Perfetti van Melle
Function within company	Coordinator Systems & Auditing Benelux
Size company (employees, turnover)	4 production plants in the Netherlands
Current ERP system	SAP
Current quality management system	In house build SharePoint applications

### General questions

Have you worked with different quality management software? What are your experiences with these software?	
<p>Next to SAP Perfetti van Melle creates and designs the software used themselves for over 10 years now.</p> <p>We had a temporarily account to QAonline to observe how that software works. But in our opinion that software focusses too much on only one type of risk control.</p> <p>The base of our QMS handbook is an intranet website. Divided per department, processes, subprocesses and work instructions. Different employees have different rights to read/ change/ authorize the documents.</p> <p>Currently we are building a software system for complaint management, this took us a year so far. SAP is the master data source, where our specification software gets it information from.</p>	
Do you feel <i>positive/ negative</i> about the software? <i>Please mention some weak points and strong points of the software.</i>	
Creating your own software modules needs investment, but creates flexibility once the software is implemented and working. Minor changes can be made easily, without having to discuss the changes with the software supplier first. Software suppliers work with a standard module, our software not. Therefore requests specific to the business are easier to realize. Together with the ICT department the software is maintained good and problems do not occur often.	We have to invent everything ourselves, sometimes that is a challenge. When a software misfunctions internal technicians need to solve the problem. This was a little difficult in the beginning, but now we are prepared with a good team.
What are functions you use most in your current ERP/ Quality management system?	
We use SAP most, than our internal handbook and then the product specification software.	
What are functions you miss in your current ERP/ quality management system when conducting your daily activities?	
<p>Risk management analysis.</p> <p>Usually when a function or module is being missed, a ICT team incl users are having brainstorm sessions together and try to solve the problem.</p>	
What are factors/ functions you would like to have seen different?	
As said above, because we own the software, we can make changes when we would like to see something different.	

What were the main reasons to buy a software?

Businesses need a base to store and save their data in an organized way. I believe that is the main reason to buy a software. Of course it makes certain activities easier, but that is a nice side effect. Storing and saving data is critical in the food industry now a days.

What were the main reasons not to buy a software?

We decided to build software our self and not to buy a software because all software (-suppliers) did not fit to our visions and required functions.

### Implementation phase

How long did the implementation phase take before the quality management software could be fully used?

Depends on the software we build. If a system only is implemented in the Netherlands and Belgium than it is probably implemented within a year. When these implemented software grow and the global Perfetti van Melle group want to take the software over, it requires some more time.

Was the implementation of a quality management software costs saving at the end?

Yes, especially because the software we created is implemented globally right now as well. This means we can share a lot of information, and certain documents and procedures only have to be written once.

How much time does the quality management software save on day-to-day activities? *Please specify in minutes/ hours per day.*

Difficult to say. But the software is implemented on the production floor as well. So no paper checklists are being used on the production floor anymore. This saves a lot of time for archiving.

What should other businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?

What do you want with the software, how would you do it without and what will it help you. Start with implementing the most basic document control, you can always add functions or modules. Do not let the software supplier mislead you with great stories about functions you do not necessarily need.

## Appendix 4 – Interview Vergeer Kaas

Date	30-5-2018
Name company	Vergeer Kaas
Function within company	QESH Manager
Size company	550 employees, 9 quality department
Current ERP system	Navision (making the swift to AX Dynamics Microsoft)
Current quality management software	Manual Master & QAonline for >10 years

### General questions

Have you worked with different quality management software? What are your experiences with these software?	
<p>Sharepoint → a software that is built for a specific business. The software is designed based on the workflow of the business.</p> <p>Eclarion → a software for product specification management.</p> <p>Navision → ERP system with module designed for product specification management.</p> <p>Manual Master → software build for document control/ document management.</p> <p>QAonline → risk management software.</p>	
Do you feel <i>positive/ negative</i> about the software? <i>Please mention some weak points and strong points of the software.</i>	
Information is more reliable With SharePoint it is easy to tailor build your own modules. In that way you are less dependent on a software	It needs lots of thinking building your own modules.
What are functions you use most in your current ERP/ Quality management system?	
<p>Quality management software could be divided into 4 different topics.</p> <ol style="list-style-type: none"> <li>1. Document control</li> <li>2. Specification management</li> <li>3. Risk management</li> <li>4. Laboratory information management</li> </ol> <p>Depending on the type of business are rating can be made of importance of these topics. In the eyes of the interviewee specification management is most important. This because it costs most work without a software, and impacts the final product almost directly. A software for document control would be less value adding, as it does not influence the product directly and can be done more easily without software.</p> <p>Next to that is complaint management an important topic as well. This can often be integrated in the ERP system.</p>	
What are functions you miss in your current ERP/ quality management system when conducting your daily activities?	
<p>Links/ information streams are present between different software, but the effective communication between these software is not the best. There is always one software which is seen as master data, and others build upon that information. Changing something in a non-master software means that it is not automatically copied to the other software. I would like to see this different, although I have no idea how.</p>	
What are factors/ functions you would like to have seen different?	

