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MASTER

An approach including operational tool for DEKRA to asesss and improve their Knowledge Management Maturity

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An approach including operational tool for DEKRA to assess and improve their Knowledge Management Maturity

Master's thesis

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I. PREFACE

This Master's thesis is a result of a research for the graduation project as part of the Master of Science degree program in Operational Management and Logistics (OML) at the Eindhoven University of Technology (TU/e). The research was commissioned by DEKRA Certification B.V. (DEKRA) in Arnhem the Netherlands. DEKRA is a global provider of a wide range of auditing, certification, and testing services. The aim of this research is to develop a knowledge management maturity model for DEKRA for the company to determine at which level they operate at the moment and which steps need to be taken to grow in to the desirable altitude of the model.

My gratitude goes out to my supervisor Prof. Dr. Ir. J.J.M. Trienekens, who gave me the opportunity to participate in this interesting research topic. Moreover, I would like to thank him for helping to improve this thesis significantly with his critical view.

Another expression of gratitude goes out for ms. A.F. Vollema and mr. F. Thon for giving me the opportunity to write this thesis at DEKRA and offering me their guidance in the whole process. To provide the opportunity to conduct the qualitative research within the company.

Finally I would like to thank the respondents that participated in the interviews for their answers. Without them it would not have been possible to conduct the research.

It has been a challenging period for me but I would like to emphasize that it has been an interesting project to work on.

Robbert A.L. Nagelkerke

II. ABSTRACT

This research was initiated by DEKRA certification B.V. They are interested to know more about the functioning of the company and how to improve this. The main reason for this is that knowledge is one of their most important assets, to obtain and grow this feature it is significant to establish how the company currently is operating. To measure this a tuned Knowledge Management Maturity Model is needed with an accompanying assessment tool, which is used to measure and model the Knowledge Management Maturity of organisations. Intuitively DEKRA suspects that their current Knowledge Management Maturity level is low. This feeling is partly based on a report commissioned by DEKRA, which was written by van Sandellhof (2011), and focussed on the "Training and Qualification" processes within DEKRA.

However, to develop a roadmap towards the desired Knowledge Management Maturity a more accurate measurement is needed. Therefore, the following research objective is developed.

The aim of this master's thesis is to develop a Knowledge Management Maturity Model, to determine in which maturity level DEKRA is currently operating and to provide a roadmap to guide them to the desired Knowledge Management Maturity level.

Research Methodology

The master thesis project consists of three phases. In the first phase a systematic literature review is done. This review is used to ensure that the literature review is thorough and fair and to maximize its usefulness. Even though systematic literature reviews require considerable more effort than traditional reviews, the extra effort is justified since the literature review is a critical part of the master thesis project. If the literature review is flawed then the validity of the entire master thesis project can be questioned as well.

The second phase consists of the tuning of the chosen Knowledge Management Maturity Model to the situation at DEKRA. The tuned proposed Knowledge Management Maturity Model will be pre-tested. This test will validate relevance and usefulness of the chosen Knowledge Management concepts used in the proposed Knowledge Management Maturity Model. The pre-test will be used to tune and discover problems in the assessment tool which will accompany the Knowledge Management Maturity Model.

The Outcome of the pre-test will serve as a starting point for phase three. In the next phase a pilot study is done and used to determine the usefulness of the proposed Knowledge Management Maturity Model and tool, as well as encounter problems with the tool itself. The results of the questionnaire will be used to give an indication of the current Knowledge Management Maturity Level within the DEKRA organization.

Research Execution and Results

From the structural literature review three Knowledge Management Maturity models emerged. The three models were assessed using 4 criteria: Rigour, Relevance, Complexity, and Operationality. During a focus group meeting with the relevant stakeholders, based on these assessment criteria, the Knowledge Navigator Model was chosen. Even though this is the most complex model the complexity was deemed necessary for the purposes of assessing the DEKRA organisation.

After phase one was completed the chosen model was tuned to the DEKRA organisation creating the proposed Knowledge Management Maturity Model. To assess the proposed model and to make the accompanying tool operational a pre-test was conducted. During the pre-test 3 people were

interviewed from the Quality department since they have access to different business lines and have intimate knowledge of the current Knowledge Management process embedded within DEKRA.

During the pre-test, the concepts in the proposed Knowledge Management Maturity Model were validated. Problems in the tool were found and the questions were clarified with language adjustments as well as example from the DEKRA practice.

In the final phase the Pilot study was conducted. This study had 10 participants from different levels and business lines in the organisation, ensuring that people from different backgrounds could provide feedback on the assessment tool. The received feedback to enrich the assessment tool gave us the opportunity to validate the effectiveness of the assessment tool.

The results of the questionnaire filled in during the pilot study gave insight into the current Knowledge Management Maturity level within DEKRA, which seems to be between Knowledge Management level 1 and level 2 as defined by the proposed Knowledge Management Maturity Model. It should be noted that the results differ between the different levels of the organisation and that a larger sample would most likely yield a lower result.

TABLE OF CONTENTS

1   INTRODUCTION

First a general introduction is given which gives insight into the reasoning behind the project as well as a sketch of the environment where the study was held. Then the objective is described, followed by the research questions and the scope of the project. Finally, an outline of the structure of the thesis is given.

The study was done at DEKRA Certification B.V. group (DEKRA). DEKRA is a global provider of a wide range of auditing, certification, and testing services. The expertise covers management systems, products, and components with a specialization in safety, environment, and health. The company is comprised of 1600 staff and more than 500 partners in over 50 countries.

DEKRA's core business is the exploitation of knowledge in the organisation, giving value to their customers by ensuring a safe world for everybody. To ensure that DEKRA can achieve a maximum return on its knowledge assets they need to be managed properly. The risks associated with not properly managing the knowledge inside the organisation include loss of knowledge (e.g. due to experts leaving the organisation), repeat work due to not properly disseminating the solution to certain questions/problems, and/or loss of orders due to not being able to use knowledge effectively.

The first study DEKRA commissioned in 2011 by Van Sandelhoff BV was to create a master plan with the focus on "Training and Qualification". This focus was chosen by DEKRA since their core business revolves around the knowledge their employees hold to execute their roles and tasks. After an intensive discussion with DEKRA and an inventory by Van Sandelhoff BV of the needs within DEKRA, the decision was made to focus the study around two main areas.

The first area is the structure of training and qualifications within DEKRA. The second area are the concrete steps that will be taken to create top educational facilities within the company to achieve the training and qualification goals.

The first area was tackled by creating an ideal qualification process. The study first inventoried the as is qualification process. The as is situation was outlined by analysing three sources of information, namely: The business line presentation given in April 2011, Interviews with employees, and additional information and documentation provided.

Seven key features of an ideal qualification process were identified:

1. Time to compliance
2. knowledge and skills guarantees
3. Regulatory compliance
4. More standardization
5. Better access to information
6. More standardization and objectivity when testing learning activities
7. Broaden its use

Beside these features, they developed a training portfolio and coordination's to guide the employees of DEKRA. As part of the master plan a learning service centre should be set up. The learning service centre provides, coordinates, and manages the educational tools and content.

The master plan is very comprehensive in its approach considering all the facets of the organisation, this made it very complex. This complexity while it was deemed necessary for the proposed transformation goals to be reached. The original goal of the report was to control costs as well, after

the report was finished the trade-off between comprehensiveness, costs, complexity, time and risk was assessed in a go/no-go moment.

At the go/no-go point the project was not taken further, since there were concerns about the trade-offs proposed by the report. Thus, introducing risks into the organisation that DEKRA could not justify.

As an alternative, to mediate the risks and costs, a stepwise approach was chosen in the different business lines, e.g. Ron Verhaegen took the lead in the business assurance business line where systems for sharing knowledge are developed. A more unified approach was desired, since developing systems and tools for each business line individually would mean triple work, which adds costs and time. To achieve these goas the master thesis project was initiated.

The intent of this master thesis project is to provide insight into the current knowledge management maturity of the organisation. Intuitively a rather low level of maturity is expected (also based on the outcome of the Sandelhoff report), there is a need to assess this low level more precisely and to define the next steps towards a higher Knowledge Management Maturity level. One of the areas that was not yet explored is the management of external knowledge. In this report that term needs to be investigated and its relevance to the end goal of this master thesis needs to be decided.

Ultimately the research should lead to an operational approach for DEKRA, i.e. a tool that can be used periodically to assess its level of Knowledge Management Maturity and provide improvement steps and help it accomplish its organisational goals and mission. At the same time the research itself and the resulting conclusions will help to create awareness around the topic of Knowledge Management and the potential risks for the organisation mentioned above.

1.1   The objective

For organizations knowledge is one of the most important assets, it allows the company continuously improve their processes to the highest level of efficiency and gain competitive advantages. (Oliva, 2014) Knowledge is pivotal for the competitiveness of organisations (Chen et al. 2009). It has become crucial for firms to implement the effective management, nurturing, and use of knowledge to stay innovative and relevant. One of Knowledge Managements main objectives is to optimize the structured handling of the knowledge within the organization (Heisig 2009).

Combining the initial literature search and the problem facing of the organization the following objective is formulated.

The aim of this master's thesis is to develop a Knowledge Management Maturity Model, to determine in which maturity level DEKRA is currently operating and to provide a roadmap to guide them to the desired Knowledge Management Maturity level.

In which the model should not only be a point of reflection as the current state of Knowledge Management within the organisation, but be a guide as to what actions can and need to be taken to safeguard and effectively use the knowledge within the organisation.

This thesis aims at an approach for DEKRA to assess its own knowledge management maturity, and to define improvement steps. The approach should be operational in the sense that it contains a tool, i.e. an assessment instrument, that will be validated in a pilot study. The thesis will make use of existing principles and theoretical concepts from peer reviewed journals to strengthen the theoretical framework of the assessment approach. .

1.2   **Research Approach**

In order to develop a Knowledge Management Maturity Model the research is divided into three phases. In the first phase a Knowledge Management Maturity Model is selected and tuned to the DEKRA organization. The goal of the second phase is to validate the tuned knowledge management concepts in a pre-test. Finally in the third phase the proposed tool will be tested and validated in a pilot study.

For DEKRA to grow into a higher maturity level several research questions are defined. Firstly in order to establish what kind of maturity levels there are, followed to determine where DEKRA operates at the moment and finally to provide a guide to what steps they can take to achieve their organizational goals.

In the first phase models need to be selected from literature in a structured literature review in such a way that they following research questions RQ1 and RA1.1.

RQ1: How to select a Knowledge Management Maturity Model from the Knowledge Management Literature that fits the needs of the DEKRA organization?

RQ1.1: What is the role of "External Knowledge" in these Knowledge Management Maturity Models which influences the DEKRA organisation?

Outcome: A selected and tuned Knowledge Management Maturity Model.

These questions have been selected to select the model and tune it to the DEKRA organization.

During the second phase the objective is to validate the concepts found in literature in such a way that they are applicable in the DEKRA organization. This will be done by answering the following questions RQ2 and RQ2.1.

RQ2: Which Knowledge Management Maturity Model concepts can be tuned to develop a Knowledge Management Maturity Model that is useful to the situation at DEKRA?

RQ2.1: Which Knowledge Management Activities (KMA), addressed in the proposed Knowledge Management Maturity Model, are relevant to DEKRA?

Outcome: A tuned Knowledge Management Maturity Model that is made operational to act as an assessment instrument for a periodic assessment at DEKRA, which is tuned and localized.

The questions in phase two have been conducted in order to establish in which maturity level DEKRA is operating and which Knowledge Management Maturity Models are relevant to the DEKRA organization.

The final phase consists of a pilot study with the aim of gaining insight into the knowledge management solutions and activities within DEKRA, the results will expose the knowledge management maturity level and the awareness of the basic Knowledge Management principles within DEKRA. The results of the pilot study will be used to enrich and validate the proposed evaluation framework. This step is important since the results of the pilot study can only be used properly if it is known how the participants interpret the evaluation framework.

RQ3: Can the tool be used to measure the Knowledge Management Maturity Level in the DEKRA organization?

RQ3.1: Could the tool be used to identify practical examples. Is the terminology and the conceptual structure effective or efficient to reach the Knowledge Management Maturity Model?

RQ3.2: Is the terminology and questions from the proposed Knowledge Management Maturity Model evaluation framework interpreted in the way intended by the proposed Knowledge Management Maturity model?

Outcome: An enriched validated Knowledge Management Maturity Model. Which is proven to be effective trough the pilot study.

The questions in phase three will provide the roadmap and tools for DEKRA to continue continuously improving their organizational processes by periodically measuring their Knowledge Management Maturity level.

1.3   Scope

Since recent acquisitions of other firms by DEKRA do not use the same knowledge management system and have their own corporate culture these are considered out of scope. Knowledge Management Activities which are identified as relevant to the DEKRA situation are in scope.

The way that external knowledge is used within the organisation is in scope. Since the sharing of knowledge, the in-house knowledge by DEKRA with external parties is subject to strict regulation in the various regions DEKRA does business, therefore it is considered out of scope for this project.

1.4   Thesis Structure

The outline of the rest of the thesis is given in this section, this will help understand how the project is reported. First in section 2 some theoretical background and basic concepts regarding knowledge management will be discussed to clarify the terminology to be used in this thesis. The Methodology used during this Master of Science thesis project will be described in section 3. The execution of the (case study) research and the results will be given in section 4 followed by a discussion in section 5. To conclude this thesis an overview of the salient results and takeaways from the project will be given.

2   THEORETICAL BACKGROUND

In this section a background will be given about the general field of Knowledge Management. This includes the discussion of definitions in literature and how they are used in this thesis. The interpretation of the concepts that underpin the field of Knowledge Management and Knowledge Management Maturity Models are described.

2.1   Knowledge

The meaning and definition of knowledge has been discussed and investigated since the time of the ancient Greeks. Although the traditional epistemology of knowledge centres on "truthfulness" in management science literature the definition of "justified true belief" is most prevalent (Ganesh et al. 2014; Emens 2015; Nonaka 1994; Land et al. 2009). This distinction is important since organizations are a collection of individuals thus knowledge is a dynamic human process of justifying personal beliefs as part of a search for the truth, rather than a static form expressed in formal logic devoid of the human element (Nonaka 1994).

Symbols	Data	Information	Knowledge

Figure 1: from Symbols to Knowledge

Translating knowledge into transferrable symbols and back again is an arduous process, prone to misinterpretation. As depicted in Figure 1; symbols (i.e. letters, numbers, or signs) are used to depict data. Data put into context becomes information i.e. "Information is organised data adding meaning to a message" (North & Kumta 2014).

A sample of descriptions, which describe the distinction between information and knowledge is given below, after which they are discussed:

"Information is that commodity capable of yielding knowledge, and what information a signal carries is what we can learn from it. Knowledge is identified with information-produced (or sustained) "
(Dretske 1981)

"Man cannot grasp the meaning of information about his environment without some frame of value judgement." (Nonaka 1994)

There can be said information is consumed and interpreted on an individual level which is how knowledge is transferred from person to person. To conclude the main difference between information and knowledge is that information lacks the interpretation by the individual that makes knowledge valuable.

In Table 1 a representative sample is given of the definitions of knowledge in literature.

Publication	Definition
(Nonaka 1994)	"justified true belief"
(CBI (Carnegie Bosch Institute) 1995)	*"Knowledge refers to the tacit or explicit understanding of people about relationships among phenomena. It is embodied in routines for the performance of activities, in organisational structures and processes and in embedded beliefs and behaviour. Knowledge implies an ability to relate inputs to outputs, to observe regularities in information, to codify, explain and ultimately to predict. "*
(Kpmg 2000)	*"The knowledge in the business about customers, products, processes, competitors, etc. That can be locked away in people's minds or electronic form. "*
(Alavi & Leidner 2001)	*"Knowledge is information possessed in the mind of individuals: it is personalized information (which may or may not be new, unique, useful, or accurate) related to facts, procedures, concepts, interpretations, ideas, observations, and judgments."*
(Pee & Kankanhalli 2009)	*"In organizational context, knowledge is defined as a justified belief that increases an entity's capacity for effective action."*
(Jochem et al. 2011)	*"Knowledge is built on information and its interpretation."*

There are different views on what knowledge is, these definitions are described in table 1. For the purposes of this thesis the following definition will be used: Knowledge is information possessed individual or in an organizational context, a justified belief to relate inputs to outputs, to codify, explain and ultimately to predict.

Polanyi put it *"We can know more then we can tell"* (Polanyi 1958). Polanyi draws the distinction between "tacit knowledge" and "explicit knowledge".

Explicit Knowledge can be transmitted in formal systematic language, i.e. it is knowledge that can be codified (Polanyi 1958; Nonaka 1994).

Tacit Knowledge consists of mental models, beliefs, and perspectives which are not easily captured and/or shared skills (Nonaka 1991).

2.2   External Knowledge

Companies have long recognized the use of external knowledge sources to create, exploit and recognize strategic opportunities, improve the innovativeness, and increase the competitiveness (Foss et al. 2013; Grigoriou & Rothaermel 2015). The methods and effectiveness is widely researched in strategic management literature (Monteiro & Birkinshaw 2016; Andersson et al. 2002).

Grigoriou and Rothaermel find that external sourcing strategies are less effective when firms can already internally generate new knowledge or if they have high internal coordination costs. (Grigoriou & Rothaermel 2015). It is remarked that employees of different institutions would like to improve the exploitation and usage of external knowledge (Antonova & Gourova 2008). The ability of a firm to absorb and effectively use external knowledge is directly correlated to the openness of the internal

network (Grigoriou & Rothaermel 2015; Monteiro & Birkinshaw 2016). Since a higher Knowledge Management Maturity Level is associated with an opener internal network, it is expected that a higher KM level is correlated with a better absorption of external knowledge.

The influence of external knowledge on KM Maturity levels is not well researched and reported in literature. When looking at the Knowledge Management Maturity Model (KMMM) literature the focus is on the people, process, and technology which are expressed in various different forms within their own "system boundary" of the firm (Pee & Kankanhalli 2009; North & Kumta 2014; Jochem et al. 2011; Khatibian et al. 2010). In most KM frameworks Knowledge dichotomies (e.g. "tacit versus explicit knowledge" and "individual versus collective knowledge") are used to describe the kind of knowledge being used (Heisig 2009). An analysis by Peter Heisig in 2009 of 160 KM frameworks found that 6 out of 119 which uses dichotomies to describe knowledge distinguished between "internal and external knowledge" (Heisig 2009).
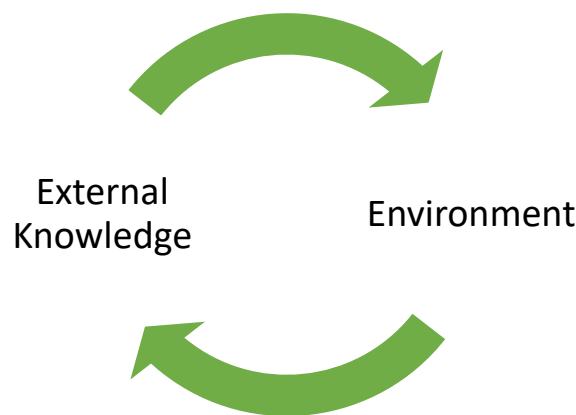
Figure 2: the interchangeability of the terms.

