BACHELOR THESIS

The design of an expert profile and the availability of employee expertise sources

UNIVERSITY OF TWENTE.

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Management summary

Motivation and research set up
This summary provides a short overview of the thesis. The research conducted in cooperation with Thales Nederland is focused on designing an expert profile, researching the availability of employee expertise sources and employee expertise management policies. Thales would like to explore the possibility of building expert finding system to cope with fluctuations in demand. Creating a tool that facilitates a temporary increase and decrease in workforce works to that effect. The expert finding system helps to increase efficiency and creates a network for employees. A composite problem-solving approach has been created for the purpose of this research. In this research interviews are conducted with 10 different companies to get a grasp of the current state of employee expertise management. The companies that were part of this research were categorized into small/medium and large sized companies, with the boundary between these two classes at 250 employees. This distinction was made to explain possible variations in the results.

Findings
Expert finding systems that are described in literature use academics as experts. This research is conducted in an industrial environment and therefore the results can be seen as pioneering. The overview of the expert finding process shows how this system could operate in industrial context. Keyword extraction through classification is found to be the most suitable text mining technique for the automatic generation of expert profiles. The visualization technique that is suggested for the expert profile is an adapted version of the histogram visualization proposed by Xun (2015).

The results from literature study and interviews have been combined to create an expert profile (see page 25). The input on features in the expert profile from interviews varied wildly. The features added to the expert profile chosen because they can contribute to making the best match possible. The proposed expert profile could be a point of reference for companies that are developing a system that needs an expert profile. The expert profile has been evaluated with the use of an UTAUT questionnaire.

Furthermore, the research showed that the employee expertise sources that are available within companies have little overlap. In the category small/medium the sources office document, CV and certificates were found to be most available, in the category large these were: office documents, email and CV. Awareness of the need for an employee expertise management policy has been found. Yet, such policies were almost never implemented.

Recommendations
The use of automatic generation of expert profiles should only be implemented for large companies that utilize widely used software tools, such as Workplace by Facebook. As small/medium sized companies have a wide variety of software and sources they use, it is highly expensive to automate this process. Moreover, smaller companies have less sources available, which causes the profiles to not be accurate and comprehensive enough. Therefore, small/medium sized companies should manually fill out the expert profiles, if they were to participate in an EFS. Thales should investigate creating an employee expertise management policy that can be adopted by different companies, as this allows for widely adopted policy that fits the expert finding system.

Table of Contents

Colophon i
Acknowledgements iii
Management summary iv
Table of Figures vii
Chapter 1: Introduction 1
1.1 About the Thales Group 1
1.2 Research motivation 1
1.3 Problem solving approach 2
1.3.1 Comparison 2
1.3.2 Composition 2
1.4 Context analysis 3
1.4.1 Identification of action problem 3
1.4.2 Problem cluster and motivation core problem 5
1.5 Data collection methods 6
1.5.1 Literature research 6
1.5.2 Research setup 6
1.6 Deliverables and knowledge/ research questions 7
1.7 The scope 9
1.8 Reliability and validity 9
1.9 Disclaimer 9
1.10 Readers guide 10
Chapter 2: Expert finding system 11
Chapter 3: Theoretical perspective 14
3.1 Task-technology fit model 14
3.2 UTAUT model 15
3.3 Literature review 16
3.3.1 Text mining 16
3.3.2 Visualization techniques 19
3.3.3 E-recruitment and user profiling 20
Chapter 4: Solution generation 22
4.1 Acquisition research population 22
4.2 (Phone)interview design 22