Ideologically, there would be one software which has all functions required for the business to run. This is difficult to realize, as every business is different and has other priorities and ways of working. Having less different software at one business, the communication would be easier and more direct. Looking at the developments of different software suppliers, the programs and functions they offer start to overlap. Which could mean that in the future less different software is needed to conduct the same activities.

What were the main reasons to buy a software?

#### Document control

The larger a business becomes, the more documents are present, the more essential document control is. Where a starting business can control is document with Word (simply because Microsoft tells you when a document is saved, by whom it is written and where it is saved), larger businesses benefit from a document control system/ software.

Implementing a document control software does not take all the work away. Employees still have to write all their procedures and documents. But what the software does is making sure that new document follow the correct route for implementation, that the documents are reviewed and approved by the right employees/ managers. It ensures that older documents are revised in time, that the necessary employees have the rights to see/read/change documents. When a new version is written, the older versions are archived.

A document control software support the business to work with structure, something which is, especially in the food industry, important.

It creates uniformity in documents and procedures.

#### Specification management

In the food industry having correct information on your labels and specifications is crucial. Product specifications are the base of the labels on the product itself. Depending on the products a business produces/ sells, the management of the specifications can be a challenge. At the business where sweets were produced, and the final product was a mix package with 10 different sweets, the specification management required some attention. In that case a specification management software supports the process of correct label making. Especially when the software is linked to the ERP system with recipes of the production. It makes the information more trustworthy and reliable. Information is automatically linked to the right product and typo errors occur less frequent. Have a look at the customer list of the business. Does it contain international customers which require different law and regulation regarding labelling? These differences can be managed by a software as well.

#### Risk management

The role of the quality manager expanded over the years. Where two decades ago the quality manager was the person physically checking all out going products, today the quality manager often has a QESH role (quality, environment, safety, health). This means a quality manager needs to have a lot of knowledge about a several topics. Next to that amount of laws and regulations increasing and becoming more strict. That is why risk management becomes more and more important. Risk management is often an important topic during an audit, and costs the quality manager a lot of administrative work. Most risk management software are created and designed by quality/ safety experts, their expertise helps the quality manager to identify and reduce risk.

What would the main reasons be to not buy a software?

Once the software is implemented the business is dependent on the organization which provided the software. The software could experience as bureaucratic, when a new document has to go through several acceptance stages, while before an employee could send it to the manager and get approval. Employees need to get familiar with the software and need to have a certain amount of computer skills. At the production line level, this happens to be a problem. Paper printed instructions, work

orders or files are most effective for production employees. That makes having different administration methods for production work and office work. A bridge between these two streams is needed.

Regarding IT, the implementation of a software requires some work as well. Is the IT outsourced, who is responsible for errors, is the internal storage space large enough, can the internet process the software and its information, what happens when internet has a breakdown, etc.

On other side of the implementation of a software and its dependency upon the organization, is the termination of the contract. How will that work, what will happen with all data gathered by the software? Can the business keep the information although they start with a different software from another supplier?

Next to that there is always the risk that employees do not use the software to its full extend and start making their own documents.

### Implementation phase

How long did the implementation phase take before the quality management software could be fully used?

Depends on the type of organization. But implementation for sure needs a project management team. It can take 4 weeks but also 4 months, all dependent on the availability and capability of the project team.

The software needs to get tailored to the business. All documents need to get transferred to the system. Employees need to get trained.

In the end, the software needs to develop. There cannot be expected that from the start the software works perfectly. The software will be a long term project.

Was the implementation of a quality management software cots saving at the end?

Yes

How much time does the quality management software save on day-to-day activities? *Please specify in minutes/ hours per day.*

This is hard to answer. Once the software is implemented it takes time before employees are used to the program. In the beginning it takes a more time to conduct the day-to-day activities, but after a while this changes. The software removes several day-to-day activities of the to do list of employees, which saves time. For example: the automatic save of a new document version and archiving the older version.

For some businesses document control and specification management is just not workable anymore. 1000 + specification to manage is difficult without a system that automatically updates and saves. At that point implementing software is not really about time/cost saving (efficiency), but about effectiveness. Next to that, data is more trustworthy and reliable. This causes less mistakes to be made, which is an increase in efficiency.