First different definitions KMMMs use to define "external knowledge" or the "environment" are given and then discussed below (Figure 2).

> "The topics of this structural field relate to the important participants from outside the "system boundary" of the organization. Aspects covered are customers and other stakeholders, the comparison with other enterprises, and the problems of using external knowledge. " (Ehms & Langen 2002)

> "External knowledge is the interorganizational knowledge of the partners of the value creation process. " (Jochem et al. 2011)

Hedlund and Nonaka model (1993) assumes that there are 4 different "carriers" or agents of knowledge within an organization namely individuals, the small group, the organization, and the interorganizational domain (customers, suppliers, competition, government, etc.) (Hedlund 1994; Nonaka 1994; McAdam & McCreedy 1999). Thus, even though that the definition of the actors/sources of external knowledge is consistent in literature, the influence of external knowledge management on the KM Maturity level and consequent effect on organizational completeness has been under explored.

For this research the concept that will be used is by Jocem et al 2011, "External knowledge is the interorganizational knowledge of the partners of the value creation process." Since DEKRA's values for their customers is determined by their knowledge, their added value is directly determined by their ability to use their knowledge and the knowledge of third partners in the value creation process.

2.3 Knowledge Management

The term KM was first coined by Karl Wiig in 1986 at a conference in Switzerland (Ganesh et al. 2014). Ganesh stated that in order for an organisation to maximize its return intangible assets it needs to engage in KM. Which is:

"The systematic, explicit, and deliberate building, renewal, and application of knowledge."
(Ganesh et al. 2014)

However, literature sometimes the terms "Intellectual capital" (IC) and "Knowledge management" (KM) are incorrectly used interchangeably. Where "intellectual capital" are intangible assets not easily valued in financial terms. Such assets can be comprised of employee skills, information, patents, copyright, brands, Research and Development (R&D), licensing opportunities etc. (McAdam & McCreedy 1999).

A general goal of KM is to improve the systematic handling of knowledge and potential knowledge within the organization. (Heisig 2009)

"Knowledge management enables individuals, teams, and entire organizations to collectively and systematically create, share, and apply knowledge to achieve their strategic and operational objectives" (North & Kumta 2014)

The four factors that are critical to the success of Knowledge Management initiatives are (Heisig 2009):

1. Human-oriented factors: culture, people, and leadership
2. Organisation: process and structure
3. Technology: infrastructure and applications
4. Management process: strategy, goals, and measurement

Knowledge management has been researched for many years by different parties. For DEKRA it is important to keep a clear distinction between intellectual capital and knowledge management to ensure that their intellectual capital is used in the most effective manner. To accomplish this DEKRA needs to have a clear view of their knowledge management which means collectively and systematically create, share, and apply knowledge to achieve their strategic and operational objectives.

2.4 Knowledge Management Maturity Models

In this section a general overview of the different kind of Knowledge Management Maturity Models is given to sketch the current field in the knowledge management literature.

The Capability Maturity Model (CMM) developed by the Carnagie Mellon University, is used to determine the software engineering and process maturity of an organization and has had widespread acceptance and adoption (Pee & Kankanhalli 2009; Oliva 2014; Kulkarni & Louis 2003). CMM defines 5 levels of Maturity: initial, repeatable, defined, managed, and optimizing (Kulkarni & Louis 2003). The model defines different relevant Key Process Areas (KPAs).

Currently the Knowledge Management Maturity Models are divided between CMM based and Non-CMM based models, some studies combine the two of them. One example of the CMM based models was conducted by Ehms & Langen at Siemens AG 2002. They stated that the names of the levels were adopted from the CMM concept. However, since knowledge management is a developing field thus the maturity levels are based on better process and activities within the organization.

The counterpart researched by KPMG, 2000, is the non – CMM based Knowledge Management Maturity Models they state that the knowledge management is based on a knowledge journal of executive steps rather than levels. They do state that individual processes should been designed with knowledge management concepts in mind.

Some choose to combine the two fields like Pee & Kankanhalli 2009 did. In their research was stated that Knowledge Management Maturity Models should not be considered for the entire organization but rather focus on knowledge intensive departments. Hsieh et al. 2009 state that for an organization the path to maturity must be continuously evaluated and has to be guided by a strong maturity framework. This framework can then be used as a benchmark to culture and knowledge management of the organization. Rather than other models which their studies on literature the model of Oliva 2014, is based on representative quantitative research. With this they identified the important of understanding the barriers of knowledge management within an organisation. By knowing the barriers they can develop strategies to go to an higher level of knowledge management maturity. (Pee & Kankanhalli 2009; Hsieh et al. 2009; Oliva 2014)

3 RESEARCH METHODOLOGY

To tune the Knowledge Management Maturity Model firstly a model from the literature has to be chosen and tuned. In the second part of this section is to conduct the pre-test to validate the concepts and the assessment instrument. In the end of this chapter the model is tested in a pilot study conducted with people throughout the organization. The goal of carrying out these steps is to create a validated Knowledge Management Maturity Model tuned for DEKRA that provides a clear roadmap to reach the next maturity level.
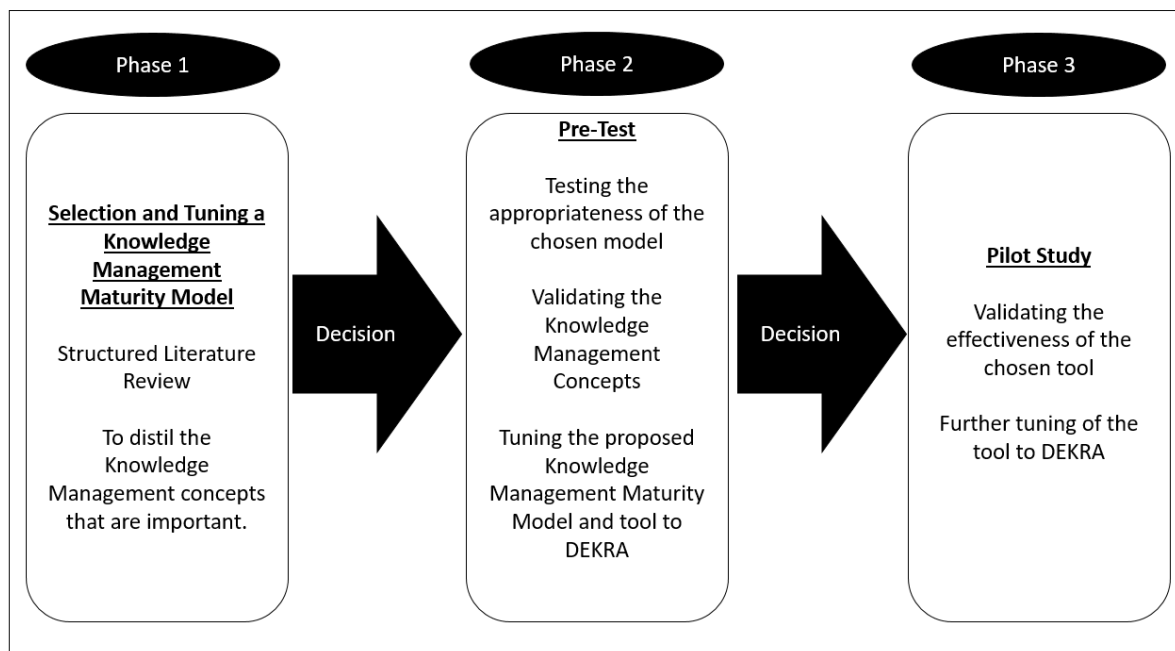
Figure 3: Research flowchart

3.1 Systematic Literature Review

Research plan for the systematic literature review (SLR) is described in this paragraph. First the research questions, the keywords, and a set of inclusion and exclusion criteria are presented. Then the validity is discussed in two parts, the construct validity, and the internal validity. The external validity is not discussed in this section since that concerns the extent to which the results of the study can be generalised (Yin 2009), which will be addressed in section 5. Finally, the reliability is discussed. Reliability refers to when the study would be repeated using the same methods as described in this section, the resulting conclusions should be the same (Yin 2009).

The main reason for performing a Systematic Literature Review is to ensure that the literature review is thorough and fair to maximize its usefulness (Kitchenham 2004). SLRs do require considerably more effort than traditional reviews however, this SLR is a crucial part of the project, since if the literature review is flawed the validity of the remainder of the thesis can be questioned as well (Randolph 2009).

This study has been done as a Systematic Literature Review based on the original guidelines for a single researcher as proposed by (Kitchenham 2004) namely:

1. Developing a protocol.
2. Defining the research question.
3. Defining the search strategy.
4. Defining the data to be extracted from each primary study including quality data.
5. Maintaining lists of included and excluded studies
6. Using the data synthesis guidelines
7. Using the reporting guidelines.

The step "Specifying what will be done to address the problem of a single researcher applying inclusion/exclusion criteria and undertaking all the data extraction" is not included since the study is conducted by a single researcher.

3.1.1 Research questions

The Systematic Literature Review addresses the following questions mentioned in section 1:

RQ1: How to select a Knowledge Management Maturity Model from the Knowledge Management Literature that fits the needs of the DEKRA organization?

RQ1.1: What is the role of "External Knowledge" in these Knowledge Management Maturity Models which influences the DEKRA organisation?

3.1.2 Search Process

In accordance with the guidelines first a research protocol was designed. The search process was done manually of specific journal articles and conference proceedings. The Databases queried were the databases connected to the Eindhoven University of Technology: Wiley, The Emerald, Elsevier, Springer, and ProQuest, these databases were selected since they have publications covering the field of knowledge management and are used in studies in the field (Hsieh et al. 2009; Heisig 2009).

Google Scholar was used to query the databases simultaneously in the months of February and March of 2016. Google Scholar was used as a time saving measure. Studies in the use of google scholar have shown that it is capable of delivering comparable results to traditional computerizes search methods (van der Zandt 2016).

3.1.3 Inclusion and exclusion criteria of the search protocol

As part of the search protocol the following inclusion and exclusion criteria were used. These criteria are used to ensure the quality, validity, and repeatability of the systematic literature review.

Inclusion criteria

- Published in a peer reviewed journal
- Main topic of article must be Knowledge Management

Exclusion criteria

Articles complying with the following criteria are excluded.

- The Knowledge Management Maturity Model does not include a published validated evaluation framework
- Models without reproduced case studies published in peer reviewed literature

3.1.4 Keywords

The following Keyword combinations were used to conduct the Systematic Literature Review in the mentioned databases. The queries were conducted in the months of February and March of 2016.

- Knowledge Management Maturity Measurement
- Knowledge Management Maturity Model
- Knowledge Management Maturity Measurement External Knowledge

3.1.5 Validity

Construct Validity: Predefined search criteria, definitions of keywords, relevant sources, and search space should achieve construct validity.

3.1.6 Reliability

To insure the repeatability a clear research protocol is defined, including research guidelines including keywords and a clearly defined search space. Secondly the given inclusion and exclusion criteria should not only insure reliability but also guarantee the quality of the SLR.

3.2 Selecting and tuning proposed Knowledge Management Maturity Models

The aim of the second phase of the project is to design the proposed KMMM and to validate the design by conducting a pre-test. The pre-test outcome which will serve as a starting point for the pilot study conducted in phase three is described in the next section. The steps taken to complete this phase are described in this section and aim to answer RQ2 and RQ2.1.

RQ2: Which Knowledge Management Maturity Model concepts can be tuned to develop a Knowledge Management Maturity Model that is useful to the situation at DEKRA?

RQ2.1: Which Knowledge Management Activities (KMA), addressed in the proposed Knowledge Management Maturity Model, are relevant to DEKRA?

3.2.1 Selecting Knowledge Management Maturity Models

From the Systematic Literature Review, multiple Knowledge Management Maturity Models emerged. The first selection process was done by the author using the criteria described below. To ensure the quality of the data extracted from the studies criteria were used to rate and review the Knowledge Management Maturity Models which emerged from the process described above. Quality criteria are needed to ensure the results of the systematic literature Review are robust (Kitchenham 2004).

During a group meeting with the relevant stakeholders in the project. The stakeholders from DEKRA and Eindhoven University of Technology attended. First the Knowledge Management Maturity Models were presented then the different criteria were discussed. The outcome was that the Knowledge Management Maturity Model and Knowledge Management concepts were selected. Finally, there was a discussion about the relevant Knowledge Management concepts at DEKRA and how they fitted in with the Knowledge Management Maturity Models and Knowledge Management concepts selected through the process above. The conclusion of this discussion was that one model was selected with the remark that concept of external knowledge used within the organization should be tuned.

Based on the decisions made above the proposed Knowledge Management Maturity Model was written by making the adjustments. The method used to validate the proposed Knowledge Management Maturity Model is discussed below.

Criteria for selection of the Knowledge Management Maturity Models.

As mentioned to ensure the quality of the extracted data the criteria by which the studies (that are selected through the Systematic Literature Review) are measured need to be clearly defined. Here the criteria used are defined and discussed, to provide that clarity. The selected Knowledge Management Maturity Models were judged relative to one another.

The four criteria by which these Knowledge Management Maturity Models were reviewed are:

- Rigour
- Relevance
- Complexity
- Operationality

Since the proposed Knowledge Management Maturity Model needs to be sufficiently founded in literature as well as be implementable in practice. Thus, the Knowledge Management Maturity Models need to have a balance of the two factors, i.e. a rigour/relevance balance needs to exist.

For a study to be scientifically rigorous the theoretical basis of the Knowledge Management Model needs to be founded in scientific literature and convincing. First the methodology used to establish the theoretical framework of the study needs to be rigorous and transparent. The journal of publication and the impact factor over 2015 were considered as well since this gives an indication as to the quality of the research.

To judge the practical relevance of a selected study, the method to validate the Knowledge Management Maturity Model is considered. The sample size, diversity in the sample population, and whether a quantitative, qualitative study or a combination was used, these factors are an indication of the practical relevance of the Knowledge Management Models under consideration. The number of studies found that cited the Knowledge Management Maturity model in peer reviewed journals was used as well, since this is an indication of whether the Knowledge Management Model is used in practice.

In general complexity can be described as the amount of parts there are in a model and the number of interactions between those parts, the more parts and interactions the more complex a model is (Flood 1987). Complexity costs time and money, to judge the Knowledge Management Maturity Models under consideration the complexity needs to be considered, since this will have a large impact on the amount of effort required. In the design phase the amount of complexity introduced into the process needs to be considered carefully and weight against the extra information and usability that is created by introducing more complexity.

The final criterion is operationality. This criterion is used to compare how implementable the Knowledge Management Maturity Models are, i.e. how much effort is needed to implement the model in practice. The inclusion of a validated evaluation framework which is described in a peer reviewed journal has a positive effect of the score. Whether the model has been validated in multiple settings and thus has been proven to be generally implementable is considered as well.

3.2.2 Questionnaire design

To evaluate the Knowledge Management Maturity Model a questionnaire will be designed to accompany the proposed Knowledge Management Maturity Model. The questionnaire is separated into the sixteen knowledge areas, and will contain 68 questions. Each question is related to a specific knowledge management activity described in literature. The aim of the pre-test and pilot study is to

tune and validate the activities and questionnaire to the DEKRA organisation. Which will achieve the outcome of an efficient validated instrument to determine the Knowledge Management Maturity level within DEKRA.

3.2.3 Pre-testing proposed KMMM

To measure to Knowledge Management Maturity level of an organization a survey has been chosen. This quantitative instrument was conducted on a qualitative matter in order to proof its validity. In the future in can be used in as a quantitative research due to its repeatability and the possibility to do throughout research. Pre-testing of surveys has been universally acknowledged as important, however for most questionnaires it is unclear whether a pre-test was performed or no information about how and with what results (Presser et al. 2004). Therefore, this thesis includes a clear description of the methodology used and the results obtained from the pre-test.

Cognitive interviews differ from traditional interviews in the way that they provide insight into the process which is elicited by questions, rather than focussing on producing codable responses (Presser et al. 2004). The goal of the pre-test of the evaluation framework is finding problems, such as with the interpretation of the questions, terms, and definitions used.

3.2.4 Pre-test Process

Three experts were interviewed about the frameworks individually; they were asked to reflect on how well tuned the design is to the situation at DEKRA, as well as if they found any problems. Problems could be terms or questions that are unclear or in need of clarification, as well as basic grammatical or spelling errors. Finally, the interviewees were asked to provide examples of knowledge management activities in the organisation so they could be included in the evaluation framework. The included examples provide context and aid in the interpretation of the questions.

After the interviews the changes were made to the proposed Knowledge Management Maturity Model and the accompanying evaluation framework. The proposed changes were collected into a final document, each change had a comment indicating the reasoning behind it. The final document was then sent to all the participants for a final feedback round. The feedback received was then processed and the appropriate changes were made to the proposed Knowledge Management Maturity Model. This final feedback round gives everybody the chance to reflect on the feedback they and others gave as well as validating the actual implementation of the changes. This step is important since people do not remember why they gave the feedback even the next day (Presser et al. 2004).

3.2.5 Expert selection for the pre-test

The expert where selected from the quality department since they have intimate knowledge of the Knowledge Management processes in the company and the Knowledge Management System used by everybody in the company. The experts were selected since they collaborate with different business units in multiple locations, thus have a broad view of how knowledge is handled in the organisation.

3.2.6 Weaknesses pre-test method

Due to the large number or knowledge areas and knowledge management activities that the proposed Knowledge Management Maturity Model covers a loss of concentration of the interviewee and interviewer can occur during the interview. This is addressed by focussing on the most salient areas

and activities, rather than discussing every single one in detail. During the pre-test with certain questions clarifications needed to be provided about certain Knowledge Management concepts.