4.3 Survey design 22
4.4 Research analysis 23
Chapter 5: Results 24
5.1 Expert profile 24
5.2 Employee expertise sources 26
5.2.1 Category small/medium 28
5.2.2 Category large 28
5.2.3 External sources 29
5.2.4 Recommendation sources 29
5.3 Employee expertise management policies 30
Chapter 6: Conclusion 31
6.1 Discussion 31
6.2 Recommendation 32
6.3 Evaluation 32
6.4 Limitations 34
6.5 Contribution to theory and practice 35
6.6 Future research 35
References 36
Appendix 39
A.1 Approach systematic literature review 39
A.2 MPSM and Design Science extensive comparison 40
A.2.1 Managerial problem-solving method (MPSM) 40
A.2.2 Design science 41
A.2.3 Comparison 42
A.2.4 Conclusion 43
A.3 Definitions 44
A.4 Interview design 46
A.5 Interview summaries 47
A.5.1 Interview Company 1 summary 47
A.5.2 Interview Company 2 summary 48
A.5.3 Interview Company 3 summary 49
A.5.4 Survey Company 4 Summary 50
A.5.5 Survey Company 5 Summary 50

A.5.6 Interview Company 6 summary 51
A.5.7 Phone interview Company 7 summary 52
A.5.8 Interview Company 8 summary 53
A.5.9 Phone interview Company 10 summary 54
A.6 Transcripts 55
A.6.1 Transcript Company 6 55
A.6.2 Transcript Company 2 60
A.7 UTAUT-questionnaire 71
A.8 Survey Expert Finding Systems 73
A.9 Explanation employee expertise sources 75

Table of Figures

FIGURE 1: EFS ILLUSTRATION 3
FIGURE 2: PROBLEMS CONCERNING THE IMPLEMENTATION OF AN EFS 4
FIGURE 3: CORE PROBLEM ANALYSIS 5
FIGURE 4: OVERVIEW EXPERT FINDING 12
FIGURE 5: TASK-TECHNOLOGY FIT 14
FIGURE 6: UTAUT MODEL 15

Chapter 1: Introduction

In this section, I will briefly describe what topics will be discussed in this thesis. The bachelor assignment that I have acquired, has been executed in collaboration with Thales Nederland. This thesis researches what sources are available for expert finding systems (EFS), within industrial context, and what the design of an expert profile should look like. EFS's are a means for locating a particular expertise that can be matched with a request for expertise to help solve a problem.

1.1 About the Thales Group

First, I will give a general description of what Thales[1] is about. Thales is a high-tech company that delivers tailor-made solutions to very specific problems. Thales is concerned with five key sectors: defense and security, space, ground transportation, aerospace and digital identity and security. In the Netherlands, they are well-known for their state-of-the-art radar and communication systems and their role as supplier to the government. During my internship at Thales, Gemalto has been acquired, adding 15 000 employees to the Group's workforce. Gemalto is mainly concerned with digital identities and authorization in the digital domain. This acquisition fortifies the ambition of creating a safer world.

1.2 Research motivation

Nowadays, high tech companies are competing on a tight labor market for well-educated personnel. Thales has come to realize that the "old fashioned" recruitment methods no longer suffice. Thales' workforce is struggling to keep up with the growth of order acquisition. If a local EFS would be established in Thales' region, they might be able to cope with the growth in demand more easily. More flexible allocation of expertise, not just within in a company, but within an entire region, could be beneficial for all parties involved.

Moreover, an EFS has the potential to increase efficiency in any number of processes within a company and therefore reduce the increased labor-per-employee pressure. EFS's can increase efficiency through faster localization of the appropriate expertise to answer questions that would otherwise require longer to be resolved. For example, an engineer that works on a job that he does not yet have the right knowledge and skills for, could spend weeks of gaining this expertise in this field without being productive. If there were an EFS available for this employee, he could have located an expert on this subject, who could have helped him acquire the needed expertise to proceed more quickly. Thus, saving time and being more efficient.

The network feature of the EFS allows its users to get in contact with people outside their known associates circle. Especially for new employees in a large company, that do not yet know their colleagues, an EFS could also provide social interaction and the beginning of new relations.

The last reason for introducing an EFS is to improve customer satisfaction. By being able to respond more quickly and more properly to new demands that arise within the market, a better service can be delivered. This customer-oriented approach will give the user of an EFS a competitive advantage. This is an indirect consequence of an EFS.

[1] Thales Group, Retrieved from URL: https://www.thalesgroup.com/en/global/about-us

1.3 Problem solving approach

The problem-solving approach that is chosen, is a composite method. Both the managerial problem-solving method and the design science are combined to create a suitable problem-solving approach.