What should other businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?

Start making an overview for the business. What do you want, what are your priorities. What do we already have, and is there a software that can do it better. How will the software improve this? To have an understanding of the software, always visit a comparable business to see the software operating. Do not forget the technical/ pricing aspects either. Does the software work with licenses, or fixed prices. Have a look at the market position of the software supplier. Does it mainly operate in the Netherlands, Europe or worldwide? Is the software being bought by businesses in the food industry, by multinationals or SME's?



## Appendix 5 – Interview Avebe

Date	8-6-2018
Name company	Avebe
Function within company	Quality Management Specialist
Size company (employees, turnover)	3 production plants in the Netherlands, 1 in Sweden, 1 in Germany
Current ERP system	SAP
Current quality management system	Switching from Sharepoint to ARIS. Pimpcode for product specifications

### General questions

Have you worked with different quality management software? What are your experiences with these software?	
<p>Currently we are switching from using Sharepoints to ARIS. ARIS is being used for process control and document control. An extra module is added for risk management.</p> <p>Product specifications were managed manually, but the switch to a software is being introduced as well. Pimpcode will be used for that.</p> <p>ARIS will be working independently without a link/ information stream to SAP. Pimpcode will be connected to SAP.</p>	
Do you feel <i>positive/ negative</i> about the software? <i>Please mention some weak points and strong points of the software.</i>	
As ARIS is being implanted for all production locations in Europe, it is a great tool that different languages can be uploaded under the same document.	Within Sharepoint documents could not controlled enough to our standards. Version management was difficult and lots of employees could not find the information they needed.
What are functions you use most in your current ERP/ Quality management system?	
<p>Functions we use most are: document control, process control and risk management.</p> <p>Next to that the full text search engine is one of the most functional and most used tool I know. Next to that you can search for document on staff/ department level. Being a food business processing, analyzing and archiving lots of data, it is very important to easily find information. Our previous software could not realize that, but ARIS does. It has a full text search ability, which can scan documents on content base. Accessibility to information is a very important requirement for us.</p>	
What are functions you miss in your current ERP/ quality management system when conducting your daily activities?	
<p>As the software is fairly new we do not miss anything yet, but I can see that we would want to have a link between the software in the (near) future. Right now we have to enter all risk management data our self, but if that has a link to raw material management module and process control it would be easier.</p>	

What were the main reasons to buy a software?
<p>We did choose for implementing a new software because we could not control our document/versions of document properly with the previous software. Avebe became too large for working with Sharepoint, which could be a good software for smaller businesses.</p> <p>When expanding your business, at one point a software is essential, then there is no way of managing all data flows in your business.</p>
What were the main reasons not to buy a software?
<p>You are dependent on a system and it costs money. It has to add value to your business and department.</p> <p>It is possible to add quality management modules to SAP, but we did consciously decide not to. SAP is very firm and robust. It is almost impossible to make some changes in the software.</p>

### Implementation phase

How long did the implementation phase take before the quality management software could be fully used?
<p>We started with a project team in the end of 2014, and our target is to have the software working 100% in the end of 2018. The software is already live and working in several production plants, but the finishing touch needs to be finalized.</p>
Was the implementation of a quality management software costs saving at the end?
<p>Yes. But the focus of buying a software is that data is more reliable, less fault sensitive and the tracking and tracing is better administrated.</p>
How much time does the quality management software save on day-to-day activities? <i>Please specify in minutes/ hours per day.</i>
<p>Too difficult to make an estimation. In the beginning you need to invest time, after a while the software saves time.</p>
What should other businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?
<p>Is the software providing solutions for the problems you currently have?</p> <p>Can the software make links between different internal processes?</p> <p>Is the software supplier suitable for your business? (price/quality wise)</p>

## Appendix 6 – Interview Bolletje B.V.

Date	7-6-18
Name company	Bolletje
Function within company	Manager Quality & Process Technology
Size company (employees, turnover)	
Current ERP system	Microsoft Dynamics
Current quality management system	EXB, Bestmix