3.2.7 Pre-test Validity

Construct validity

During the interview the interviewee and the interviewer have the opportunity to suggest changes and explain the reasoning behind it. The interviewer will have the chance to make additional notes of suggested changes. Construct validity is safeguarded since the participants will have a chance to reflect on their own modifications and on all the adjustments made at the end of the interview rounds.

Since the theoretical framework (as covered in section 2) for the basis of the proposed design was obtained through a SLR, ensuring the validity of the starting point of this design.

Internal validity

The combination of the theoretical framework used from phase one and the experts which collaborate with different business units ensure the internal validity of the pre-test.

3.2.8 Pre-test Reliability

Thanks to the open atmosphere throughout the interview due to the method of questioning and two chances to reflect on the answers the reliability of the study shall be ensured.

3.3   Pilot Study

To achieve the output of a validated Knowledge Management Maturity Models and accompanying questionnaire, a pilot study was conducted. The pilot study will enable us to find faults and unclear questions or subjects in the questionnaire, and test the interpretation given to the questions by the respondents. As discussed in the introduction the following research questions will be answered using the method described in this section:

RQ3: Can the tool be used to measure the Knowledge Management Maturity Level in the DEKRA organization?

RQ3.1: Could the tool be used to identify practical examples. Is the terminology and the conceptual structure effective or efficient to reach the Knowledge Management Maturity Model?

RQ3.2: Is the terminology and questions from the proposed Knowledge Management Maturity Model evaluation framework interpreted in the way intended by the proposed Knowledge Management Maturity model?

3.3.1   Multi Method Multiple-Case Study

The characteristics research design can be separated into a number of categories, namely: holistic single- and multiple-case designs, and embedded single- and multiple-case designs (Yin 2009). Thus four in total, all four types have advantages and disadvantages and it is therefore important to carefully consider the best design for the case study that is being planned (Figure 4) (Yin 2009).
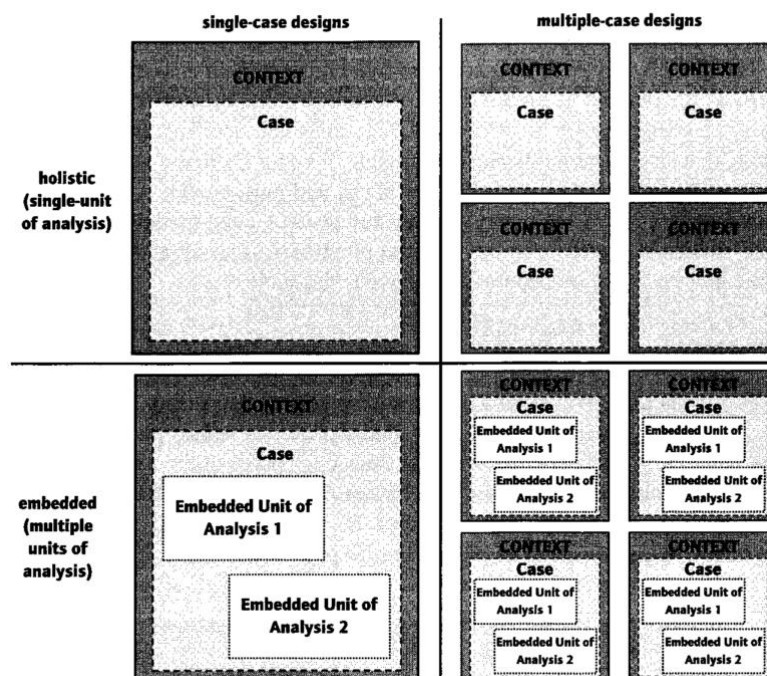
Figure 4: the four basic types of case study design (Yin 2009)

When a case study addresses only the general global nature of an organisation that is a holistic study. When multiple subunits of analysis are identified and examined the study is always an embedded study,

e.g. a study could include different services of the organisation as well as units of staff and individual employees.

Holistic case studies are appropriate when no subunits for evaluation can be identified. The risks of a holistic study could include the risk that important processes are left unexamined due to the abstract nature of the study. Another possibility is that during the execution of the case study the focus can shift from one area to the other, resulting in a completely different orientation of the study. When the orientation shifts the design, design choices made for the case study might not be appropriate any more for the new orientation. Thus, reorientations during the study need to be avoided, and if necessary a new study must to be initiated (Yin 2009).

Using an embedded study will mediate the risks accompanying a holistic study discussed above. Since embedded studies have subunits to make sure that the case study stays on topic. However, an embedded study has advantages and disadvantages of its own.

Since the project is limited in time and budget but aims to capture the workings of an international organisation in one model, a single case study is chosen. This single case study has been chosen because of the brought scope it needs to cover. Other studies involve an excessive amount of people and time.

A combination of different quantitative and/or qualitative research techniques, methods, approaches, concepts, or language into a single study is called mixed methods research (Yin 2009). The combination of different methods allows the research not only to reveal how people would answer the questionnaire, but also examine the reasoning behind their answers. With this proof is provided that the questionnaire is interpreted in the way as it was designed. Finally, it will be easier to discover flaws in the methods used in the evaluation framework.

3.3.2 Interview Protocol Design

This section will elaborate on the interview protocol design for the pilot study, the complete protocol used can be found in Appendix III. All supporting material and the questionnaire provided to the participants were in English. The interviews were conducted either in Dutch or English depending on what language the participant were more comfortable in. The interviews conducted in Dutch were translated and transcribed in English by the interviewer.

Due to time restraints and participant availability, most participants have tight schedules and work on out of the office a large part of the time, the protocol was restricted to one face to face session. After the interview the participants received the transcript to which they could provide feedback. The interviews were transcribed using notes and the audio recording made of the interview. The audio recordings are private and destroyed after the project is finished. The interviews were one hour as communicated to the participants when they received the invitation.

At the start of the interview a short explanation is given about the project and the model. The questionnaire was organized per knowledge area, the interviewee had the chance to answer the questions after which a short discussion was held about their answers and questions.

After the questionnaire, a couple of questions about the organisation, themselves, and about their opinion of the model, this section of the interview was semi-structured with open questions. At the end the interview the interviewee was thanked and reminded that they would receive the transcripts as soon as possible.

3.3.3 Data analysis

The questionnaire will be analysed first to determine the Knowledge Management Maturity Level. This will give DEKRA insight into their Knowledge Management Maturity Level and the strengths and weaknesses of the organisation. It will create a roadmap to improve the organisation, i.e. which Knowledge Management Activities to focus on in the short and long term.

The questionnaire is analysed to identify faults and unclear questions. This is done by aggregating the feedback and analysing the arguments, reflecting on the original intent behind the design.

3.3.4 Subject Selection and sample size

Initially ten people were selected from the different business lines in the company. This sample size was chosen to get a good spread between different function and people from the different business lines. The spread between the different functions and business units is chosen to benefit from the different perspectives, which is vital since the different business lines have different products and cultures.

Table 2: number of interviewees per group

	Nr. People
Business Line Director (BLD)	3
Manager (MNG)	3
Global Technical Leader (GTL)	1
Auditors (AUD)	3
Total	10

A smaller sample size would mean not having an even spread among the business lines at all levels thus skewing the results. A larger initial sample size would take more time and due to the stopping criterion below is not necessary.

Stopping criteria Interviews Pilot Study

To ensure that the sample size is large enough to answer the research question and reach the desired outputs the stopping criteria was set to two consecutive interviews where no new data, issues, or problems were discovered. This should allow the limitation on the number of interviews, whilst still making sure all relevant data is gathered.

3.3.5 Weaknesses Pilot Study method

Due to the large number or knowledge areas and knowledge management activities that the proposed Knowledge Management Maturity Model covers a loss of concentration of the interviewee and interviewer can occur during the interview.

This will be addressed by focussing on the most salient arears and activities, rather than discussing every single one in detail. The interview will be taped to ensure that all salient points are transcribed after the interview, even if they are missed during the interview.

3.3.6 **Pilot study Validity**

Construct validity

During the Interview the changes will be marked by the interviewee and the interviewer, the interviewer will have the chance to make additional notes of suggested changes and their reasoning behind it. To ensure completeness the interviews will be recorded and transcribed by the interviewer. Construct validity is a safeguarded since participants have a chance to reflect on their own changes by checking the complete transcript afterwards.

Internal validity

The combination of the theoretical framework used from phase one and the participant which come from different business units ensure the internal validity of the pilot study.

3.3.7 **Pilot study Reliability**

The participants will be selected from a variety of levels and business lines to ensure that when repeating the process selecting similar participants from different backgrounds will yield similar results. The reliability will be improved through adding examples and definitions to the questions, minimizing the chance questions will be misunderstood.

An open atmosphere throughout the interview will ensure the accuracy of the answer of the questions, beside this there will be two chances to reflect on the answers in order to improve the reliability of the study.

4   RESEARCH EXECUTION AND RESULTS

In this section the results will be presented of the three phases of this master thesis project. First the results of the Structured Literature Review will be presented followed by the resulting proposed Knowledge Management Maturity Model. The results of the pre-test and pilot study follow. This section will conclude with a presentation of the results obtained from the pilot study.

4.1   Structured Literature Review

The Structured Literature Review resulted in a selection of three Knowledge Management Maturity Models which will be discussed in this section. The Knowledge Management Maturity Models were selected manually by searching the databases available. A description of the selected Knowledge Management Maturity Models is given followed by a discussion of the selection criteria and a conclusion.

There are well known and widely used models developed by consultancy companies, such as Siemens, KPMG, and TATA consultancy (Ehms & Langen 2002; Kpmg 2000), do not include an evaluation framework which is published in peer reviewed journals, thus they were excluded from consideration.

Published KMMMs are peer reviewed and include case studies to validate them. However most of the published studies do not include the used evaluation framework (Pee & Kankanhalli 2009), thus making replication of the study difficult. These studies were also excluded from consideration (Khatibian et al. 2010; Robinson et al. 2006; Jochem et al. 2011).

4.1.1 General Knowledge Management Maturity Model

The objective of the General Knowledge Management Maturity Model (G-KMMM) is to be an ideal Knowledge Management Maturity Model which is applicable on different subjects (such as entire organizations, departments, and individuals) independent of their environment. It does have clear descriptions of the important terms and concepts used. It includes an applied and explained assessment instrument. This is necessary for any Knowledge Management Maturity Model to be implementable and comprehendible by an organizations and (Pee & Kankanhalli 2009).

Table 1: G-KMMM characteristics per Knowledge Management Maturity Level (Pee & Kankanhalli 2009)

Maturity Level		General description	Key Process Areas (KPAs)		
			People	Process	Technology
5	Optimizing	KM is deeply integrated into the organization and is continually improved upon. It is an automatic component in any organizational process	Culture of sharing is institutionalized.	KM processes are constantly reviewer and improved upon. Existing KM processes can be easily adapted to meet new business requirements. KM procedure are an integral part of the organization	Existing KM infrastructure is continually improved upon.
4	Managed	KM initiatives are well established in the organization	Common strategy and standardized approaches towards KM KM is incorporated into the overall organizational strategy More advanced KM training Organizational standers	Quantitative measurement of KM processes (i.e., use of metrics)	Enterprise wide KM systems are fully in place Usage of KM systems is at a reasonable level Seamless integration of technology with content architecture
3	Defined	Organization has put in place a basic infrastructure to support KM	Management is aware of its role in encouraging KM Basic training on KM is provided (e.g., awareness courses) Basic KM strategy is put in place Individual KM roles are defined Incentive systems are in place	Process for content and information management is formalized Metrics are used to measure the increase in productivity due to KM	Basic KM infrastructure in place (e.g., single point of access) Some enterprise-level KM projects are put in place
2	Aware	Organization is aware of and has the intention to manage its organizational knowledge, but it might not know how to do so	Management is aware of the need for formal KM	Knowledge indispensable for performing routine tasks is documented	Pilot KM projects are initiated (not necessarily by management)
1	Initial	Little or no intention to formally manage organizational knowledge	Organization and its people are not aware of the need to formally mange its knowledge resources	No formal processes to capture, share, and reuse organizational knowledge	No specific KM technology or infrastructure in place

The G-KMMM is comprised of five maturity levels; namely initial, aware, defined, managed, and optimizing (Pee & Kankanhalli 2009). At level 1, the initial stage, there is no formal organisation of knowledge and little or no intention to implement a formal organisation of knowledge. Once the organisation is aware of the need to manage their organizational knowledge and has the intention to do so it has reached Knowledge Management Maturity level 2. At Level 2 the organisation does not necessarily need to know how to organise their Knowledge, an organisation just needs to have the intent.

When an organisation has achieved Knowledge Management Maturity level 3, the defined stage, the organisation has put in a basic implementation of structures and systems to support the management and organise the organisational knowledge.

The need that continuous improvement in Knowledge Management is needed is reflected in the fact that Knowledge Management Maturity level 5 is called optimizing in which Knowledge Management is a part in all organizational processes (see Table 1).

Key Process areas

The General knowledge management maturity model (G-KMMM) is based on three Key process areas (KPAs) People, Process, and Technology (Pee & Kankanhalli 2009).

People KPA refers to the organizational culture, strategies, and policies.

Process KPA refers to the aspect concerning KM activities

Technology KPA refers to the aspects related to KM technology and infrastructure

In Table 1**Error! Reference source not found.** the set of characteristics of each individual KPA at each of the five KM Maturity levels. The characteristics are based on the most common seen in the CMM based KMMMs found in literature, these characteristics are used or implied in non-CMM based KMMMs found in literature (Pee & Kankanhalli 2009).

4.1.2   Olivia Knowledge Management Maturity Model

The 5 explanatory factors of corporate Knowledge Management from the Oliva KMMM are explained (Oliva 2014). Finally, the target management objects of the proposed model are defined.

As mentioned above the model proposed by Oliva has 5 different explanatory factors namely Organization, information, culture, participation, and engagement.

Organization

"The company seeks to develop company makes use of information resources to develop its Knowledge Management" (Oliva 2014).

Information

"Information represents how much the company makes use of information resources to develop its Knowledge Management" (Oliva 2014).

Culture

"Culture represents the degree of importance of the company's orientation towards the creation of knowledge" (Oliva 2014).

Participation

"Participation reveals how the company deals with the subject in a participatory and transparent manner with its employees" (Oliva 2014).

Engagement

"Engagement reveals how the company engages stakeholders in its environment of value to make its Knowledge Management more efficient and effective" (Oliva 2014).

4.1.3 **Knowledge Navigator Model**

In this section the definitions of the different explanatory factors and target management objects are discussed. First the definitions of the target management objects in the KNM are given (Figure 5) (Hsieh et al. 2009).

The Knowledge Navigator Model (KNM) proposes that three main target management objects should be emphasized and managed for Knowledge Management (Knowledge Management) implementation effectiveness, namely Culture, Knowledge Management Process, and Information Technology (IT).

<u>Culture</u>

Culture incorporates a set of shared values, norms and beliefs, mainly implicit, that the members of an organization possesses. Knowledge Management requires a culture in which knowledge sharing, shared learning and collaboration are entrenched (Hsieh et al. 2009).

<u>Knowledge Management Process</u>

"Process, policy, and strategy- these facilitate and guide the efforts of the people to capture and use the knowledge in the organization to achieve business benefits."(Hsieh et al. 2009) Knowledge Management processes can be seen as a structure which can be used to coordinate the effective and successful management of knowledge. The individuals within the organization will adapt processes from local sharing, creation, and capturing of knowledge at lower KMM levels to global sharing, creation, and capturing of knowledge. The scope of implementation will expand from local to global as well. (Hsieh et al. 2009)
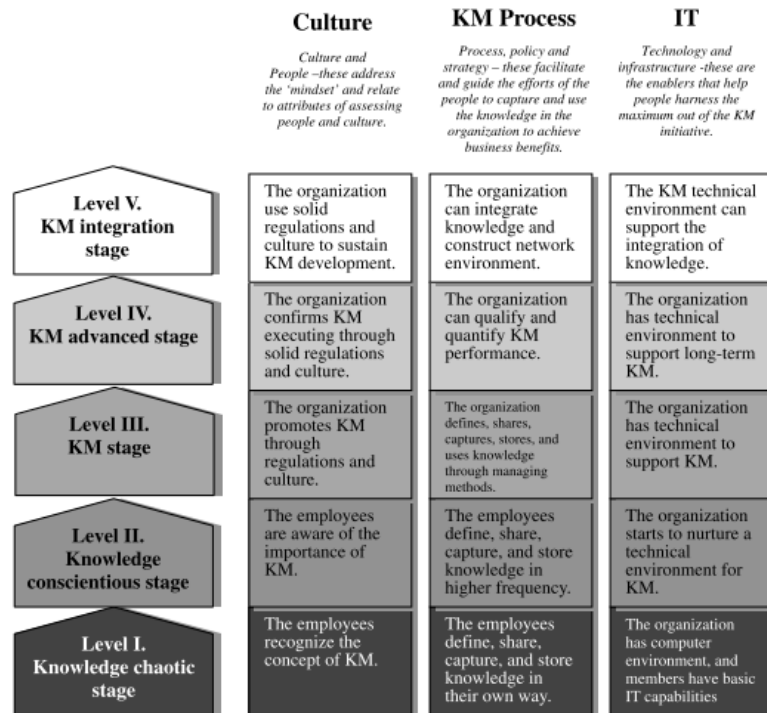
Figure 5: KNM Target Management Objects

Information Technology

"Technology and infrastructure –these are the enablers that help people, harness the maximum out of the Knowledge Management initiative." (Hsieh et al. 2009) the stages for information technology development are described as follows:

Stage I is labelled ''end-user-tool systems" or ''person-to-technology", as information technology provides people with tools that improve personal efficiency. Examples are word processing, spreadsheets, and presentation software.

Stage II is labelled ''who-knows-what systems" or ''person-to-person", as people use information technology to find other knowledge workers. Examples are yellow-page systems, and intranets.

Stage III is labelled ''what-they-know systems" or ''person-to-information", as information technology provides people with access to information that is typically stored in documents. Examples include data mining, and search engines.

Stage IV is labelled ''how they-think systems" or ''person-to-system", in which the system is intended to help solve a knowledge problem. Examples are expert systems, artificial intelligence, and business intelligence. Hence, the information technology trigger for Knowledge Management, the focus when applying information technology, the dominating strategy for KM, and the attitude towards information technology change according to the Knowledge Management stages.

4.1.4   Knowledge Management Maturity Model selection criteria

In this section the selected Knowledge Management Maturity Models are assessed on the criteria described below. The assessment is done relative to one another in order to assist in the selection making process.