The MPSM provides a step by step structure to tackle business related problems through research. This method consists of seven steps. This method is developed by Heerkens and Van Winden. Design science is a method designed for the creation of constructs, methods, models and instantiations (Peffers et al., 2008). Many researchers have investigated the application of design science within engineering context. Ken Peffers has made a commonly accepted framework for design science within the information system industry. He proposes a mental model to structure a research. This design science consists of seven steps. An extensive analysis of both methods can be found in the appendix A.2.

1.3.1 Comparison

The first stage is similar for both methods, as is the second. The third stage of the MPSM is a more detailed analysis of the problem, which is included in the first two phases of the design science approach. The fourth stage is where the purpose of both methods gives way for differences. The development of an artifact needs more emphasis on the actual design and development. More specifically, the design of one solution. The MPSM focusses on more than one solution. This causes the next phase to be different as well. A solution choice must be made in the MPSM approach, this is not needed in the design science approach, as there is just one solution. The demonstration and solution implementation phase are similar. The communication phase is solely implemented in the design science. An overview is given in table 1.

Table 1: MPSM compared with Design Science

	MPSM	**Design Science**
Phase 1	Problem identification	Problem identification and motivation
Phase 2	Solution planning	Define objectives of a solution
Phase 3	Problem analysis	**X**
Phase 4	Solution generation	Design and development
Phase 5	Solution choice	**X**
Phase 6	Solution implementation	Demonstration
Phase 7	Evaluation	Evaluation
Phase 8	**X**	Communication

1.3.2 Composition

Both approaches have characteristics that the other does not. As this thesis is concerned with the actual design of an expert profile, the design science is the more logical choice. However, the MPSM could complement the design science such that it will be more comprehensive. Therefore, a composite of both methods will be utilized in this research. This composite method will consist of phase 1, 2, 3, 6 and 7 of the MPSM, and phase 1, 2, 4, 6, 7 and 8 of the design science approach. This approach is showed in Table 2.

Table 2: Composite method

	Composite MPSM/ Design Science
Phase 1	Problem identification/ Problem identification and motivation
Phase 2	Solution planning/ Define objectives of a solution
Phase 3	Problem analysis
Phase 4	Solution generation/ Design and development
Phase 5	Solution implementation/ Demonstration
Phase 6	Evaluation
Phase 7	Communication

1.4 Context analysis

EFS's are designed to link a person with a need for expertise to an expert that has knowledge and experience in the requested area of expertise. An EFS can function through intermediation of a human, as was the case in some of the researched companies. However, this is outside the scope of this thesis. This thesis will be limited to the automatic functioning of EFS. In these systems, software must be available to automatically process the input and produce the output.

An EFS will look for matches based on an algorithm. In Thales' situation, the preferred setting for the EFS is to display three matches to the person requesting the expertise. However, EFS generally do not provide options. A visualization of the general functioning of an EFS is presented in figure 1.