### General questions

Have you worked with different quality management software? What are your experiences with these software?	
<p>In 2017 Bolletje switched from an own designed ERP system to Microsoft Dynamics. This was quite a change because their old system was going to stop. Their old system/ software worked good, but Microsoft Dynamics has more potential features.</p> <p>For document control/ management Bolletje uses the software EXB. A software created for process control, internal handbook, and risk analysis. EXB does not have a link to Microsoft Dynamics.</p> <p>For product specifications Bolletje uses BESTMIX, a software focusing on recipe and process control. Data is manually entered from the specifications from the raw materials, recipes are made and product specifications are created based upon that information.</p>	
Do you feel <i>positive/ negative</i> about the software? <i>Please mention some weak points and strong points of the software.</i>	
The software is clear and to the point. Not difficult in use.	EXB does not have a link to Microsoft Dynamics neither to BESTMIX. This would make administrative processes faster.
What are functions you use most in your current ERP/ Quality management system?	
In EXB the search engine is used most. This search feature easily scans all content of the documents present. Retrieving product specifications from BESTMIX and recipe management is very important to Bolletje as well.	
What are functions you miss in your current ERP/ quality management system when conducting your daily activities?	
As we just implemented a new software, tailor made to the requirements of Bolletje, no functions are missed.	
What are factors/ functions you would like to have seen different?	
Recently there has been found out that there can be automatically made a production planning according to allergens. That would have been nice to know earlier.	
What were the main reasons to buy a software?	

To have all data centralized.
What were the main reasons not to buy a software?
Expensive and the dependence on a supplier.

### Implementation phase

How long did the implementation phase take before the quality management software could be fully used?
For the management the implementation was quite fast, within 2 months
Was the implementation of a quality management software costs saving at the end?
Yes. In the beginning it needs investment, money and time wise, but after a certain period it pays back. The fact that less mistakes are made/ data more reliable that saves you incidents and therefore time.
How much time does the quality management software save on day-to-day activities? <i>Please specify in minutes/ hours per day.</i>
It does not necessarily saves an employee minutes per day, but overall it does save labor hours. More important is that the data at a business becomes more reliable because it is standardized and uniform. Before implementing the software and creating the business specific needs for the software, the business needs to think about their information streams. This helps to get these streams more efficient and effective. Next to that tracking and tracing, something very important now a days, is organized way better in a software. The information is easily retrievable and very reliable.
How did you come in contact with the organization implementing the quality management software? (via sister/ mother company, sector related fairs, internet).
A team was created to lead the 'new software project', requirements, needs and interests of different future users of the software were gathered. After that ICT conducted a market research, and made a top 3. Different businesses were visited to have a look at the software. This is a very important step, as you can see how the software works for day to day activities. The whole project was guided by a consult agency.
What should other businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?
Keep it simple. Standardizing is the main reason to implement a software, so do not get distracted by all great looking features and keep it by standard features. After the software is implemented, modules can always be added.

## Appendix 7 – Interview Manual Master

Date	24-5-2018
Name company	Manual Master
Function within company	Sales manager
Size company (employees, turnover)	-
Current ERP system	-
Current quality management system	-

### General questions

Have you worked with different quality management software? What are your experiences with these software?
N.A.
Do you feel <i>positive/ negative</i> about the software? <i>Please mention some weak points and strong points of the software.</i>
<p>I think Manual Master is a very clear and precise software to make the daily activities of the Quality Manager easier.</p> <p>There can occur a problem with transferring video's or CAT documents to the software and then downloading them. This is something we have to find a solution for in the near future.</p>
What are functions you use most in your current ERP/ Quality management system?
Functions most used in our software are: document control, process management, audit status lists.
What are functions you miss in your current ERP/ quality management system when conducting your daily activities?
We missed a module for specification, that we are currently creating a software module for specifications: Certify.
What are factors/ functions you would like to have seen different?
N.A.
What were the main reasons to buy a software?
To assist the quality manager with daily tasks and to store all data at one spot. Software have the ability to present data in a very clear way, so that core information is seen directly.

What were the main reasons not to buy a software?
Even if you are a small business you can optimize your process with a software. The earlier you start implementing a software, the less work it takes to transfer all documents.

### Implementation phase

How long did the implementation phase take before the quality management software could be fully used?
It depends on the business and its implementation team. I have seen businesses where the whole software was working independently within 4 weeks, but I also have seen cases in which 20 weeks were necessary.
Was the implementation of a quality management software costs saving at the end?
I believe so, although it is an investment at the end it pays back. The reliable data shows where in the process mistakes are being made, administrative activities need less labor hours, etc.
How much time does the quality management software save on day-to-day activities? <i>Please specify in minutes/ hours per day.</i>
Depends on the type of employee. But for the quality manager I think it saves half an hour per day.
What should other businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?
Realize that software can make your process more efficient, and administration more effective. Links between different information sources can be made, data is more reliable, and more easy to access. Every food business faces the same problems regarding law and regulations becoming more strict, and this is a method to administrate the compliance of the business.