<u>**Criteria**</u>

- **Rigour:** Indicates to what extend the model is founded in literature, and if the model does use methods that ensure the rigour of proposed Knowledge Management Maturity Model. The impact factor (in May 2016) of the journal where the Knowledge Management Maturity Model was originally published is taken into account as well.
- **Relevance:** assesses to what extend the methods used to validate the model are relevant to the business in general and can be adapted to the situation at DEKRA. Subsequent models, which were unearth during the structural literature review that build on the concepts of the discussed Knowledge Management Maturity Model are taken into account as well.
- **Complexity**: assesses how complex the design of the model and evaluation framework are, i.e. the broader the model the more different concepts are included the more time it will take to use and understand.
- **Operationality**: this criterion assesses whether there is enough information available to use the model in practice. Are there clear examples on how to use the evaluation framework and were there other case studies found during the structural literature review of others using the Knowledge Management Maturity Model.

First the General Knowledge Management Maturity Model (G-KMMM) (Pee & Kankanhalli 2009)

Rigour: The Impact factor of the journal of publication in 2015 is 0.43[1], which is the lowest of the three by a large margin. The article itself does provide ample information about the design and validation process, and the model has been used in multiple Knowledge Management Maturity Models proposed by others (Kuriakose et al. 2010). Thus the model rates a 6/10 for rigour.

Relevance: The G- Knowledge Management Maturity Model scores as sufficient (6/10) on the relevance category since it includes an evaluation framework which has been validated in a case study. The evaluation framework has clear instructions and as mentioned above has been used as a basis in several different other models.

Complexity: Since the model is made to be broadly applicable, thus the evaluation is done with 21 questions that inquire about the three key process areas. This means that the model rates 2/10 for complexity.

Operationality: Due to the multiple case studies conducted with the model and the evaluation framework the model rates 9/10 for operationality.

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[1] As reported on ResearchGate https://www.researchgate.net/journal/0219-6492_Journal_of_Information_Knowledge_Management
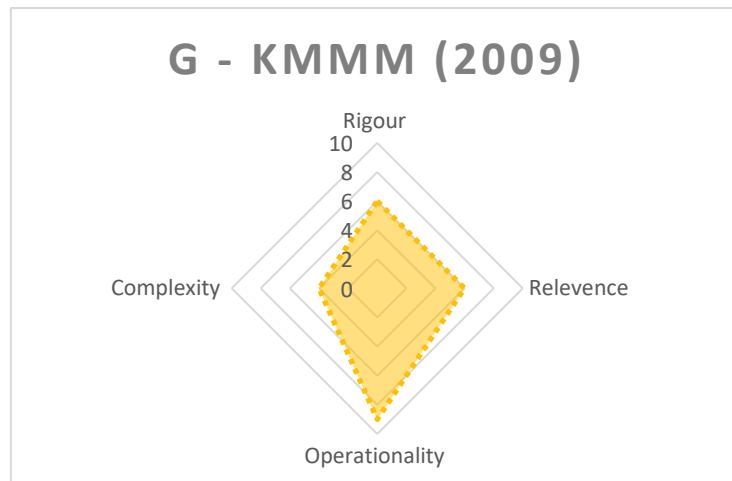
Figure 6: General Knowledge Management Maturity Model criteria assessment

The Knowledge Management Maturity Model proposed by Olivia (2014) (Oliva 2014)

Rigour: Impact factor for the journal of publication in 2015 is 3.06[2]. The Model is designed using rigour quantitative methods used to design the model and evaluation framework. Thus the model rates 9/10 for rigour.

Relevance: During the structural literature review no citations of this model were found, however the large survey conducted with 171 valid respondents in the form of large Brazilian companies and subsequent quantitative analysis give a good basis for the relevant use of the model. Thus the model rates 6/10 for relevance.

Complexity: Even though the evaluation model only has 11 questions the model itself is quite complex mainly due to its quantitative nature. Thus the model rates 8/10 for complexity.

Operationality: Thanks to the large survey mentioned above the materials to adapt the study are available through a peer reviewed medium. Thus the model rates 8/10 for operationality.
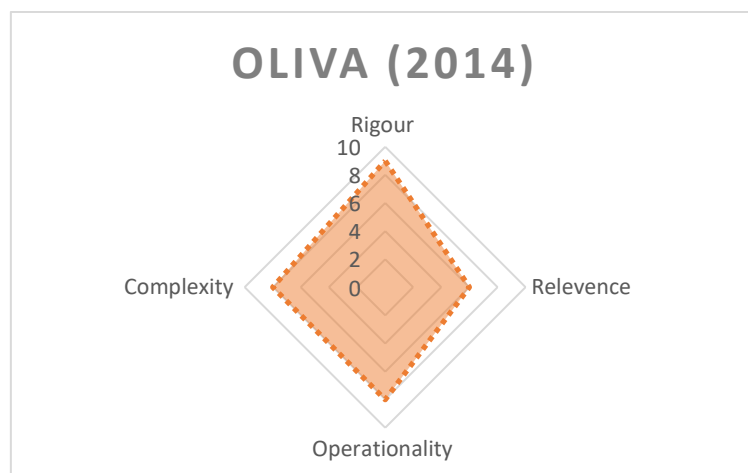
Figure 7: Oliva (2014) proposed KMMM criteria assessment

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[2] As reported on ResearchGate https://www.researchgate.net/journal/1367-3270_Journal_of_Knowledge_Management

The Knowledge Navigator model (KNM) (Hsieh et al. 2009)

Rigour: The impact factor of the journal of publication in 2015 is 4.68[3]. The model uses rigorous methods in their design process, not only relying on literature but also including academic experts and Knowledge Management consultants. Thus, the model rates 10/10 for rigour.

Relevance: The quantitative nature of the case study used to validate the model, which entailed 30 companies studied in different industries makes the model relevant. However the model has only been cited, that was unearth during the SLR, a once by other models (Oliva 2014). Thus, the model rates 9/10 for relevance.

Complexity: The model has 16 knowledge areas with a total of 68 questions in the evaluation model making it the most complex model of the three discussed in this section. Thus, the model rates 10/10 for complexity.

Operationality: Even though the model has a description of the evaluation framework it does not include complete guidelines for reproduction of the study. Thus, the model rates 7/10 for operationality.
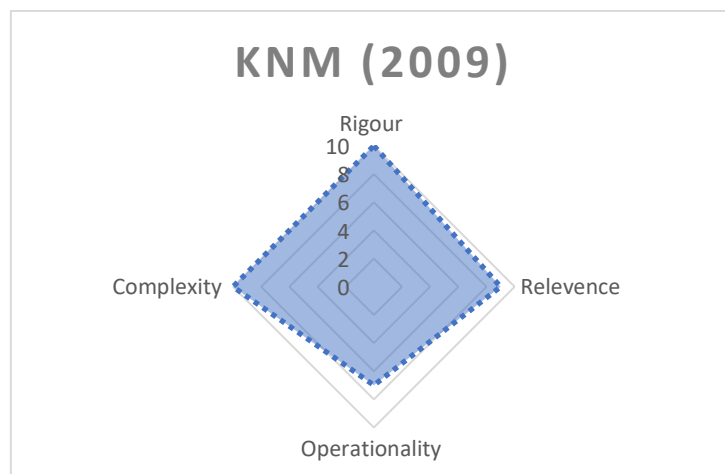
Figure 8: Knowledge Navigator Model criteria assessment

4.1.5 Conclusion

Based on the assessment criteria it was decided in a focus group to base the proposed Knowledge Management Maturity Model on the Knowledge Navigator Model. The reason for this outcome is that this model covers the broad scope that was intended in the assignment. Since DEKRA is a multinational organization containing different business lines it is necessary for the model to encapsulate that complexity. To customize the model it has to be tuned for DEKRA.

The initial assignment was to include the concept of External Knowledge Management, this has been done partly by tuning the proposed model using the concept from the Knowledge Management Maturity Model of Oliva (2014).

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[3] As reported on ResearchGate https://www.researchgate.net/journal/0957-4174_Expert_Systems_with_Applications

4.2   Proposed Knowledge Management Maturity Model

In this section the proposed Knowledge Management Maturity Model will be presented and discussed. First the redefined Target Management Objects will be discussed, the characteristics of which at each Knowledge Model maturity level are given in Table 3. After which the Knowledge Management Maturity levels are defined (see Table 4).

Table 3: Target Management Objects characteristics per maturity level

	Culture	**KM Process**	**IT**
	Culture and people – these address the 'mindset' and communities within and connected to the organization	Process, policy, and strategy – these facilitate and guide the efforts of the people to capture and use the knowledge to which the organization has access to achieve business benefits	Technology and infrastructure – these are the enablers that help people harness the maximum out of the Knowledge they and the organization has access to
Level V KM integration stage	The organization use solid regulation, communities, and culture to sustain KM development	The organization can integrate the knowledge to which the organization has access to and construct network environment	The KM technical environment can support the integration of all the knowledge the organization has access to
Level IV KM advanced stage	The organization confirms KM executing through solid regulations, communities, and culture	The organization can qualify and quantify KM performance	The organization has technical environment to support long-term KM
Level III KM stage	The organization promotes KM through regulations, communities, and culture	The organization defines, shares, captures, stores, and the knowledge to which it has access to through managing methods	The organization has technical environment to support KM
Level II Knowledge conscientious stage	The employees are aware of the importance of KM	The employees define, share, capture, and store knowledge to which the organization has access to in higher frequency	The organization starts to nurture a technical environment for KM
Level I Knowledge chaotic stage	The Employees recognise the importance of KM	The Employees define, share, capture, and store knowledge to which the organization has access to in their own way	The Organization has a computer environment, and members have basic IT capabilities

4.2.1   Target Management Objects

As discussed above the proposed Knowledge Management Maturity Model is based on the Knowledge Navigator Model of Hsieh et al. (2009), as discussed in the previous section some Knowledge Management concepts will be updated and localized to fit the specific situation at DEKRA. Knowledge Navigator Model was developed with a specific focus on different manufacturing companies (Hsieh et al. 2009), thus the concepts and definitions will need to tuned to work for a technical service company like DEKRA.

One of the concepts that that needs tuning is the way external knowledge management is incorporated into the Knowledge Navigator Model. In the Knowledge Navigator Model the use of external knowledge increases the higher the maturity level and does not exists in the lower Knowledge Management maturity levels, this is contrary to the view of the focus group. As discussed in Section 2 the view of the focus group is that there is always interaction with external knowledge sources and stakeholders at all maturity levels, however the interaction varies according to the characteristics of the maturity level of the organisation. This view is also used in Oliva (2014) where one of the five factors discussed is stakeholder engagement in the knowledge management value framework (Oliva 2014).

Culture

Culture incorporates a set of shared values, norms and beliefs, mainly implicit, that the individuals in an organization possesses. Knowledge Management requires a culture in which global knowledge sharing, shared learning and global collaboration within the company and with its stakeholders whom are engaged with the Knowledge value chain within the organisation (Hsieh et al. 2009; Oliva 2014).

Knowledge Management Process

"Process, policy, and strategy- these facilitate and guide the efforts of the people to capture and use the knowledge in the organization to achieve business benefits." (Hsieh et al. 2009) Knowledge Management processes should be a structure which is used to coordinate the effective and successful management of knowledge. The individuals within the organization will adapt processes from local sharing, creation, and capturing of knowledge at lower Knowledge Navigator Model levels to global sharing, creation, and capturing of knowledge. The scope of implementation will expand from local to global as well. (Hsieh et al. 2009)

Information Technology

Technology and infrastructure – these are the enablers that help people, harness the maximum out of the Knowledge Management initiative, and promotes the internal and external sharing, creation and capture of knowledge (Hsieh et al. 2009).

4.2.2 Knowledge Management Maturity Levels

Table 4: proposed Knowledge Management maturity levels, adapted from (Hsieh et al. 2009)

Knowledge Management Maturity Level	Description
Level 5. Knowledge Management Integration Stage	A Level V organization has developed the abilities to adapt flexibly in order to meet new requirements in Knowledge Management or any business initiative without dropping a maturity level. These abilities are presented in the integration and fusion of internal, external, existing, and up-to-date business-related knowledge regarding product, service, operational process, and management discipline.
Level 4. Knowledge Management Advanced Stage	An advanced strategic-oriented plan and standardized approaches to the subject of Knowledge Management is a feature of Level IV organizations. Managers are able to harness knowledge from all the touch points in the organization and realize the business benefits from it.
Level 3. Knowledge Management Stage	The goal of this level is to provide evidence of the business value of Knowledge Management by formally conducting Knowledge Management programs and capturing lessons learned that can be transferred and used to help the organization better implement Knowledge Management on a larger and expanding scale.
Level 2. Knowledge Conscientious Stage	A practical definition of Knowledge Management is explored within an organization and consideration of its applicability is made. Organizational processes are partly described as Knowledge Management tasks and, by virtue of ideas from individual ''Knowledge Management pioneers'', pilot projects on Knowledge Management typically emerge.
Level 1. Knowledge Chaotic Stage	Organizations have no formal processes for using organizational knowledge effectively for business delivery. Organizational knowledge is fragmented in isolated pockets, and stays in people's heads. Individual may have ample knowledge but do not know how to harness it in a structured manner in order to derive business benefit.

4.3   Pre-test Research Execution and Results

In this section the results of the pre-test conducted will be discussed. The alterations to the survey in the form of comments, particle examples, and improving the questions reported in full can be found in Appendix II.

As stated in section 3 the aim of the pre-test is to find major faults with the survey, as well as to answer RQ2 and RQ2.1. During the pre-test the experts have time to go through all 16 Knowledge Arears and 68 Knowledge Management Activities and related survey questions.

> **RQ2:** Which Knowledge Management Maturity Model concepts can be tuned to develop a Knowledge Management Maturity Model that is useful to the situation at DEKRA?

> **RQ2.1:** Which Knowledge Management Activities (KMA), addressed in the proposed Knowledge Management Maturity Model, are relevant to DEKRA?

The experts did not answer the questions rather the focus was on finding faults and improvements before conducting a pilot study. First the changes in the questions will be discussed with the descriptions that were added based on the comments during the interviews, after which the examples which were added are evaluated.

4.3.1   Survey Questions

One of the major additions which the pre-test revealed was that the terms used in literature needed to be either replaced by DEKRA terminology or defined and explained using examples in practice. In DEKRA the different "departments" are called "business lines" it is important to be congruent with the terminology of the firm since the survey is not exclusively aimed at people who are familiar with the field of Knowledge Management or the Knowledge Management initiatives and activities within the firm.

The experts agreed that since Knowledge Management is part of the ongoing process, which is congruent with literature (Jochem et al. 2011; Perez-Araos et al. 2007), within a firm thus to emphasize this in the questions. As a result, question 2.4 was changed to include "Continuously supporting Knowledge Management".

Terms that were not commonplace in the daily operation of the DEKRA needed to be clarified with definitions and description. One Knowledge Area which needed the most clarification was Intellectual Capital, multiple experts remarked for the need of definitions and the need for further clarification on the knowledge area and the survey questions. The following definition was added:

> *"Intellectual Capital are all the knowledge resources a company can use to drive profits, attain new customers, create new products, or otherwise improve the business."* (Chetty & Mearns 2012)

In the feedback given the group confirmed that this definition is in line with their interpretation of what the knowledge area addresses. Confusion is commonplace when having to distinguish between Intellectual Capital and Intangible Assets, since intangible assets are a part of the Intellectual Capital. As described above Intellectual capital encompass more than just intangible assets.

In knowledge identify and classification it was unclear whether the question was meant on an organizational business or domain level. In question 5.3 it was ambiguous if the organizational knowledge was identified by members themselves or identified and classified for them.

For the knowledge protection question 11.2 was changed to 'do regulations, processes or platforms protect knowledge?'.

Within communities of practice an adjustment was made to the question that results into question 14.1 'are there existing processes, regulation or platforms to encourage members to participate in CoP's?'.

In the knowledge management system four of the nine questions were redefined as follows. In the Knowledge Area Information Technology infrastructure information technology jargon is used, which is unclear so question 16.1 was redefined to 'are there existing processes or regulation to construct and maintain a "who-is-who" system or platform?'. 16.2 is now 'are there existing processes or regulation to construct and maintain a knowledge map (a "where-is-what" system or platform)?'. Question 16.7 is now 'does the Knowledge Management System support Knowledge Management between individuals as well as between and within groups?'. Finally question 16.9 is now 'does the system architecture links unrelated knowledge capture and management systems (e.g. human relation system, customer relation system, the financial management system and others)?'.

4.3.2 **Examples**

For the purposes of clarification and to put the questions in the right context the experts were asked to provide examples of the Knowledge Management terms used and the Knowledge Management Activities which were the subject of the survey questions. During the pre-test it became clear that the addition of these examples are essential since the survey is not only intended for employees familiar with the field of knowledge management, but respondents will have a diverse background to get a fair view of the Knowledge Management Maturity in the firm.

As mentioned above the Knowledge Area of Intellectual Capital needed the benefit of clarification of the terms used. Next to providing the definitions for the relevant terms examples found in literature and provided by the experts were included. The term intellectual Capital is defined by literature in three forms described below.

- Human capital, i.e. the knowledge and wisdom of the employees
- Structural capital, i.e. the hardware, software, and trademarks left behind in an organisation once the employees have vacated
- Relational capital; i.e. the relationships build up with customers and stakeholders

Intellectual Capital has impact on the financial performance for example when knowledge keepers leave the company which is a risk to continuation of its operations.

To clarify question 11.3 examples of intellectual property which are e.g. patents, brands, copyrights, franchises, and software were added to the questionnaire.

4.4   Pilot Study Improvement to the model

In this section the results of the Pilot Study as they relate to the validation of the evaluation framework and the Knowledge Management Maturity Model will be presented. The complete results can be found in the appendix. First changes made after the feedback of the participants of the study are presented. After which the interpretation of the questions is discussed.

4.4.1   Problems found

Overall the questions could be answered however some clarification was still needed mainly caused by the translation of the technical jargon that is used in the questionnaire. This is mediated by adding examples and defining the unclear terms as found in the questionnaire.

The terms that needed defining are: Knowledge Management Promotion, Knowledge Classification, Community of practice, Tacit Knowledge and Knowledge Management System. People outside of the field of Knowledge Management are not familiar with the precise scope and definition of the terms used in this questionnaire.

4.4.2   Interpretation of Knowledge Management concepts

It is important to understand how people in the organization interpreted the Knowledge Management concepts discussed in the questionnaire. Since this will determine the value of the outcome of the questionnaire. The term Knowledge Management Promotion as referred in this thesis is meant to mean the promotion of the Knowledge Management processes within the organization. Thus a high maturity of Knowledge Management Promotion means that people are aware of the Knowledge Management processes and are able to understand and use them. To mediate this misunderstanding an introduction is added to the chapter.