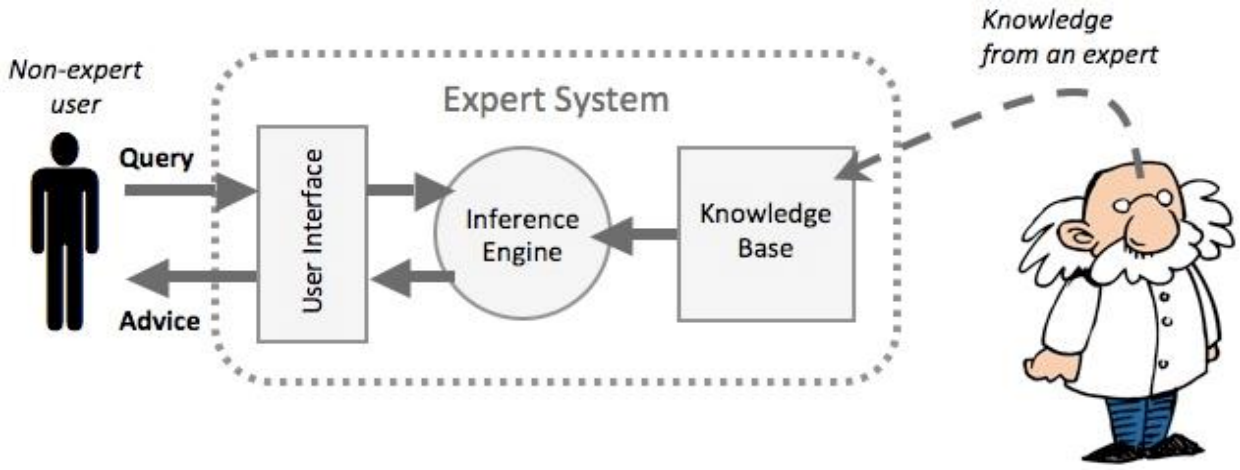

Figure 1: EFS illustration

1.4.1 Identification of action problem

In the introduction, the problem was briefly described. In this section, further elaboration will be done to properly specify the action problem. Subsequently, the norm and reality are discussed.

In literature, the automatic generation of the expert profiles is done via text mining. Text mining software will go through academics' theses and automatically produce a profile. In Thales' case, the

expert profiles need to be both human and machine readable. It needs to be machine readable for the EFS to match the expert profiles with the processed request. The human readable aspect is a prerequisite, because the person that requested the expertise must make a choice between the three experts suggested by the EFS. This is not necessarily based on the highest match quotient. The expert profiles contain more than just the areas of expertise. For example, a feature of the expert profiles could be the hobbies of a person. The choice between the suggested experts is more likely to yield successful cooperation if the persons involved also match on a personal level. The situation where this EFS is operating successfully is the norm. Currently, the suggested EFS is an idea and is therefore not functioning, this is the reality.

A significant difference that separates this thesis from previous research in this field, is the context which it operates in. Earlier research has mostly made use of academics as experts. This enabled the theses text mining approach. This thesis will focus on the application of EFS within industrial context, more specifically, in the industrial region surrounding Thales Nederland, Hengelo. Consequently, there are a lot of experts, that have not written a thesis. Even if they have written a thesis, it is likely that additional knowledge is acquired, and the profile would be incomplete if the traditional approach would be used. Moreover, the employee expertise sources available within industrial companies vary widely. Therefore, the automatic generation of the expert profiles is difficult to execute. This is the action problem.

Problems concerning the implementation of EFS in industrial context is depicted in figure 2.

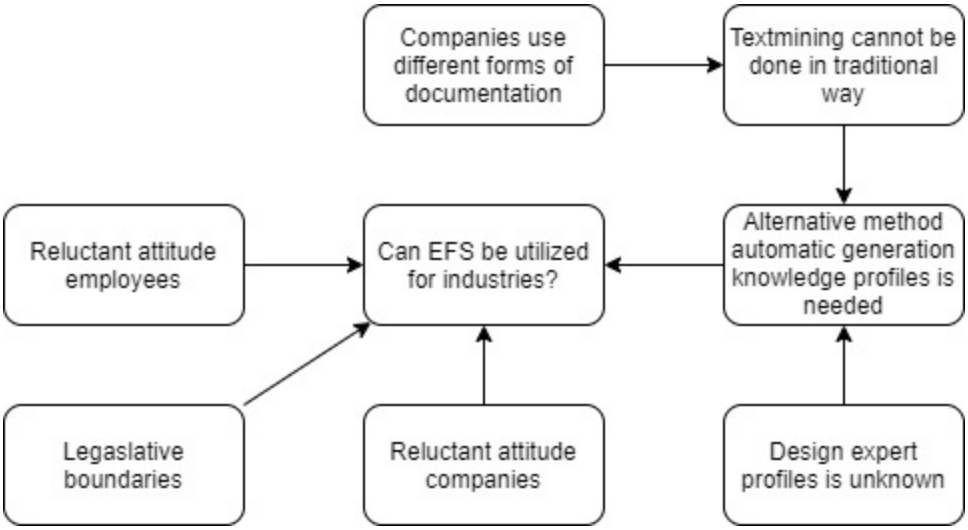

Figure 2: Problems concerning the implementation of an EFS

The reluctant attitude of employees towards the acceptance of the usefulness of such a system is a problem to be considered. From a psychological perspective, it is likely that employees will oppose this new approach to problem-solving, as most people dislike change. Moreover, contacting new people is difficult for some people. Therefore, leaving the comfort zone of working with known colleagues and cooperating in an unfamiliar environment is not obvious for all people.