## Appendix 8 – Interview Ben & Jerry's

Date	8-6-18
Name company	Ben & Jerry's
Function within company	QA Officer
Size company (employees, turnover)	350 employees
Current ERP system	SAP
Current quality management system	QiSoft + VisPro

### General questions

Have you worked with different quality management software? What are your experiences with these software?	
<p>Currently we work with SAP, QiSoft and VisPro.</p> <p>SAP is a software we have to use because of Unilever. By using the same software there is more uniformity. In that way communication is easier. For example: national customer service units can enter a complaint in the system, and we can respond to it.</p> <p>QiSoft is a software which is known for its tailor made modules. It is focused on production process control. Different parameters are being indicated by the software.</p> <p>VisPro is the software we build ourselves (with external help). It gathers all information from the metal detector and E-weighing.</p>	
Do you feel <i>positive/ negative</i> about the software? <i>Please mention some weak points and strong points of the software.</i>	
QiSoft is very user friendly and easy to use. Because QiSoft is tailor made, changes in the software can be made according the needs of the business.	All information needs to be entered manually. No data via SAP is linked.
What are functions you use most in your current ERP/ Quality management system?	
<p>Process control via the parameters. When a limit for a certain parameter is exceeded, a note is sent to the operators and the process supervisor.</p> <p>VisPro is used most to store the data directly in line.</p>	
What are functions you miss in your current ERP/ quality management system when conducting your daily activities?	
<p>A link to data from SAP. It would be handy to have a link to SAP, so we do not have to manually enter data into QiSoft, such as production planning from SAP to QiSoft.</p> <p>Our other software, VisPro has a link to SAP. That works very well.</p> <p>We are currently expanding VisPro with new modules. Process control is partly added to VisPro. The final pallet check before the products leave our production plant is now being administrated automatically by VisPro. A photograph is made and saved with the correct production data from SAP. Next to that we are creating a lab result module.</p> <p>I do not think a risk analysis module would add value to the business at this moment. We have our own methods to identify risks, adding and implementing another module would costs much time and extra work.</p>	
What are factors/ functions you would like to have seen different?	

We still work a lot with Excel sheets because SAP is not extensive enough with its information. For example with rejected/ blocked products. SAP does not have enough options to write down a root cause, or a detailed description. Next to that the information is so less, it is difficult to find a blocked product after a while.

What were the main reasons to buy a software?

Reliability of information. As a food business you need to assure the reliability of your administration. Auditors ask for it a lot and for tracking and tracing it is very important.

What were the main reasons not to buy a software?

It costs money and makes more work. Controlling the processes so closely, the software always finds improvements. Once one improvement is made, or a problem is solved, the next problem is identified and needs to be solved.

A year ago we almost bought a new software, but we decided not to buy a new one. The new software was not able to provide all functions and features we wanted/ need to control production.

### Implementation phase

How long did the implementation phase take before the quality management software could be fully used?

We already have QiSoft for over 15 years. I do not know how long it took to implement the software. But it is tailor made so I expect it took some time.  
Updates are not needed regularly base. That is very positive.

Was the implementation of a quality management software costs saving at the end?

With all the side costs I do not think that saving costs is easily realized. Training of employees, changes in the software.

How much time does the quality management software save on day-to-day activities? *Please specify in minutes/ hours per day.*

Difficult to specify. I think it generates work. Back in days a lot less employees were needed in the office and more on the production floor, now it is almost the opposite. Of course that is partly due to the new requirements and regulations.

What should other businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?

First focus on the basics, then expand modules. If the product specifications are not a controlled process, start focusing there. After that process control tools are a good module to invest in.



## Appendix 9 – Interview Uniekaas Holland B.V.

Date	8-6-18
Name company	Uniekaas Holland B.V.
Function within company	QA manager
Size company (employees, turnover)	150 employees
Current ERP system	Navision
Current quality management system	None

### General questions

Have you worked with different quality management software? What are your experiences with these software?	
<p>At Uniekaas we work with Navision and WMS (warehouse management system, which we use for tracking and tracing). Before I started working for Uniekaas I worked as an interim manager at different businesses. So I have seen several software (M3, SAP), but do not know all the ins and outs of these software. I know M3 is similar to Navision, a software that I find user-friendly and has several options for the quality department. SAP, on the other hand, is less user-friendly. It is difficult to understand and changes in the software are not made easily. But it has several options for quality management and works good when a business has several production plants which need to communicate with each other.</p> <p>Currently we are not using a quality management software at Uniekaas.</p>	
Do you feel <i>positive/ negative</i> about the software? <i>Please mention some weak points and strong points of the software.</i>	
N.A.	N.A.
What are functions you use most in your current ERP/ Quality management system?	
In our ERP system I do use the tracking and tracing module the most. Researching production dates/ orders/ best before dates.	
What are functions you miss in your current ERP/ quality management system when conducting your daily activities?	
I have the feeling a lot most time with searching for the right documents during the day. At Uniekaas we have a thousand documents at hundred different spots. That makes it difficult to work fast.	
What are factors/ functions you would like to have seen different?	
Right now our specification control is based upon an Excel file. I would like to see that in a software in the near future. I know that Navision has some options for that, so we are exploring our possibilities. Next to that our document control is not in a software either. Versions get lost sometimes, employees do not use the right documents, etc.	
What were the main reasons to buy a software?	