The participants had particular issues with Knowledge Identify and Clarification due to the mistranslation as classified was being understood by 'to keep secret' instead of 'the classification of knowledge'. This is remedied by eliminating classified and reformulating the questions using classification.

Even though after the pre-test a definition was added of the community of practice the participants had difficulty linking the definition to actual processes within the company. By asking for examples and adding these examples to the final version this term was clarified.

After the pre-test a short definition of tacit knowledge was added however this appeared not sufficient for the participants. In the introduction more background information is given in the final version of the questionnaire.

The different definitions from participants when asked to fine a Knowledge Management System were accurate. However in the introduction the term is described more clearly as to make sure that all the participants interpret the question the same way.

4.5   **Pilot Study Analysis Results**

In this section the results of the survey conducted as part of the pilot study will be presented. First the basis evaluation scores are discussed, followed by the scores measured by the survey. These are the results of the survey before any final changes were made.

The evaluation gives us weighted averages for each question, the averages summed up return an evaluation score. The relation between the evaluation scores and the corresponding Knowledge Management Maturity levels can be found in Table 5. These scores were obtained from the evaluation model as described in Hsieh et al. 2009.

Table 5: Score ranges Target Management Objects (Hsieh et al. 2009)

	Level I	Level II	Level III	Level IV	Level V
Culture	~ 70	71 ~ 140	141 ~ 210	211 ~ 280	281 ~
KM Process	~ 200	201 ~ 500	501 ~ 800	801 ~ 1100	1101 ~
IT	~ 100	101 ~ 200	201 ~ 300	301 ~ 400	401 ~
Combined Target Management Objects	~ 140	141 ~ 320	321 ~ 500	501 ~ 680	681 ~

4.5.1   **Knowledge Management Maturity Levels**

First the total evaluation scores per target management object were calculated. First the total evaluation scores per target management object (C= culture; P = Knowledge Management Process; T = Information Technology). This was done by multiplying the score given for the item in the survey (SC_{iC} ; SC_{ip}; SC_{iT}) times the Knowledge Management Maturity Level of the corresponding item of the target management object (WC_{iC} ; WP_{iP} ; WT_{iT}). The sum of these Individual scores is the total evaluation score per target management object.

- SC_{ic} = The score for the iC^{th} evaluation item in the Target Management Object Culture
- SC_{iP} = The score for the iP^{th} evaluation item in the Target Management Object Knowledge Management Process
- SC_{iT} = The score for the iT^{th} evaluation item in the Target Management Object Information Technology
- WC_{iC} = The maturity level of the iC^{th} evaluation item in the target management object Culture
- WP_{iP} = The maturity level of the iP^{th} evaluation item in the target management object Knowledge Management Process
- WT_{iT} = The maturity level of the iT^{th} evaluation item in the target management object Information Technology
- C = The number of evaluation items in target management object Culture
- P = The number of evaluation items in target management object Knowledge Management Process
- T = The number of evaluation items in target management object Information Technology

To calculate the overall Knowledge Management Maturity evaluation score according to the proposed Knowledge Management Maturity Model a weighted average will be taken of the three individual evaluation scores of the Target Management Objective. Where the weights used are W_C = 0,4 ; W_P =

0,3 ; W_T = 0,3, these weights were obtained from literature and validated through discussion with experts in the pre-test. The total evaluation scores are presented in Figure 9.
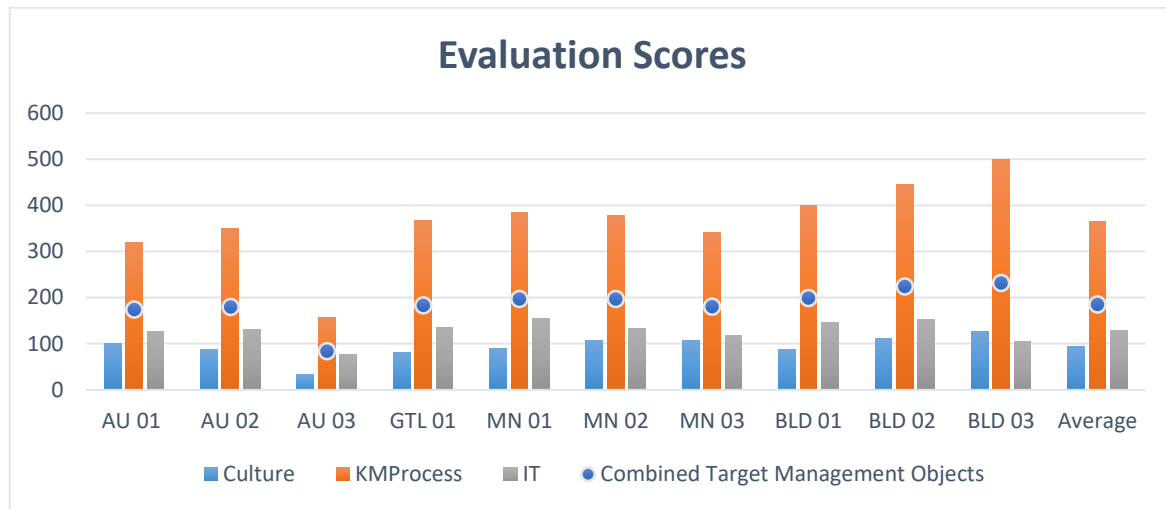
Figure 9: Evaluation scores per interviewee

In Figure 10 the evaluation scores are presented as % of the maximum obtainable score. This is done to illustrate the room for growth and to emphasise the differences between the participants.
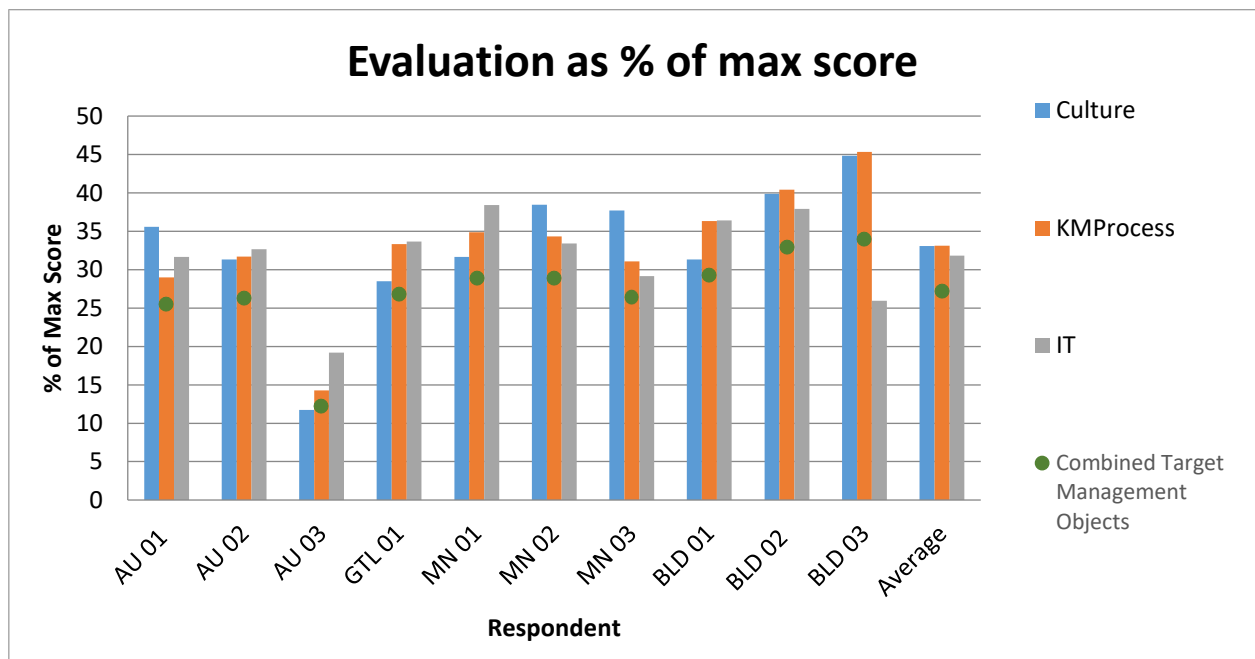
Figure 10: the evaluation scores as a percentage of the maximum achievable score.

Using Table 5 the evaluation scores were converted into the Knowledge Management Maturity levels. The overall Knowledge Management Maturity Level is 2, except for 1 participant (AU 03 which gad an average Knowledge Management Maturity level result of 1) the Knowledge Management Maturity level on an individual level is 2. When looking at the evaluation score range of the combined Target Management Object (141 ~ 320) all scores are at the lower end of the score range. It should be noted that if a larger sample size was taken consisting of non-management participants that the results would be significantly lower than the result of the pilot study.
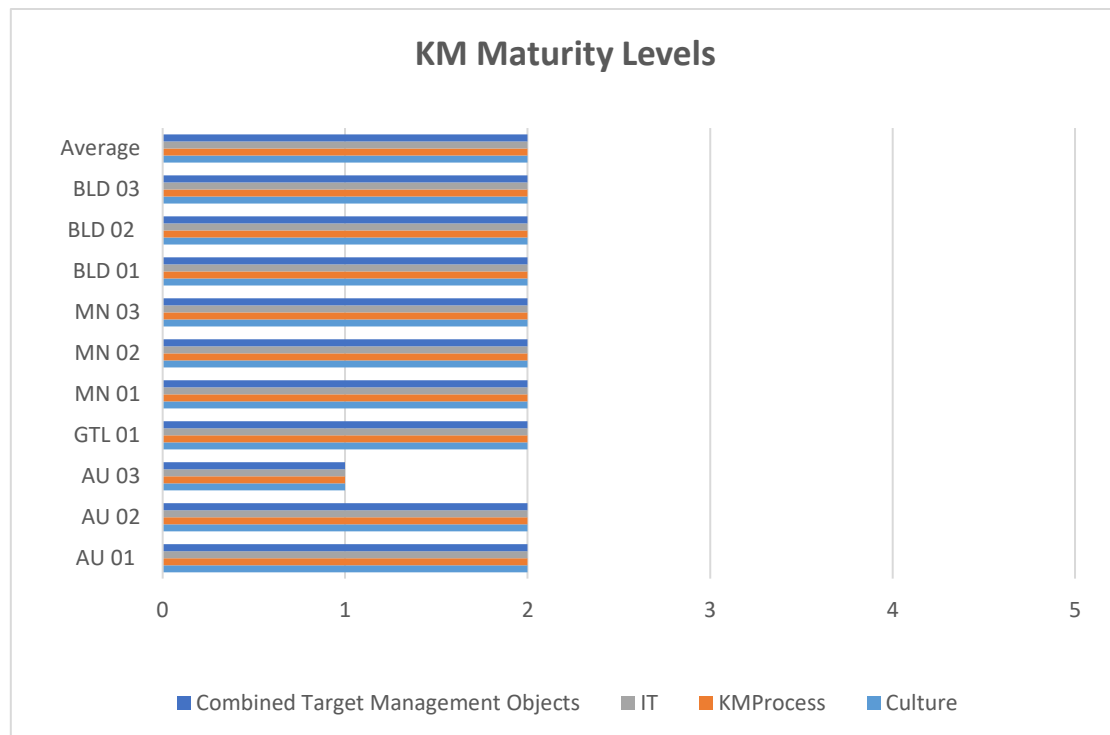
Figure 11: resulting Knowledge Management Maturity levels.

5 DISCUSSION

In this Master Thesis a tool is developed to determine the Knowledge Management Maturity level at DEKRA. The results of each of the three phases of the research project will be discussed in this chapter.

The discussion for the first phase will focus on the selection and tuning of the Knowledge Management Maturity Model and will take place in section 5.1. The pre-test in the second phase will be discussed in section 5.2 and focusses on the comments and errors accrued then. Finally the discussion for phase 3 in section 5.3 will expand per Target Management Object where the organization stands as well as the effectiveness of the questionnaire.

5.1 Knowledge Management Maturity Model selection

From literature three Knowledge Management Maturity Models were presented, the findings from the discussion showed that two lacked the scope and depth that the assignment needed. The General Knowledge Management Maturity Model was set up to be broadly applicable but through its broad appeal was missing some key Knowledge Management concepts like External Knowledge Management. This was reflected in the criteria discussed in section 4.1.1, where the strong point the operationality did compensate for the lack of complexity needed to cover the desired scope.

The Knowledge Management Maturity model proposed by Olivia (2014) had a broader scope and was validated in a quantitative study, however lacked the detail that was called for in the application in one large organisation such as DEKRA. This detail is needed to provide the desired roadmap for improving the Knowledge Management Maturity within the organisation.

The Knowledge Navigator Model proposed by Hsieh et al. (2009) was chosen because of its scope and complexity, as well as the rigour of the study compared to the other two. The fact the Knowledge Navigator Model includes a framework makes it operational as well.

The only criterion where the Knowledge Navigator Model did not score the highest score for the selection criteria is operationality, where the proposed Knowledge Management Maturity Model of Oliva (2014) scored higher. Even though the complexity of the Knowledge Navigator Model was deemed necessary to cover the desired scope it was noted that this would create extra workload not only for the research project but would require extra time from the participants as well. Which is a risk to the quality of the answers given in the survey, since if the participants could lose their focus and the thought behind the answer will decrease.

5.2 Pre-Test

The goal of the pre-test is to further tune the Knowledge Management concepts and questionnaire to the situation at DEKRA, as well as to gather examples from DEKRA practice and find faults. Three experts were interviewed on an individual base. The interviewees concluded that Knowledge Management is part of an ongoing process. Some of the questions had to be reformed in order to emphasize that the processes should continuously support Knowledge Management. In order to make sure that terms in the survey are congruent with terminology of DEKRA certain terms had to be changed and uniformly used like business lines rather than departments or units.

Terms and concepts from the Knowledge Management literature had to be clarified like for example Intellectual Capital, Intellectual Property, Quantitative measures for knowledge processes,

Communities of Practice, Data Warehouse, Tacit Knowledge, Knowledge Base, Artificial Intelligence and Explicit Knowledge.

The major Knowledge Management activities as discussed during the interviews were considered relevant for DEKRA even though they had to be tuned and defined as to make them clear for the participants in the survey.

The discussion about External Knowledge focused on the use within the organization since that is where most improvements can be made. By improving efficiency of the Knowledge Management processes within the organization the use of External Knowledge will be improved as well, due to the changing culture.

5.3 Pilot Study

In this section the results that were presented in section 4.4 are discussed. First the adjustments made in the questionnaire and then the results of the questionnaire itself. During the pilot study the focus was on finding faults and to determine the validity of the questionnaire. In this way we try to demonstrate that the original goal of developing a tool to measure the Knowledge Management Maturity Level at DEKRA is reached.

Participants were able to answer most of the questions, although some needed more clarification of the jargon that was used. Since clarifications and introductions were added as well as examples gathered during the pilot study as well as the pre-test, the questionnaire should be understandable for all employees at DEKRA. One suggestion could be to translate the questionnaire into the native language of the employees to make sure that there are no mistranslations.

Another risk is that if the questionnaire is digitalized and distributed amongst a larger population of participants, people will not read the questions and clarifications carefully enough to understand the questions and answer them properly. This could be mediated by adding security questions like multiple choice questions in which participants give the right definition for the terms they were used in previous questions.

5.4 Pilot study outcome

In this section the results of the questionnaire will be discussed. This should give some insights into the actual maturity level at DEKRA. Even though the pilot study was not large enough to give definitive answer about at what Knowledge Management Maturity Level DEKRA is, however a good assumption could be made. Useful insights are given about the working of the organization.

Even though no significant difference was found or demonstrated between the target management objects it is still useful to discuss them separately. Since this is the best way of developing a road map towards a higher Knowledge Management Maturity Level for the entire organisation.

5.4.1 Culture

Culture is the most important target management object since this will determine if employees will effectively take part in the Knowledge Management Processes and us the IT tools that the organization has developed and implemented.

The resulted Knowledge Management Maturity Level for DEKRA for the target management object culture is between level 1 and level 2. Which means that the employees recognize the importance of

Knowledge Management (level 1), however they are not yet fully aware of the importance of Knowledge Management within DEKRA (level 2). For example BLD 01 commented: "that even though people are able to apply the knowledge, the available knowledge is not always being used". GT 01 commented: "that people are not aware about the available regulations, processes, or communities in place to capture knowledge". Not all Knowledge Management Processes and the importance of them have reached all members within the organization.

5.4.2   Knowledge Management Process

Just as culture the target management object of Knowledge Management Process is between Knowledge Management Maturity level 1 and Knowledge Management Maturity level 2. Which means that in some cases employees still use their own processes to define, share, capture and store knowledge from the organization. In other cases the implemented processes are used which lead to more regular use of those processes.

Partipate AUO1 commented: "that some strategies are communicated but not the way they are implemented". This shows that processes which are rolled out in the organization are not embedded fully and people are not totally aware of the implementation.

5.4.3   Information Technology

Within DEKRA the Knowledge Maturity Level of Information Technology is between level 1 and 2 in line with the Culture and the Knowledge Management Process. Meaning the organization has access to basic computer environment and IT capabilities but is evolving their infrastructure towards the technical environment for supporting Knowledge Management within the organization.

BLD03 commented: "that there is a knowledge management system, but not all data is integrated and used". This is echoed by BLDO1 which indicates that "SharePoint functions and is implemented but is not really used fully at the moment".

5.4.4   External Knowledge

Comments made by the participants made clear that the use of external knowledge within the organization is ad hoc and depends on the individual members of the organization. This is not only reflected within the low overall management maturity level but also in comments like: BLD03 "when people want external training they will seek it out". As well as the fact that the Knowledge Management System does not include all the world wide DEKRA locations.

6　　　CONCLUSION

In this section the separate research questions are discussed as well as the main objective. Finally the limitations and recommendations are given. Since the master thesis project has three separate phases they will be elaborated upon individually.

RQ1: How to select a Knowledge Management Maturity Model from the Knowledge Management Literature that fits the needs of the DEKRA organization?

RQ1.1: What is the role of "External Knowledge" in these Knowledge Management Maturity Models which influences the DEKRA organisation?

The first phase consisted of the systematic literature review which was used to select existing Knowledge Management Maturity Models from literature. The three selected models; General Knowledge Management Maturity Model, the Knowledge Management Maturity Model proposed by Oliva (2014), and the Knowledge Navigator Model.