The same logic can be applied to the acceptance of the companies involved. Allowing employees to possibly aid other companies, possibly competitors, by providing confidential information will have to be

legally excluded. Moreover, an EFS should operate within the confines of international and national legislation. It will take open-minded influential initiative takers to start this process.

Another possible problem could be of administrative nature. For example, a company as Thales could need an expert for two months to assist in a project. Can this person work for another defense related company shortly after? Moreover, EFS will not be accepted if it is used as a recruitment tool for companies. The possibility of losing your workforce by poaching of competitors with an EFS contributes to the reluctant attitude of companies as well. These are issues that need to be dealt with before successful implementation could be achieved.

1.4.2 Problem cluster and motivation core problem

The problem cluster shows the causes and consequences of problems that contribute to the action problem. The action problem is the problem perceived by the company. Thales would like to successfully implement an EFS. There are several problems that contribute towards an unsuccessful implementation.

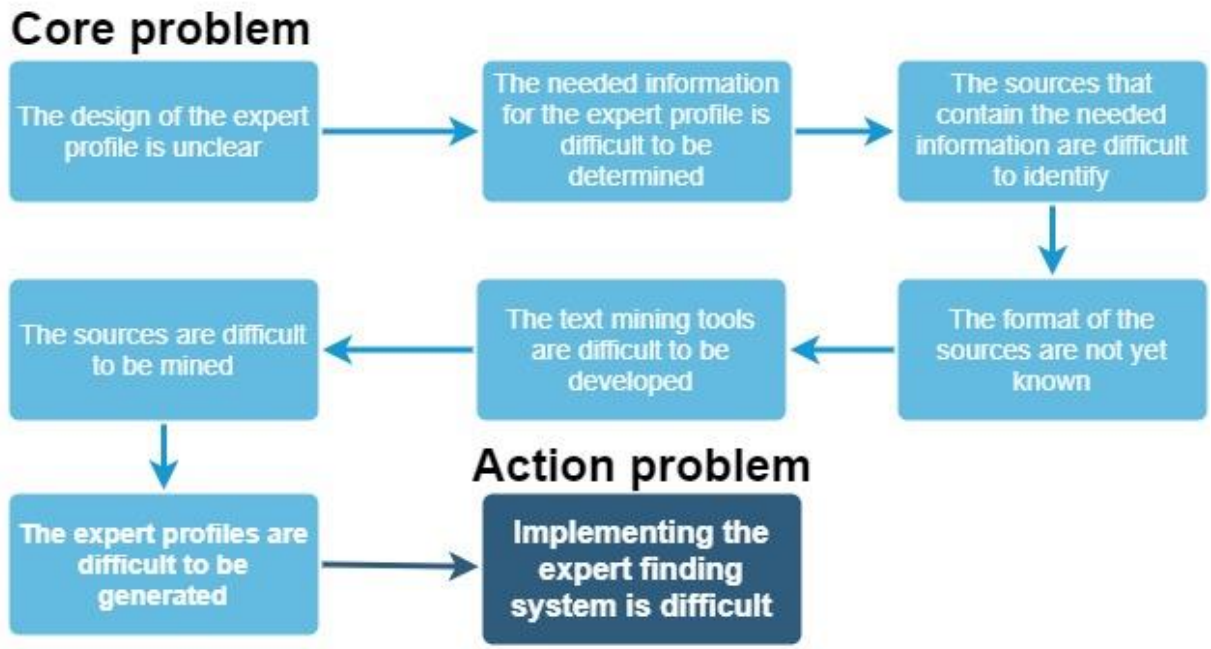

Figure 3: Core problem analysis

As stated before, generating the expert profiles is a crucial part of the functioning of an EFS. However, these cannot be generated at the current state of development. Mainly because it is not clear what information should be included in the expert profile. This has several consequences. Firstly, as it is unclear what should be included in the profile, the required information is also unknown. The sources cannot be identified because the information that should be in the sources is the still unknown. Consequently, it is not known which format the sources have. Therefore, the software that should mine the sources cannot be developed, causing the sources not to be mined.