The main reason for us to buy a new software is reliable data and efficiency. Right now we never know if we use the right information and loose much time making important documents last minute. This especially happens with product specifications.

What were the main reasons not to buy a software?

We do not really know which software to choose. We have had a few demos and they all have interesting options. But making the final decision is difficult. During a work week so much other projects and activities are going on that we cannot find the moments to make a market analysis for ourselves.

### Implementation phase

How long did the implementation phase take before the quality management software could be fully used?

We were being told by Manual Master it could take 4 weeks, but also 4 months, dependent on the project team that is working on it. I thought this were realistic numbers, so I would assume the same time for us.

Was the implementation of a quality management software cots saving at the end?

We hope so. But looking at the time we use not efficient right now, I cannot imagine it will not be cost saving. Next to that I hope that is creates more structure, not only for the quality department, but for the whole business.

How much time does the quality management software save on day-to-day activities? *Please specify in minutes/ hours per day.*

N.A.

What should other businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?

N.A.

## Appendix 10 – Interview Uniekaas Holland B.V.

Date	8-6-18
Name company	Uniekaas Holland B.V.
Function within company	QC employee
Size company (employees, turnover)	150 employees
Current ERP system	Navision
Current quality management system	None

### General questions

Have you worked with different quality management software? What are your experiences with these software?	
<p>The system we all use at Uniekaas is Navision. As quality employee I use Navision for complaints, tracking and tracing and searching information about the production planning.</p> <p>You have to get used to the system, there are a lot of different ways to get to the information you want, but once you know the steps it works fine.</p> <p>Before this job I did not work in the food industry, so I do not have any experience with other software.</p>	
Do you feel <i>positive/ negative</i> about the software? <i>Please mention some weak points and strong points of the software.</i>	
N.A.	N.A.
What are functions you use most in your current ERP/ Quality management system?	
<p>In Navision I use the search engine most, to find product numbers / names.</p> <p>Next to that I have to file all complaints in Navision. In this way other departments can see the complaints too. I do have an extra Excel file next to it, in order to keep the overview. I did not have the time yet to find out how to present the data in Navision in a clear way.</p>	
What are functions you miss in your current ERP/ quality management system when conducting your daily activities?	
<p>I do not know what all opportunities are in Navision, so that is something I would like to find out. Although I would not mind working with Excel either. The only thing is that Excel documents are more sensitive for fault and impurities.</p> <p>For the data we get from the laboratory I miss a link to download all data directly. Right now we type everything we get by hand in a Excel document. This, again, is sensitive for mistakes and takes up a lot of time. I know that several managers already tried to start such a data link, but it never was implemented/ worked.</p>	
What are factors/ functions you would like to have seen different?	
<p>As I said before, I would like to see a laboratory information link and a better way to get overview on the product specifications. Right now I have no idea where to get my information to make a new product specification.</p>	
What were the main reasons to buy a software?	

I do not think I am in the position (employee wise) to make decisions about implementing software. The main reason I would like to see a software is that all data is stored at the same place and in the same way. This would give a lot of overview in our documentation and administration.

What were the main reasons not to buy a software?

I think it will take a lot of time to transfer all documents and change everything to a new system. If we would have an extra employee, we could also control and manage everything manually.

### Implementation phase

How long did the implementation phase take before the quality management software could be fully used?

N.A.

Was the implementation of a quality management software costs saving at the end?

N.A.

How much time does the quality management software save on day-to-day activities? *Please specify in minutes/ hours per day.*

N.A.

What should other businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?

N.A.