The three Knowledge Management Maturity Models found were assessed based on pre-determined criteria: Rigour, Relevance, Complexity, and Operationality. Based on these criteria a focus group of relevant stakeholders made the decision to continue with the Knowledge Navigator Model, it was determined that the model was complex enough to be useful to the DEKRA organisation.

The concept of External knowledge was not present in all Knowledge Management Maturity Models found during the Systematic Literature Review. Where it was present it is incorporated throughout the Knowledge Management activities at the different Knowledge Management Maturity levels rather than seen as a separate concept. In the proposed Knowledge Management Maturity Model the same approach is chosen. If the internal Knowledge Management processes are not at the desired level, the management of external knowledge will be inefficient as well.

RQ2: Which Knowledge Management Maturity Model concepts can be tuned to develop a Knowledge Management Maturity Model that is useful to the situation at DEKRA?

RQ2.1: Which Knowledge Management Activities (KMA), addressed in the proposed Knowledge Management Maturity Model, are relevant to DEKRA?

The choices made in phase one were used to identify the Knowledge Management Maturity concepts important to DEKRA. These were then used to tune the Knowledge Navigator Model to be used in the DEKRA organisation. To validate that the Knowledge Management concepts and activities used in the proposed Knowledge Management Maturity Model a pre-test was done.

During the pre-test the Knowledge Management concepts and activities were validated. The pre-test was used as well to find problems with the question in the tool as well as to gather terminology and examples from the DEKRA practice. The terminology and examples were used to enrich and tune the assessment tool, thereby making it operational.

RQ3: Can the tool be used to measure the Knowledge Management Maturity Level in the DEKRA organization?

RQ3.1: Could the tool be used to identify practical examples. Is the terminology and the conceptual structure effective or efficient to reach the Knowledge Management Maturity level?

RQ3.2: Is the terminology and questions from the proposed Knowledge Management Maturity Model evaluation framework interpreted in the way intended by the proposed Knowledge Management Maturity model?

A Pilot study was done in phase three, the study is used to validate the assessment tool that accompanies the proposed Knowledge Management Maturity Model. The feedback gained from the interviews was used to enrich the assessment tool further. Even though a further more widespread study is needed to assess the tool for mass implementation within the DEKRA organisation, the pilot study conducted here shows that the tool can be used to measure the Knowledge Management Maturity level within DEKRA.

The pilot study was used to enrich the tool with practical examples, thereby ensuring an efficient and effective way of determining the Knowledge Management Maturity level. By enriching the tool with practical terminology and examples from the DEKRA practice and adding introductory paragraphs to each Knowledge Management area will help to ensure the questions in the assessment tool are interpreted as they are intended.

The aim of this master's thesis is to develop a Knowledge Management Maturity Model, to determine in which maturity level DEKRA is currently operating and to provide a roadmap to guide them to the desired Knowledge Management Maturity level.

The aim was partially achieved. A Knowledge Management Maturity Model was chosen from literature and tuned to the DEKRA organisation. Due to time and capacity limitations the Assessment tool was only validated in a pilot study with a limited number of participants. Even though the background of the participants were diverse and thus the feedback and results still valid it should be noted that if a pilot study were conducted with a significantly larger population that results may differ.

The results of the pilot study still show in which areas the DEKRA organisation needs to improve. The most significant result being the difference in available information between the different levels of the DEKRA organisation. Which resulted in the different Knowledge Management Maturity level results. This was reflected in the comments made by the participants as well e.g. some were unsure if there even were certain Knowledge Management processes where other participants are sure that they are in place.

6.1 Limitations

The research project is limited to one location of one multinational company in Arnhem, limiting the general applicability of the proposed Knowledge Management Maturity Model to other companies without tuning the proposed Knowledge Management Maturity Model first.

The study was qualitative in nature, which is highly dependent on the people consulted at that moment in time. Steps were taken to ensure a structured approach as described in section 3 to ensure repeatability and validity of the study.

6.2 **Future Research**

The tool should be validated further using a pilot study in a significantly larger population. The wider validation will enable DEKRA to use the tool to reliably assess their Knowledge Management Maturity level. The strengthening of the research through a larger pilot study will enable the follow through on the intended road map by conducting periodic assessment of the current Knowledge Management Maturity level.

Periodic assessments of the Knowledge Management Maturity level will enable the monitoring of the spread of the relevant Knowledge Management knowledge throughout the organisation. From the pilot study it emerged that knowledge about all relevant projects and processes is not equally spread throughout the organisation which was a significant factor in the resulting difference in Knowledge Management maturity levels between the participants from different levels in the organisation.

Future research could also further determine which Knowledge Management Activities and Areas are relevant at DEKRA. Also answering the question how different Knowledge Management Activities influence one another? Which is important to know when developing a more effective roadmap towards a higher Knowledge Management Maturity level.

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APPENDIX I   KNOWLEDGE MANAGEMEN ACTIVITEIS

8   KNOWLEDGE AREAS

8.1   Knowledge Management strategy

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
1.1	Business vision, mission, and task		2	
1.2	Knowledge Management strategy		3	
1.3	The processes or regulations to continually improve Knowledge Management strategy		4	
1.4	The link between business vision, mission and task, and Knowledge Management strategy		5	

8.2   Knowledge Management promotion

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
2.1	Members' recognition of the importance of Knowledge Management	1		
2.2	Managers' commitment to Knowledge Management	4		
2.3	Members' basic concept of implementing Knowledge Management	2		
2.4	The unit (committee or team) to plan or promote Knowledge Management		2	
2.5	The pilot or formal Knowledge Management program		3	
2.6	The Knowledge Management implementing unit (department)		3	
2.7	Members implement Knowledge Management actively and the Knowledge Management activities are embedded in ordinary operating process	5		

8.3 Knowledge Management assessment

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
3.1	The use of quantitative measures and the concept of quality control to assess Knowledge Management activities		4	
3.2	Knowledge Management assessment methods link to the organization performance management		4	
3.3	The overall benefit from Knowledge Management in terms of the improvement on the customer service, the product, and the partner relations, and thus obtain good reputation		5	
3.4	Consider the expense of implementing Knowledge Management activities in annual budget		4	
3.5	The related decision making process will consider the investment return rate of Knowledge Management		5	

8.4 Intellectual capital

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
4.1	Members' recognition of the importance of the Intellectual capital	3		
4.2	Consider the intellectual capital in evaluating the financial performance of the organization		4	
4.3	Try to value the intangible asset		4	

8.5 Knowledge Identify and classification

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
5.1	Members' identification of the knowledge which members are related with		1	
5.2	Members' identification of the knowledge within the organization		2	
5.3	Members' classification of the organization knowledge		2	
5.4	Perform the knowledge audit		3	

8.6 Knowledge sharing

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
6.1	Members have the culture of knowledge sharing, and with the positive attitude	4		
6.2	The regulations or processes to facilitate knowledge sharing		3	
6.3	The regulations or processes to encourage employees to participate projects and share project results		3	
6.4	The regulations or processes to share knowledge with external organizations		5	

8.7 Knowledge capture

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
7.1	Members are aware of where to obtain the knowledge they need		2	
7.2	The regulations or processes to assist members to obtain internal knowledge		3	
7.3	The regulations or processes to assist members to obtain external knowledge		3	

8.8 Knowledge store

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
8.1	Members are able to store files for related material		1	
8.2	The regulations or processes to store files for related material		2	
8.3	Electronically store or deliver related material			2

8.9 Knowledge application

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
9.1	Members are able to apply internal knowledge to accomplish task		3	
9.2	Members are able to apply external knowledge to accomplish task		2	

8.10 Knowledge creation and innovation

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
10.1	Members have creative and innovation culture	3		
10.2	The regulations or processes to encourage members to create		4	
10.3	The regulations or processes to promote innovation		4	
10.4	There always are creative ideas on product, services or the workflows		5	

8.11 Knowledge protection

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
11.1	Members have the concept of knowledge protection	3		
11.2	The regulations or processes of knowledge protection		4	
11.3	The use of intellectual property management system			4

8.12 Knowledge learning and training

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
12.1	Members use every kinds of learning channel to carry on knowledge learning	3		
12.2	The regulations or processes to encourage members' knowledge learning		3	
12.3	Structured on-the-job training project		3	
12.4	The e-learning or related educational training system			3
12.5	The link of the employees' performance evaluation and the learning and training program		4	
12.6	The link of the employee learning and training program and the organizational human resource planning and development plan		5	

8.13 Best practices

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
13.1	Perform benchmarking or best practices		4	

8.14   Communities of Practice (CoPs)

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
14.1	Members' participation of various CoPs	3		
14.2	The regulations or processes to encourage members to participate in CoPs		3	
14.3	The related system for CoPs			3
14.4	The quantitative measures to assess the cost and performance of CoPs		4	

8.15   IT Infrastructure

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
15.1	Members are able to use e-mail, internet or search engine			1
15.2	The integral information system to transfer and deposit information			3
15.3	The database is updated periodically and the content of the database are consistent			2
15.4	Data warehouse			4

8.16 Knowledge Management System

Number	Knowledge Management activities	Target management object level		
		Culture	Knowledge Management Process	IT
16.1	The regulations or processes to construct and maintain Yellow Pages		3	
16.2	The regulations or processes to construct and maintain knowledge map		3	
16.3	Provide knowledge base system			3
16.4	The regulations or processes to acquire internal knowledge to improve the quality and quantity of knowledge in knowledge base		4	
16.5	The regulations or processes or acquire external knowledge to improve the quality and quantity of knowledge in knowledge base		5	
16.6	Provides the system function of sharing tacit knowledge			4
16.7	Provides the system function of supporting individual and group Knowledge Management			4
16.8	System to connect to daily work			4
16.9	System connect to other enterprise system			4
16.10	Provide system function to share tacit/explicit knowledge with external organizations			5
16.11	Use data mining, text mining or other artificial intelligence technology to acquire business intelligence			5

8.17   Survey Questions

Knowledge area	Interview 1	Interview 2	Interview 3
1 Knowledge Management Strategy			1.1 Are there clearly defined business visions, missions, and tasks in place with respect to KM?
2 Knowledge Management Promotion	2.2 Does senior management actively promote KM?	2.2 Does senior management actively promote KM?	2.3 Are members aware of the KM projects which are being implemented? 2.4 Are there formulized written procedures or programs in place for implementing and continuously supporting KM?
3 Knowledge Management Assessment	3.5 Does the decision making process for investment in KM consider the investment return rate of KM?		
4 Intellectual Capital (IC)			
5 Knowledge Identify and Classification	5.2 Is content identified and organized at business unit or domain level?		5.2 Is content identified and organized at business unit or domain level? I.e. can members identify the knowledge in the organization. 5.3 Is organizational knowledge classified by members? 5.4 Are standard measures of KM impact monitored to ensure on-going performance?
6 Knowledge Sharing	6.4 Are there regulations, processes, or platforms to share knowledge with external organizations?		6.2 Are knowledge flow processes embedded in core business processes and domains (i.e. business lines)? 6.4 Are there company regulations, processes, or platforms to share knowledge with external organizations?
7 Knowledge Capture	7.2 Are there regulations, processes, or platforms in place to assist members to obtain internal knowledge? 7.3 Are there regulations, processes, or platforms in place to assist members to obtain external knowledge?		
8 Knowledge Store	8.1 Are members able to store (not find) documents?		
9 Knowledge Application			
10 Knowledge Creation and Innovation	10.2 Are the existing regulations, processes, and platforms to encourage members to generate ideas and create knowledge in the organization?		10.1 Is there a culture of innovation and creativity in the organization?
11 Knowledge Protection	11.2 Do the regulations, processes, or platforms protect knowledge?		
12 Knowledge Learning			
13 Best Practices			

14 Communities of Practice (CoPs)	Are there existing processes, regulation, or platforms to encourage members to participate in CoPs?		
15 IT Infrastructure			
16 Knowledge Management System	16.1 Are there existing processes or regulation to construct and maintain a "who is who" system or platform? 16.2 Are there existing processes or regulation to construct and maintain a knowledge map (a "where is what" system or platform)? 16.7 Does the Knowledge Management System (KMS) support KM between individuals as well as between and within groups? 16.9 Does the system architecture links unrelated knowledge capture and management systems (e.g. Human relation system, customer relation system, the financial management system, and others)?		

8.18   Examples

Knowledge area	Interview 1	Interview 2	Interview 3
1 Knowledge Management Strategy			
2 Knowledge Management Promotion			
3 Knowledge Management Assessment	Example 3.1: measuring the number of: Minutes of meetings distributed Amount of committee work		Example 3.1: Amount of time of committee work Number of auditors with up to date training Example 3.3 KPIs
4 Intellectual Capital (IC)	4.2 Example: Knowledge keepers leaving the company and impacting the financial performance.		4.3 e.g. patents, brands, copyrights, franchises, and software
5 Knowledge Identify and Classification			
6 Knowledge Sharing			
7 Knowledge Capture			
8 Knowledge Store			
9 Knowledge Application			
10 Knowledge Creation and Innovation			
11 Knowledge Protection			11.3 e.g. designs, art, and literary works
12 Knowledge Learning			
13 Best Practices			
14 Communities of Practice (CoPs)			
15 IT Infrastructure			
16 Knowledge Management System			

8.19   Comments

Knowledge area	Interview 1	Interview 2	Interview 3
1 Knowledge Management Strategy			
2 Knowledge Management Promotion			
3 Knowledge Management Assessment			
4 Intellectual Capital (IC)	Intellectual Capital examples Human capital, i.e. the knowledge and wisdom of the employees Structural capital, i.e. the hardware, software, and trademarks left behind in an organisation once the employees have vacated Relational capital; i.e. the relationships build up with customers and stakeholders		Intellectual Capital are all the knowledge resources a company can use to drive profits, attain new customers, create new products, or otherwise improve the business. 4.3: Intangible assets: is intellectual assets which are not physical in nature.
5 Knowledge Identify and Classification			
6 Knowledge Sharing			
7 Knowledge Capture			
8 Knowledge Store			
9 Knowledge Application			
10 Knowledge Creation and Innovation			
11 Knowledge Protection			11.3 Intellectual property refers to creations of minds and is protected by law by e.g. patents, copyright, and trademarks.
12 Knowledge Learning			
13 Best Practices			
14 Communities of Practice (CoPs)			Communities of Practice are a structure for sharing knowledge which lies disperse over individuals, specialists, business units, and locations (Meeuwesen & Berends 2007)
15 IT Infrastructure	Definition of a data wherehouse added: Within business intelligence environment a data warehouse is the system used for reporting and data analysis. It stores current and historical data from one or more sources (e.g. sales, customer relation management, and external sources) and produces business intelligence data using that data.		
16 Knowledge Management System			16.1 Thus are members able to find relevant people in the organization. 16.6 Tacit knowledge consists of mental models, beliefs and perspectives which are not easily captured and/or shared skills (Nonaka 1991). 16.11 Artificial intelligence are software technologies which make a computer perform equal or better than normal human computational ability.

APPENDIX III   INTERVIEW PROTOCOL PILOT STUDY

The interviews are conducted in English or Dutch (and then translated for reporting purposes).

The goal of the pilot study interview is to detect and prevent problems, as well as to validate the survey questionnaire. This is part of the demonstration and evaluation stages in the design science process discussed below.

Introduction of the research

This pilot study is conducted as part of a graduation project of the Master of Science program Operational Management and Logistics at the Eindhoven University of Technology.

During the project a Knowledge Management Maturity Model is proposed build using Design Science research Methodology (Peffers & Tuunanen 2007).

1. Problem Identification and Motivation
2. Define the objectives for a solution
3. Design and development
4. Demonstration
5. Evaluation
6. Communication

Structure of the interview

For analysis purposes <u>the interview should be recorded</u>, the participants should give permission. After the study the recordings will be <u>deleted</u>. After the interview a report will be written to

This is conducted as a semi-structured cognitive interview (Presser et al. 2004) as to detect and prevent problems and validate the interpretation of the survey questions.

After the questions are answered of every Knowledge Area the interviewee will be asked to give his/her interpretation of the question. There is also space to provide examples and comments, this will help in the evaluation and analysis of the interview.

9   QUESTIONNAIRE

Answer Liker scale

0. Don't know
1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly Agree

Notes: place to make notes of examples, problems, and interpretations.

9.1   Knowledge Management strategy

Questions:

Number	Question	Answer
1.1	Are there clearly defined business visions, missions, and tasks in place with respect to Knowledge Management?	
1.2	Is Knowledge Management supplying a direct input to strategic management?	
1.3	Are there existing processes and regulations to continually improve Knowledge Management strategy?	
1.4	Is there alignment between business vision, mission, and tasks?	

Notes:

9.2　**Knowledge Management promotion**

Questions:

Number	Question	Answer
2.1	Is Knowledge Management recognized as a key organizational competence?	
2.2	Does senior management actively promote Knowledge Management?	
2.3	Are members aware of the Knowledge Management projects which are being implemented?	
2.4	Does a cross-functional unit (committee or team) exist to plan or promote Knowledge Management?	
2.5	Are there formulized written procedures or programs in place for implementing and continuously supporting Knowledge Management?	
2.6	Is there a department, area, or effective group dedicated and responsible for the Knowledge Management practices in your organization?	
2.7	Have the Knowledge Management initiatives resulted in the proactive Knowledge Management culture, where Knowledge Management activities are embedded in the organisation?	

Notes:

9.3 Knowledge Management assessment

Questions:

Number	Question	Answer
3.1	Are the knowledge processes measured quantitatively? Example: measuring the number of: • Minutes of meetings distributed • Amount of time of committee work • Number of members with up to date training	
3.2	Are the Knowledge Management assessment methods integrated in the organizational performance management?	
3.3	Do the business metrics (e.g. KPIs) reflect the benefits from Knowledge Management in terms of improvement in customer service, the products, and the partner relations with a resulting good overall reputation?	
3.4	Is Knowledge Management integrated into annual business budgeting cycles and processes?	
3.5	Does the decision making process for investment in Knowledge Management consider the investment return rate of Knowledge Management?	

Notes:

9.4   Intellectual capital

Intellectual Capital are all the knowledge resources a company can use to drive profits, attain new customers, create new products, or otherwise improve the business.