## Appendix 11 – Interview QiSoft

Date	5-3-18
Name company	QiSoft
Function within company	Sales representative
Size company (employees, turnover)	-
Current ERP system	-
Current quality management system	-

### General questions

Have you worked with different quality management software? What are your experiences with these software?	
N.A.	
Do you feel <i>positive/ negative</i> about the software? <i>Please mention some weak points and strong points of the software.</i>	
QiSoft is custom made for businesses, which means we can create a software meeting all requirements of the business.	Because we build everything specific for the business, the costs are relatively higher than other software. I guess that could be seen as a negative point.
What are functions you use most in your current ERP/ Quality management system?	
We focus mainly on process control by analyzing several production parameters and presenting the data in a clear way. We also have a very fast tracking and tracing system. Within a few hours all information about one particular product is plotted on your screen.	
What are functions you miss in your current ERP/ quality management system when conducting your daily activities?	
When businesses miss a certain function or module in the software we designed for them, we start a new project and try to implement it.	
What are factors/ functions you would like to have seen different?	
It is difficult to 'guess' what a business exactly wants and needs. Therefore it is very important to have multiple conversations before we start designing the software. We need to find the real problem businesses have and how they want to see the data in the future. It can help if the businesses send some example files how they administrate data at the current situation. But sometimes business are not open minded enough to change a method of working. That limits us in designing a good software.	
What were the main reasons to buy a software?	

I would say that a good software helps business to get their production process under control. In the end that is what all businesses should have. Only if you have control over your process, you can start improving it.

What were the main reasons not to buy a software?

Costs can be one reasons. It can be expensive for businesses to have an external company designing a software.

Next to that it is a waste to implement a software if there is not enough capacity within the company to work with the software and maintain the software.

### Implementation phase

How long did the implementation phase take before the quality management software could be fully used?

If we start building the software we could implement it within 3 months. Of course the first weeks after implementing there needs to be lots of time investment to enter all new data. But with a good project team that is done easily.

Was the implementation of a quality management software costs saving at the end?

We would say it is. If you control your production process, less faults are being made, less time and resources are being wasted and lots of efficiency improvements can be made.

How much time does the quality management software save on day-to-day activities? *Please specify in minutes/ hours per day.*

Depends on how much time the business spends on process control before the software is implemented. We would say it saves more than an hour per day.

What should other businesses in the food industry consider before implementing an Enterprise Quality Management Software to professionalize the Quality Department?

Remember that controlling your production process is one of the most important things in a business. QiSoft can help you with that.

## Appendix 12 – Research Timeline

What	When	Remarks/ details
Start thinking about thesis topic, get to know the internship company and its challenges	Week 6-9	
Start writing research proposal	Week 10	Coaching session 6/3/18
Implement feedback of coach after coaching session. Made planning together because of two week visit to India.	Week 11	Hand in draft 16/3/18
Implement feedback, conduct preliminary research, elaborate introduction & theoretical framework, elaborate practical interview	Week 12	Interview manager at UK to verify topic is a real problem. Hand in first version research proposal.
Coaching session with thesis coach. Implement feedback (elaborate Materials & Methods)	Week 13	
Hand in RPP to coach for final check. Contact businesses for interviews.	Week 14	Implement feedback immediately in week 15.
Hand in RPP (coach + library)	Week 15	April, 13
	Week 16	Vacation India
	Week 17	Vacation India
Start thesis. Conduct interviews on Wednesdays, send out interviews.	Week 18 + 19	
Analyze data, write/ create model.	Week 20	
Write report according rules (summary, intro, conclusion, etc)	Week 21	
Deadline draft thesis	Week 22	Implement final changes and feedback. Send in by Friday June, 1
	Week 23	
Deadline thesis	Week 24	June, 15 13:00 PM
Thesis presentation	Week 27	July, 2