Examples Intellectual Capital (Chetty & Mearns 2012)**:**

Human capital, i.e. the knowledge and wisdom of the employees
Structural capital, i.e. the hardware, software, and trademarks left behind in an organisation once the employees have vacated
Relational capital; i.e. the relationships build up with customers and stakeholders

Questions:

Number	Question	Answer
4.1	Intellectual capital is recognized as essential for the long-term success of the organization?	
4.2	Is the Intellectual capital considered when evaluating the financial performance of the organization? Example: The impact of Knowledge keepers on financial performance	
4.3	Are the intangible assets valued as financial assets? Intangible assets: are intellectual assets which are not physical in nature. e.g. patents, brands, copyrights, franchises, and software	

Notes:

9.5 Knowledge Identify and classification

Questions:

Number	Question	Answer
5.1	Do members know what knowledge is relevant to them?	
5.2	Is content identified and organized at business unit or domain level? I.e. can members identify the knowledge in the organization?	
5.3	Is the knowledge to which the organization has access to classified by members?	
5.4	Are standard measures of Knowledge Management impact monitored to ensure on-going performance?	

Notes:

9.6 **Knowledge sharing**

Questions:

Number	Question	Answer
6.1	Have the Knowledge Management initiatives resulted in a knowledge sharing culture?	
6.2	Are knowledge flow processes embedded in core business processes and domains (i.e. business lines)?	
6.3	Are there incentive systems in place to encourage participation in projects and share the results?	
6.4	Are there company regulations, processes, or platforms to share knowledge with external organizations?	

Notes:

9.7 **Knowledge capture**

Questions:

Number	Question	Answer
7.1	Are members aware of where to obtain knowledge they need?	
7.2	Are there regulations, processes, or communities in place to assist members to obtain internal knowledge?	
7.3	Are there regulations, processes, or communities in place to assist members to obtain external knowledge?	

Notes:

9.8   **Knowledge store**

Questions:

Number	Question	Answer
8.1	Are members able to store (not find) documents?	
8.2	Is knowledge that is indispensable for performing routine tasks documented?	
8.3	Is there any technology and infrastructure in place that enables members to store or deliver related material?	

Notes:

9.9 Knowledge application

Questions:

Number	Question	Answer
9.1	Are members able to apply internal knowledge to accomplish tasks?	
9.2	Are members able to apply external knowledge to accomplish tasks?	

Notes:

9.10 Knowledge creation and innovation

Questions:

Number	Question	Answer
10.1	Is there a culture of innovation and creativity in the organization?	
10.2	Are there existing regulations, processes, and communities to encourage members to generate ideas and create knowledge in the organization?	
10.3	Do the regulations or processes promote innovation?	
10.4	Are there always creative ideas on products, services, or processes in the organization?	

Notes:

9.11 **Knowledge protection**

Questions:

Number	Question	Answer
11.1	Do members recognize the knowledge protection as a key organizational competence?	
11.2	Do the regulations, processes, or communities protect knowledge?	
11.3	Are the required Knowledge management system and/or tools in place? i.e. a system to manage e.g. the Interpretations of certifications, models, and tests amongst others.	

Notes:

9.12   **Knowledge learning and training**

Questions:

Number	Question	Answer
12.1	Do the members use all the learning channels available to support their learning process?	
12.2	Are there existing systems to effectively encourage members' knowledge learning?	
12.3	Is the process for on-the-job training formalized?	
12.4	Is there a technology and infrastructure in place that supports e-learning?	
12.5	Is the learning and training program integrated into the employees' performance evaluation?	
12.6	Are the employee learning and training program aligned with the organizational human resource planning and development plan?	

Notes:

9.13 **Best practices**

Questions:

Number	Question	Answer
13.1	Are the existing benchmarks or best practices actively and effectively utilized?	

Notes:

9.14   Communities of Practice (CoPs)

Communities of Practice are a structure for sharing knowledge which is dispersed over individuals, specialists, business units, and locations (Meeuwesen & Berends 2007)**.**

Questions:

Number	Question	Answer
14.1	Do members' participate in various communities of practice (CoPs)?	
14.2	Are there existing processes, regulation, or platforms to encourage members to participate in CoPs?	
14.3	Is there technology and infrastructure in place that supports CoPs?	
14.4	Are the costs and performance of CoPs measured quantitatively?	

Notes:

9.15   IT Infrastructure

Questions:

Number	Question	Answer
15.1	Are members able to use e-mail, internet, and search engine?	
15.2	Is there technology and infrastructure in place to support the transfer and the depositing of information?	
15.3	Is there a managed database which is standardized?	
15.4	Does the system architecture include a data warehouse? Data warehouse: Within business intelligence environment a data warehouse is the system used for reporting and data analysis. It stores current and historical data from one or more sources (e.g. sales, customer relation management, and external sources) and produces business intelligence data using that data.	

Notes:

9.16 Knowledge Management System

Questions:

Number	Question	Answer
16.1	Are there existing processes or regulations to construct and maintain a "who is who" system or platform? Thus are members able to find relevant people in the organization.	
16.2	Are there existing processes or regulation to construct and maintain a knowledge map (a "where is what" system or platform)?	
16.3	Is there a technology and infrastructure in place that provides a knowledge base?	
16.4	Are there existing regulations or processes to acquire internal knowledge to improve the quality and quantity of knowledge in knowledge base?	
16.5	Are there existing regulations or processes to acquire external knowledge to improve the quality and quantity of knowledge in knowledge base?	
16.6	Does the Knowledge management system (KMS) support the sharing of tacit knowledge? Tacit knowledge consists of mental models, beliefs, interpretations, and perspectives which are not easily captured and/or shared skills (Nonaka 1991).	
16.7	Does the Knowledge Management System (KMS) support Knowledge Management between individuals as well as between and within groups?	
16.8	Is the Knowledge Management System (KMS) tightly integrated with business processes?	
16.9	Does the system architecture links unrelated knowledge capture and management systems where the company has access to (e.g. Human relation system, customer relation system, the financial management system, and others)?	
16.10	Does IT provide system functions to share tacit and explicit knowledge to external organizations?	
16.11	Do IT analytic capabilities provide artificial intelligence to acquire business intelligence? Artificial intelligence are software technologies which make a computer perform equal or better than normal human computational ability.	

Notes:

10   GENERAL QUESTIONS

Q1: What is your opinion on the method?

Q2: Does this model change your perspective on Knowledge Management?

Q3: What did you think about the length of the survey?

Q4: Do you think this will help the organization innovate towards a higher Knowledge Management Maturity level?

Q5: Do you think it needs any adjustments and/or additions?

Q6: How many years in the organization?

Thank the interviewee. Say the interview report will be send to them so they have the opportunity to verify that everything has been correctly interpreted.

APPENDIX IV RESULTS PILOT STUDY

10.1 Feedback and suggestions Pilot study

Knowledge area	AU 01	AU 02	AU 03
1 Knowledge Management Strategy			
2 Knowledge Management Promotion	**2.2** What do you understand to be promotion? **2.4** What is meant with a cross-functional unit is not clear. **2.6 Example**: Global Technical Leaders **2.7** This year it has been officially part of the job description of people. How well people share knowledge strongly depends on the person in the organization.		**Q: How would you define Knowledge Management promotion?** **A:** to know where the knowledge is in the organization.
3 Knowledge Management Assessment	**3.1** The question was not completely clear. **Example**: hours spend are allocated and measured **3.2** The meaning of this question is not clear. The question was difficult.	**3.3** The question needs clarification After reading the questions what do you think about Knowledge management assessment. **3.3** A: the information is available in the organization but it is not communicated to the people that need it to make decisions.	
4 Intellectual Capital (IC)	**4.3** Members are aware that that e.g. brands have value, however most members don't know how intangible assets are valued.		**4.3** examples intangible assets: the KEMA certificate

5 Knowledge Identify and Classification	**5.2** What is the meaning of this question? **5.3** What is meant with "classified by", do you mean confidential?	**5.3** What is meant with classified?	**5.3** Clarification is needed, what is meant with classified?
6 Knowledge Sharing	**6.2:** what are Knowledge Flow processes? **6.3** To what kind of projects is referred to in this question?		**Q: How would you define a knowledge sharing culture?** **A:** having company presentation that informs everybody what is happening in the company.
7 Knowledge Capture	**7.3 Example:** are the educational plans and programs for individual members.		
8 Knowledge Store	**8.1** What kind of documents does the question refer to?		
9 Knowledge Application			
10 Knowledge Creation and Innovation		**10.2** Example: an idea postbox	
11 Knowledge Protection		Q: How do you see knowledge protection in the organization? A: To protect knowledge from external organizations and partners	
12 Knowledge Learning			
13 Best Practices		**13.1** The term best practices needs more explanation and clarification	
14 Communities of Practice (CoPs)	The definition given of CoPs is not clear, further clarification was asked.		The explanation about CoPs was not clear additional explanation is needed.
15 IT Infrastructure	**15.3** To what Database does the question refers to.		

16 Knowledge Management System	**16.6** Tacit Knowledge extra explanation is needed to make the question clear. **16.11** what do you mean with this question, an example would be helpful. **16** What do you refer to as being a Knowledge Management System (KMS), the question assumes there is a KMS in the company.	**16.3** It is not clear what is meant with a knowledge base a definition and clarification is needed	**Q: After reading these questions how would you define a Knowledge Management System?** **A:** a Wikipedia for DEKRA with a searchable IT tool to find the people you need.

Knowledge area	BLD 01	BLD 02	BLD 03
1 Knowledge Management Strategy		Scope needs to be clarified, are the questions about the business line or DEKRA certification as a whole? There is no top down approach.	
2 Knowledge Management Promotion	**Q: after reading these questions, what do you think knowledge management promotion entails?** **A:** a platform to share knowledge.		
3 Knowledge Management Assessment	**Q: What quantitative measures examples do you think of when reading question 3.1?** **A:** Example: the number of people with qualifications		
4 Intellectual Capital (IC)		**5.3** Question is not clear, what is meant with classified? **5.4** Question is not clear, what are standard measures?	

5 Knowledge Identify and Classification		79	**5.3** The question is not clear, what is meant with Classified? **5.4** It is not clear what measures are referred to in the question. Examples of measures: up to date database, the spread of knowledge.
6 Knowledge Sharing	**Q: How would you define a knowledge sharing culture?** **A:** a culture that includes planned weekly trainings, and a forum that enables online discussions.		Example: results dependent reward. **6.4** Example: Webinars
7 Knowledge Capture			
8 Knowledge Store			
9 Knowledge Application			
10 Knowledge Creation and Innovation	**Q: How would you define creativity in the organization?** **A:** finding new solutions/improvements for existing processes, and adapting to external opportunities.		
11 Knowledge Protection	**Q: how would you define knowledge protection?** **A:** Giving knowledge away rather then selling it.	**11.3** It was not clear how to interpret that question.	**11.3** specify whether it is about IT tools. **Q: How would you define knowledge protection?** **A:** To protect the interpretations the organisation has or tests and norms, as well as the knowledge of customers.
12 Knowledge Learning			
13 Best Practices			
14 Communities of Practice (CoPs)			
15 IT Infrastructure			

			Q: How would you define a Knowledge Management System? A: A knowledge Management System should enable the organisation to train and maintain the knowledge of the employees in the organisation, to share knowledge throughout the organisation and with external stakeholders, and to support the operational processes with IT tools.
16 Knowledge Management System	**16.9** Additional explanation for this question is needed.		

Knowledge area	MN 01	MN 02	MN 03
1 Knowledge Management Strategy			
2 Knowledge Management Promotion			
3 Knowledge Management Assessment		**3.1** example: number of hours spend on professional deliberations/meetings.	
4 Intellectual Capital (IC)	**4.2** The question as described here needed more clarification.		
5 Knowledge Identify and Classification	**5.3** The term "classified" needed clarification.		**Q: How do you define classified?** **A:** to keep secret.
6 Knowledge Sharing	**Q: What would you say is a "knowledge sharing culture"?** **A:** To proactively and consciously share knowledge		

		Q: What do you define a cross-functional unit? A: a team between different sections of the business line but not between other business lines. Q: How would you define a knowledge sharing culture? A: People proactively use the tools available to share knowledge.	
7 Knowledge Capture			
8 Knowledge Store			
9 Knowledge Application			
10 Knowledge Creation and Innovation			
11 Knowledge Protection	**11.3** needed further clarification as to what systems or tools are referred to in the question. **Q: What do you see as Knowledge Protection within the organisation?** **A:** to be discrete with the data from clients, as well as the knowledge from DEKRA		**Q: How would you define knowledge protection?** To protect the knowledge and expertise (IC) of the firm.
12 Knowledge Learning	**12.4** Examples of E-Learning: Webinars, online modules (in DEKRApedia)		
13 Best Practices	It was not clear what is meant with best practices, adding a definition and example would help to clarify.		
14 Communities of Practice (CoPs)			**14** example of a CoP in the organization: the weekly staff meetings.
15 IT Infrastructure			

| 16 Knowledge Management System | **16.9** The question was not clear and needed additional explanation.

Q: What do you understand to be a Knowledge Management System now that you have read through all the questions?

A: A system and IT tools that supports and enhances business processes and training of staff. The system should also be able to help the business monitor itself, predict trends, and help the organisation plan. | | **Q: How would you describe a KMS as it should be?**
A: a system where employees can find whom does what. |

Knowledge area	GTL 01
1 Knowledge Management Strategy	
2 Knowledge Management Promotion	**Q: How would you define a cross-functional unit?** A unit involving different employees from different functions and disciplines. **Q: How would you describe a knowledge sharing culture in a firm?** **A:** to work together towards a higher purpose, e.g. hire effectiveness.
3 Knowledge Management Assessment	**Q: What examples can you give of quantitative measures?** **A:** number of courses and trainings.
4 Intellectual Capital (IC)	
5 Knowledge Identify and Classification	**5.3** The question was not clear, needs additional explanation. What is meant with classified?

6 Knowledge Sharing	**6.4** the question is not clear, requires additional explanation.
7 Knowledge Capture	
8 Knowledge Store	
9 Knowledge Application	
10 Knowledge Creation and Innovation	**Q: What would you define innovation?** **A:** To look further then the status-quo, to adapt to new circumstances, and be able to adapt to new technological arears as they arise.
11 Knowledge Protection	**Q: When answering these questions how do you interpret knowledge protection?** **A:** to protect the knowledge of the firm and of its clients.
12 Knowledge Learning	
13 Best Practices	
14 Communities of Practice (CoPs)	**Q: What examples can you give of how COPs are used in the organisation?** **A:** examples: Dekra connect as a tool to support CoPs, and the global technical leaders.
15 IT Infrastructure	
16 Knowledge Management System	**Q: how would you define knowledge management?** **A:** To effectively and continuously share knowledge within the organisation.

10.2 Comments

Knowledge area	AU 01	AU 02	AU 03
1 Knowledge Management Strategy	Hard to answer questions when you do not know if there is a Knowledge Management Strategy. There is a strategy to move to multiple competences and to improve the qualification system but how this is to be implemented is not communicated.		
2 Knowledge Management Promotion	**Q: What do you understand to be a knowledge sharing culture?** A: Where people are open to help other people, by not only answer their questions but really share the knowledge they have in a proactive manner.		

3 Knowledge Management Assessment	Hours are being allocated on a project basis, but afterwards there is no analysis. They are only used in personal interviews to assess where time is spent. **Q: What do you think is meant with Knowledge Management Assessment:** A: Everything what happens in the area of KM and measure the results. Looking at those results and determining the costs and benefits.	**3.2** There are knowledge management assessment methods but they are not integrated in the organizational performance process.	
4 Intellectual Capital (IC)	**4.1** There is a difference between if the organisation think Intellectual Capital are important and if the interviewee believes that the organisation handles IC in a proper way.	**4.2** to stimulate knowledge **4.3** Not sure how this is handled in the organization	
5 Knowledge Identify and Classification	**5.4** The term Measures needs to be explained and example added.	**5.1** people think they know but there is much more available. **5.2** Knowledge is not shared outside of the local department. (Business unit wise and location wise). **5.4** Not monitored especially in the sense of monitoring the number of qualifications. Q: identify and classify A: knowledge is identified however it is not communicated properly	

6 Knowledge Sharing	Measures have been taken to improve the knowledge flow processes. But those measures have not been embedded in the organization, since they are too recent. **6.4** There are no discussions with clients about interpretations etc. However, on a more basic level we do share knowledge via linkedin and newsletters. **Examples:** LinkedIn and Newsletters.	**6.2** There are processes but improvements are needed **6.3** Does not believe in incentivizing people to do their job thus did not answer	
7 Knowledge Capture		**7.2 and 7.3** There are no clear modules or processes, especially not to help with the initial training process of new employees	
8 Knowledge Store	**8.2** manuals and instructions are widely available.		
9 Knowledge Application		**9.2** Difficult questions, improvements can be made but it is hard to admit that there are deficits in your own skills and knowledge.	
10 Knowledge Creation and Innovation	**10.4** there are always ideas in the organisation, but the initiatives are not finished.	**10.1** At our department yes **10.2** You have to search for it yourself, no real processes. **10.3** Not really since we have to conform to norms **10.4** There are always creative ideas in the company	

11 Knowledge Protection	**Q: What do you understand to be knowledge protection?** A: To not give away knowledge to third parties for free and to be discrete with the knowledge and products clients entrust to us.	**11.3** Tools are in place and they are used as well	
12 Knowledge Learning	**12.1 Q: What Learning Channels do exist within the organisation?** I'm not quite sure which are available (I know they exist but don't have a good overview). **12.2** members are encouraged via their personal assessments.	**12.1** People do not know what kinds of learning channels are available. **12.3** In some functions yes, but not for every function	
13 Best Practices			
14 Communities of Practice (CoPs)	**14.2** it is part of jour job description to be part of a COP or not there are no other incentives.	CoP's are not really present at DEKRA as far as I know	
15 IT Infrastructure	**15.3** some of the databases are managed others not.	**15.3** There is not just one system but there are standards **15.4** There is no one central link but you need to use multiple systems	
16 Knowledge Management System	There is a system but it is not used properly.	**16.1** There is a system but it is not ideal **16.2** There are some existing processes **16.6** That is the biggest need of the organization **16.10** for explicit knowledge yes but not for tacit knowledge **16.11** Systems need to be integrated	

Knowledge area	BLD 01	BLD 02	BLD 03
1 Knowledge Management Strategy			
2 Knowledge Management Promotion			**Q: How would you define a cross-functional unit?** **A:** we have Knowledge Model Owners. **Q: How would you describe a knowledge sharing culture in an organization?** **A:** to have webinars and questions that are answers.
3 Knowledge Management Assessment		**3.1** Steered on a project basis, hours allocated and number of qualifications. **3.2** Not a part of the organizational performance. **3.5** For external projects it does however for internal projects it does not.	**3.1** The hours people spend are tracked and measured. **3.2** Organisational vs individual assessment **3.5** For projects the return rate is accessed but for the business processes not
4 Intellectual Capital (IC)	More Human capital will increase the financial performance.	**4.3** Not valued except for self-developed software.	
5 Knowledge Identify and Classification			
6 Knowledge Sharing			**6.2** There are flow processes but elaboration is needed.
7 Knowledge Capture			**7.2** Sharepoint is implemented.
8 Knowledge Store			
9 Knowledge Application	In principle members are able to apply knowledge, but the knowledge is not always being used.		
10 Knowledge Creation and Innovation			**10** there is a culture of innovation and creativity in the people themselves but not in the organisation.

11 Knowledge Protection			
12 Knowledge Learning			**12.1** If people are looking for training they do.
13 Best Practices			
14 Communities of Practice (CoPs)	**14** the definition of COPs was not adequate and needs improved explanation and clarification.		
15 IT Infrastructure	**15.2** Sharepoint does function and is implemented, but it is not really used at the moment.		**15.4** There is a system but not all data is integrated and used.
16 Knowledge Management System	**16.1** An IT tool exists, but it is not maintained and used properly. **16.8** Some integration exists but needs improvement.	**16.8** We are now in a phase where we are focusing on improving the integration.	**16.1** Not all locations and countries are in the system, thus it is still hard to find people. Especially in companies which are acquired and not yet fully integrated. **16.4** There are agreements about those but no support. **16.6** Interpretations are recorded and shared.

Knowledge area	MN 01	MN 02	MN 03
1 Knowledge Management Strategy			**1.4** about the general strategy and implementation of that strategy.
2 Knowledge Management Promotion			
3 Knowledge Management Assessment		**3.3** Such KPI's are not analysed to measure the impact.	**3.1** example: the number of qualifications the employees have.
4 Intellectual Capital (IC)			**4.3** The organization does not have intangible assets.
5 Knowledge Identify and Classification		**5.3** It was not clear what is meant with classified.	

Knowledge area			
6 Knowledge Sharing	**6.3** These are controlled by individual targets and in certain positions (e.g. global technical leaders).		
7 Knowledge Capture			**7.2** there are possibilities in place. **7.3** there is a study budget for employees to follow courses.
8 Knowledge Store			
9 Knowledge Application			
10 Knowledge Creation and Innovation			
11 Knowledge Protection			
12 Knowledge Learning			**12.1** there are not many learning channels.
13 Best Practices			
14 Communities of Practice (CoPs)			
15 IT Infrastructure	**15.2** There exists a basis but not sufficient or adequate.		
16 Knowledge Management System	**16.1** There is a DEKRA shell but it is not user friendly and thus not in widespread use. **16.2** arranged within business lines and differ over the organisation. **16.3** In Business Line Medical it is in place.	**Q: How do you think the organisation should use business intelligence?** **A:** business intelligence should be used to analyse the challenges of our own business and clients to create new products for the academy (teach people to overcome the business challenges their organisation face).	**16.6** Discussions via the KMS are possible. **16.9** There is no strong link between the different enterprise systems.

Knowledge area	GTL 01
1 Knowledge Management Strategy	There is discussion about the KM Strategy but it needs to be formulated.
2 Knowledge Management Promotion	

3 Knowledge Management Assessment	
4 Intellectual Capital (IC)	
5 Knowledge Identify and Classification	**5.2** they are able to after being in the organisation a bit longer.
6 Knowledge Sharing	
7 Knowledge Capture	**7.2** people are not aware of the available regulations, processes, or communities in place.
8 Knowledge Store	
9 Knowledge Application	
10 Knowledge Creation and Innovation	
11 Knowledge Protection	
12 Knowledge Learning	**12** there are a couple of tools in place for training.
13 Best Practices	**13** Not sure about the use of best practices.
14 Communities of Practice (CoPs)	
15 IT Infrastructure	**15.4** a data warehouse is included in the system architecture; however, the systems are not integrated.
16 Knowledge Management System	

10.3   General Questions

10.3.1   AU1

Q1: What is your opinion on the method?

The method is too black and white, the gray area in between is not accounted for enough.

Q2: Does this model change your perspective on Knowledge Management?

Yes,

Q3: What did you think about the length of the survey?

The length of the survey is okay.

Q4: Do you think this will help the organization innovate towards a higher Knowledge Management Maturity level?

It will be able to help the organisation to move to a higher maturity level.

Q5: Do you think it needs any adjustments and/or additions?

Q6: How many years in the organization?

20+ years

10.3.2   AU2

Q1: What is your opinion on the method?

The method is good, however it would be good to add explanations in local languages as to ensure the questions are clear (even better would be to make the entire questionnaire in the local language).

Q2: Does this model change your perspective on Knowledge Management?

Personally not, since I had a strong opinion prior to this interview.

Q3: What did you think about the length of the survey?

It was long, but that is understandable since the subject is important for the organisation.

Q4: Do you think this will help the organization innovate towards a higher Knowledge Management Maturity level?

Hard to say, however there is a great need to improve in the area of knowledge management.

Q5: Do you think it needs any adjustments and/or additions?

The anonymity of the respondent is important.

Q6: How many years in the organization?

10.3.3   **UA3**

Q1: What is your opinion on the method?

It is a good method that asks the right questions.

Q2: Does this model change your perspective on Knowledge Management?

Yes it changed my perspective completely.

Q3: What did you think about the length of the survey?

The length is fine.

Q4: Do you think this will help the organization innovate towards a higher Knowledge Management Maturity level?

Yes, but the results should be used.

Q5: Do you think it needs any adjustments and/or additions?

No

Q6: How many years in the organization?

12 years.

10.3.4   **BLD 01**

Q1: What is your opinion on the method?

Yes, but does it provide the insight we need?

Q2: Does this model change your perspective on Knowledge Management?

Yes, made me think about what we have and how we use it.

Q3: What did you think about the length of the survey?

The length was okay.

Q4: Do you think this will help the organization innovate towards a higher Knowledge Management Maturity level?

It will help, the maturity level should be expected to go higher.

Q5: Do you think it needs any adjustments and/or additions?

Ask question differently or use statements, and provide more actual examples.

Q6: How many years in the organization?

7 years in the organisation

10.3.5   BLD 02

Q1: What is your opinion on the method?

Q2: Does this model change your perspective on Knowledge Management?

Yes, it made me think about knowledge protection and intangible assets.

Q3: What did you think about the length of the survey?

It should not be longer but it is still okay.

Q4: Do you think this will help the organization innovate towards a higher Knowledge Management Maturity level?

It will help to create awareness in the organisation.

Q5: Do you think it needs any adjustments and/or additions?

The scope needs to be more clearly defined, i.e. is the question about the business line or the entire organisation. When questions ask about members then define members of what (business line or the entire organisation).

Questions need additional explanation and clarification.

It would be better to give shorter statements rather then questions.

Q6: How many years in the organization?

8 years in the organization

10.3.6   BLD 03

Q1: What is your opinion on the method?

Relevant, but more explanation is necessary.

Q2: Does this model change your perspective on Knowledge Management?

A couple of things are good to think about e.g. IC.

Q3: What did you think about the length of the survey?

The survey is quite long, and the sentences are long and complicated as well.

Q4: Do you think this will help the organization innovate towards a higher Knowledge Management Maturity level?

It will help to create awareness in the firm.

Q5: Do you think it needs any adjustments and/or additions?

Begin the questionnaire by describing the scope, i.e. the entire organisation or the business line.

Q6: How many years in the organization?

5 years

10.3.7   MN 01

Q1: What is your opinion on the method?.

No opinion.

Q2: Does this model change your perspective on Knowledge Management?

Q3: What did you think about the length of the survey?

The length is okay, but it shouldn't be longer.

Q4: Do you think this will help the organization innovate towards a higher Knowledge Management Maturity level?

It is a good way for the organisation to reflect.

Q5: Do you think it needs any adjustments and/or additions?

Q6: How many years in the organization?

1

10.3.8   MN02

Q1: What is your opinion on the method?

Questions are complicated and require more explanation. the limited awareness in the organisation makes it more difficult to answer the questions properly.

Q2: Does this model change your perspective on Knowledge Management?

No not for me personally.

Q3: What did you think about the length of the survey?

fine

Q4: Do you think this will help the organization innovate towards a higher Knowledge Management Maturity level?

It is only for measuring where the organisation is at the moment, improvements will depend on if the results are used. It will help to create awareness in the organisation.

Q5: Do you think it needs any adjustments and/or additions?

The scope of the questions need to made more clearly (i.e. are the questions pertaining to the entire organisation or the business line).

Q6: How many years in the organization?

2,5 years

10.3.9 MN03

Q1: What is your opinion on the method?

Questions are complicated and require more explanation. the limited awareness in the organisation makes it more difficult to answer the questions properly.

Q2: Does this model change your perspective on Knowledge Management?

No not for me personally.

Q3: What did you think about the length of the survey?

fine

Q4: Do you think this will help the organization innovate towards a higher Knowledge Management Maturity level?

It is only for measuring where the organisation is at the moment, improvements will depend on if the results are used. It will help to create awareness in the organisation.

Q5: Do you think it needs any adjustments and/or additions?

The scope of the questions need to made more clearly (i.e. are the questions pertaining to the entire organisation or the business line).

Q6: How many years in the organization?

2,5 years

10.3.10 GTL 01

Q1: What is your opinion on the method?

Q2: Does this model change your perspective on Knowledge Management?

no

Q3: What did you think about the length of the survey?

Okay, however it should not be longer.

Q4: Do you think this will help the organization innovate towards a higher Knowledge Management Maturity level?

Depending on the results of the survey it could be possible.

Q5: Do you think it needs any adjustments and/or additions?

The survey is already very broad, thus at the moment it should not be longer.

Q6: How many years in the organization?

19 years

APPENDIX V   PROPOSED EVALUATION TOOL

11   QUESTIONNAIRE

Answer Liker scale

6. Don't know
7. Strongly disagree
8. Disagree
9. Neutral
10. Agree
11. Strongly Agree

11.1   Knowledge Management strategy

Questions:

Number	Question	Answer
1.1	Are there clearly defined business visions, missions, and tasks in place with respect to Knowledge Management?	
1.2	Is Knowledge Management supplying a direct input to strategic management?	
1.3	Are there existing processes and regulations to continually improve Knowledge Management strategy?	
1.4	Is there alignment between business vision, mission, and tasks?	

11.2   **Knowledge Management promotion**

Knowledge Management Promotion is about the awareness of the Knowledge Management initiatives, projects, and platforms within the organization.

Questions:

Number	Question	Answer
2.1	Is Knowledge Management recognized as a key organizational competence?	
2.2	Does senior management actively promote Knowledge Management?	
2.3	Are members aware of the Knowledge Management projects which are being implemented?	
2.4	Does a cross-functional unit (committee or team) exist to plan or promote Knowledge Management?	
2.5	Are there formulized written procedures or programs in place for implementing and continuously supporting Knowledge Management?	
2.6	Is there a department, area, or effective group dedicated and responsible for the Knowledge Management practices in your organization?	
2.7	Have the Knowledge Management initiatives resulted in the proactive Knowledge Management culture, where Knowledge Management activities are embedded in the organisation?	

11.3 Knowledge Management assessment

How does the organisation assess and measure its own Knowledge Management activities? Tracking the chosen measures gives the company an overview of its performance.

Questions:

Number	Question	Answer
3.1	Are the knowledge processes measured quantitatively? Example: measuring the number of: - Minutes of meetings distributed - Amount of time of committee work - Number of members with up to date training	
3.2	Are the Knowledge Management assessment methods integrated in the organizational performance management?	
3.3	Do the business metrics (e.g. KPIs) reflect the benefits from Knowledge Management in terms of improvement in customer service, the products, and the partner relations with a resulting good overall reputation?	
3.4	Is Knowledge Management integrated into annual business budgeting cycles and processes?	
3.5	Does the decision making process for investment in Knowledge Management consider the investment return rate of Knowledge Management?	

11.4   Intellectual capital

Intellectual Capital are all the knowledge resources a company can use to drive profits, attain new customers, create new products, or otherwise improve the business.

Examples Intellectual Capital (Chetty & Mearns 2012)**:**

Human capital, i.e. the knowledge and wisdom of the employees
Structural capital, i.e. the hardware, software, and trademarks left behind in an organisation once the employees have vacated
Relational capital; i.e. the relationships build up with customers and stakeholders

Questions:

Number	Question	Answer
4.1	Intellectual capital is recognized as essential for the long-term success of the organization?	
4.2	Is the Intellectual capital considered when evaluating the financial performance of the organization? Example: The impact of Knowledge keepers on financial performance	
4.3	Are the intangible assets valued as financial assets? Intangible assets: are intellectual assets which are not physical in nature. e.g. patents, brands, copyrights, franchises, and software	

11.5   Knowledge Identify and classification

How the organisation identifies and categorises/classifies its own knowledge is important. This enables employees to find relevant knowledge which they need to perform their tasks.

Questions:

Number	Question	Answer
5.1	Do members know what knowledge is relevant to them?	
5.2	Is content identified and organized at business unit or domain level? I.e. can members identify the knowledge in the organization?	
5.3	Is the knowledge to which the organization has access to classified by members?	
5.4	Are standard measures of Knowledge Management impact monitored to ensure on-going performance?	

11.6   Knowledge sharing

Questions:

Number	Question	Answer
6.1	Have the Knowledge Management initiatives resulted in a knowledge sharing culture?	
6.2	Are knowledge flow processes embedded in core business processes and domains (i.e. business lines)?	
6.3	Are there incentive systems in place to encourage participation in projects and share the results?	
6.4	Are there company regulations, processes, or platforms to share knowledge with external organizations?	

11.7　Knowledge capture

Questions:

Number	Question	Answer
7.1	Are members aware of where to obtain knowledge they need?	
7.2	Are there regulations, processes, or communities in place to assist members to obtain internal knowledge?	
7.3	Are there regulations, processes, or communities in place to assist members to obtain external knowledge?	

11.8   Knowledge store

The storage of knowledge is important to ensure knowledge is not lost.

Questions:

Number	Question	Answer
8.1	Are members able to store (not find) documents?	
8.2	Is knowledge that is indispensable for performing routine tasks documented?	
8.3	Is there any technology and infrastructure in place that enables members to store or deliver related material?	

11.9 **Knowledge application**

Questions:

Number	Question	Answer
9.1	Are members able to apply internal knowledge to accomplish tasks?	
9.2	Are members able to apply external knowledge to accomplish tasks?	

11.10   **Knowledge creation and innovation**

Questions:

Number	Question	Answer
10.1	Is there a culture of innovation and creativity in the organization?	
10.2	Are there existing regulations, processes, and communities to encourage members to generate ideas and create knowledge in the organization?	
10.3	Do the regulations or processes promote innovation?	
10.4	Are there always creative ideas on products, services, or processes in the organization?	

11.11 Knowledge protection

Knowledge protection is not only restricted to the intellectual capital of the company itself but also encompasses the information of clients which might be sensitive and is entrusted to the company.

Questions:

Number	Question	Answer
11.1	Do members recognize the knowledge protection as a key organizational competence?	
11.2	Do the regulations, processes, or communities protect knowledge?	
11.3	Are the required Knowledge management system and/or tools in place? i.e. a system to manage e.g. the Interpretations of certifications, models, and tests amongst others.	

11.12　Knowledge learning and training

Questions:

Number	Question	Answer
12.1	Do the members use all the learning channels available to support their learning process?	
12.2	Are there existing systems to effectively encourage members' knowledge learning?	
12.3	Is the process for on-the-job training formalized?	
12.4	Is there a technology and infrastructure in place that supports e-learning?	
12.5	Is the learning and training program integrated into the employees' performance evaluation?	
12.6	Are the employee learning and training program aligned with the organizational human resource planning and development plan?	

11.13   Best practices

Best practices are the habits and activities developed and used by people in the organisation that help them effectively perform their tasks.

Questions:

Number	Question	Answer
13.1	Are the existing benchmarks or best practices actively and effectively utilized?	

11.14 Communities of Practice (CoPs)

Communities of Practice are a structure for sharing knowledge which is dispersed over individuals, specialists, business units, and locations (Meeuwesen & Berends 2007)**.**

Questions:

Number	Question	Answer
14.1	Do members' participate in various communities of practice (CoPs)?	
14.2	Are there existing processes, regulation, or platforms to encourage members to participate in CoPs?	
14.3	Is there technology and infrastructure in place that supports CoPs?	
14.4	Are the costs and performance of CoPs measured quantitatively?	

11.15   IT Infrastructure

Questions:

Number	Question	Answer
15.1	Are members able to use e-mail, internet, and search engine?	
15.2	Is there technology and infrastructure in place to support the transfer and the depositing of information?	
15.3	Is there a managed database which is standardized?	
15.4	Does the system architecture include a data warehouse? Data warehouse: Within business intelligence environment a data warehouse is the system used for reporting and data analysis. It stores current and historical data from one or more sources (e.g. sales, customer relation management, and external sources) and produces business intelligence data using that data.	

11.16   Knowledge Management System

Questions:

Number	Question	Answer
16.1	Are there existing processes or regulations to construct and maintain a "who is who" system or platform? Thus, are members able to find relevant people in the organization.	
16.2	Are there existing processes or regulation to construct and maintain a knowledge map (a "where is what" system or platform)?	
16.3	Is there a technology and infrastructure in place that provides a knowledge base?	
16.4	Are there existing regulations or processes to acquire internal knowledge to improve the quality and quantity of knowledge in knowledge base?	
16.5	Are there existing regulations or processes to acquire external knowledge to improve the quality and quantity of knowledge in knowledge base?	
16.6	Does the Knowledge management system (KMS) support the sharing of tacit knowledge? Tacit knowledge consists of mental models, beliefs, interpretations, and perspectives which are not easily captured and/or shared skills (Nonaka 1991).	
16.7	Does the Knowledge Management System (KMS) support Knowledge Management between individuals as well as between and within groups?	
16.8	Is the Knowledge Management System (KMS) tightly integrated with business processes?	
16.9	Does the system architecture links unrelated knowledge capture and management systems where the company has access to (e.g. Human relation system, customer relation system, the financial management system, and others)?	
16.10	Does IT provide system functions to share tacit and explicit knowledge to external organizations?	
16.11	Do IT analytic capabilities provide artificial intelligence to acquire business intelligence? Artificial intelligence are software technologies which make a computer perform equal or better than normal human computational ability.	