## Appendix 13 – Decision-making model Study Case Uniekaas

<p><b>Explore MARKET</b></p> <p>Explore possibilities in the for option 2 &amp; 3 in MARKET</p> <p>Options for document control:</p> <ul style="list-style-type: none"> <li>- Manual master Money wise OK. Online platform, not much server space, per 5 licensees: OK. Dutch HQ.</li> <li>- SharePoint Application Not enough knowledge/ expertise/ time to design one at Uniekaas</li> <li>- Master Control Expensive. Located in UK, international corporate clients.</li> <li>- SafeFood360 Expensive. Located in Ireland, SME clients, download on server.</li> </ul> <p>General: DOC is Uniekaas sister company, is using Manual Master + time to implement is limited, but available.</p>	<p><b>GAP</b></p> <p>What is the CURRENT situation &amp; why do we need to change is?</p> <p>Currently Uniekaas lacks structure (the Quality Department as well as the whole business). Documents are saved all over the place, everybody has different specifications and there is no clarity about who is responsible for which problem. Without creating structure and controlling the data flow, Uniekaas cannot become the top brand they target to be. Uniekaas does not have control about the process, neither does it have extensive risk control.</p>	<p><b>CONTACT</b></p> <p>Further contact with most interesting parties</p> <ul style="list-style-type: none"> <li>→ Conduct reference visit(s)!</li> <li>→ Discuss contract matter (keep points to consider of 3.4 in mind).</li> </ul>									
<p><b>CHECK</b></p> <p>CHECK, whether market/ software can fulfill the gaps in the current situation (decision based on box 1+2 &amp; 3).</p> <p>YES → continue box 5</p> <p>NO → reformulate GAP in box 1</p> <p>Only Manual Master fits to objectives &amp; points to consider. → continue</p>	<p><b>SCOPE</b></p> <p>Identify specific NEEDS and link to box of current situation measured in urgency x impact (importance).</p> <ol style="list-style-type: none"> <li>1. Structure in documents</li> <li>2. Specification management</li> <li>3. Production process control</li> <li>4. Risk analysis</li> </ol> <table border="1"> <tr> <td></td><th>High Urgency</th><th>Low Urgency</th></tr> <tr> <th>High Impact</th><td>2 Do it Now!</td><td>Do it later</td></tr> <tr> <th>Low Impact</th><td>3 Do it later</td><td>4 Never do it</td></tr> </table> <p><b>OPTIONS within scope</b></p> <p>Evaluate listed options for needs with High Urgency &amp; High impact</p> <ol style="list-style-type: none"> <li>1. Implement non-used but already bought module from ERP system → STOP MODEL &amp; START IMPLEMENTING</li> <li>For 2. Specification management this is the case. Uniekaas has Navision with specification management module, which is not being used.</li> <li>2. Add module to existing ERP system → COMPARE MARKET IN BOX 4</li> <li>3. Buy external software → COMPARE MARKET IN BOX 4</li> </ol> <p>For 1. Structure in documents: Go to box 4 and explore market options.</p>		High Urgency	Low Urgency	High Impact	2 Do it Now!	Do it later	Low Impact	3 Do it later	4 Never do it	<p><b>DECISION</b></p> <p>Make decision</p> <p>Decide for Manual Master &amp; Implement</p> <p><b>EVALUATION</b></p> <p>Evaluate choice and implementation</p> <p>Evaluate after implementation is fully finished.</p>
	High Urgency	Low Urgency									
High Impact	2 Do it Now!	Do it later									
Low Impact	3 Do it later	4 Never do it									

Figure 6, Decision Making Model Study case Uniekaas



## Appendix 14 – To the point instruction of the decision-making model

Dear food business,

**In this letter the decision-making model is explained with a to the point instruction. The boxes to be filled in are numbered and should be followed in the correct order to have the best overview and structured information.**

*Box 1 → Evaluate your current situation of processing data at the quality department, and answer the following question: Why does this need to change?*

It is important that you clarify the gap at/ the needs of the quality department. Then you know what a software should have in order to help your quality department activities.

*Box 2 → Identify specific activities of QA for your business that need improvement and prioritize by urgency x impact (importance)*

Based upon the mentioned core activities (and possible other activities written down by yourself) you should prioritize these activities. This should be done according to the high/low urgency and high/low impact scale.

*Box 3 → Evaluate listed options for needs with High Urgency & High impact*

Based upon the prioritization of box 2, you should review the activities and potential solutions. Three scenarios are possible. 1. The business already has a module within the ERP system, but does not use it (when this is the case, the business should start using the module and can stop using the decision-making tool). 2. The business has the opportunity to add an module to the current ERP system. 3. The business has to implement a secondary software for quality control. In both cases, 1+2, the business should continue with box 4 of the model.

*Box 4 → For options in box 2 & 3, compare possible software suppliers against following factors:*

When option two or three is an option (or both are potential solutions), the software / ERP modules need to be compared to the critical factors mentioned in the model.

*Box 5 → CHECK, whether possibilities found in box 4 can fulfill the gap in the current situation*

Right now, you should look back at the gap formulated in box 1. Do the potential solutions actually fulfill the gap stated in box 1? If yes, the business can continue with box 6. If not, the business should start over in box 1 and reconsider its gap.

*Box 6 → Further contact with most interesting software suppliers and discuss following factors:*

After comparing the potential software options in box 4, you should pick the most interesting suppliers and discuss details regarding experiences.

*Box 7 → Make decision based upon looking over all information gathered in the model*

At this point you have all information needed to make a choice.

*Box 8 → Evaluate choice and implementation*

With every decision made it is important to evaluate the decision. Is the gap stated in box 1 fulfilled? you should think about a long term plan for the software.

**Good luck with the decision!**