Moreover, companies use heterogenic sources and therefore multiple software approaches should be developed. If this research finds that the variety of source format is very wide, causing the need for many software approaches, Thales will consider this expensive and an EFS may not be developed.

The core problem is the unclear design of the expert profiles, as this is at the very basis of the problem. This is the initial cause, that needs to be solved before the other problems can be solved. The profile will contain information such as an employees' competencies, skills, knowledge and hobbies. The EFS will generate scores for these aspects of the expert profile. The matching software will use these scores to match a search query with a profile.

1.5 Data collection methods

In this section, the data gathering methods that are used, are discussed.

1.5.1 Literature research

The expert profile that is created is compiled by a combination of the interviews and the information gathered from literature research. Relevant articles are found by entering synonyms of search terms in different scientific databases such as Scopus. Google Scholar is used as a complimentary source to locate information. Several research questions are answered through literature research and this provides the context for the results of the research.

1.5.2 Research setup

The main task in interviewing is to understand the meaning of what the interviewees say. A qualitative research interview seeks to cover both a factual and a meaning level (Kvale,1996). Interviews are particularly useful for getting the story behind a participant's experiences. The interviewer can pursue in-depth information around the topic. (McNamara,1999). This research exists of 5 standardized open-ended interviews, 2 surveys and 2 standardized open-ended phone interviews**,** conducted with different external companies. All these companies have an office located in the Eastern part of the Netherlands. An adapted version of the standardized open-ended interview procedure as specified by Turner is followed. This procedure consists of the following steps: preparation, selecting participants, pilot testing, implementation, interpretation and conclusion (Turner, 2010). Creswell argues that the difficulty of coding the data is the main weakness of standardized open-ended interviews, as the participants explain their views in as much detail as they desire (Creswell, 2007). In this research, the transcripts aren't coded, as the difficulty of this task does not outweigh the limited value it would contribute to the research.

Thales is added in the research population, the findings of Thales are obtained via discussions with Dr. K. Nieuwenhuis. The standardized open-ended interview approach is chosen, as this allows the interviewer to direct the interviewee towards to information that is needed but provides the interviewee with enough freedom to reflect his or her vision of the situation that is discussed. The interviews had three main aims:

- to identify what should be included in an expert profile
- to identify employee expertise sources
- to determine the presence of an employee expertise management policy (EEMP) in these companies, categorized into small/medium and large.

The boundaries set to these categories are determined by the number of employees working at a company. These can be found in Table 3. 250[2] is chosen as this is the number used by MKB for separating small and medium from large. The number of employees is taken and not the number of

[2] MKB-Nederland, retrieved from URL: https://www.mkb.nl/wordlid

fulltime employees (FTE). This has been done because the purpose of the interview is to identify commonalities in employee expertise management of different categories. Employee expertise management is applicable to each employee and it therefore does not matter whether this is an FTE. Moreover, the interviewees were better equipped to estimate the number of employees rather than the number of FTE. As the research focused on what information was available on their own personnel, and some researched company's business's depend on secondment, the seconded employees were not counted towards the number of employees.

Table 3: Categories

Number of employees	Category
0 - 250	Small/ Medium
> 250	Large

If the results of the interviews show that companies have not yet implemented an employee expertise management policy, but are developing this, they are counted as "not having an employee expertise management policy". These EEMP's are still agile and if Thales were to implement an EFS, these companies can easily adjust their EEMP to fit the EFS. Therefore, the 'in-development' policies are counted as not having an employee expertise management policy.

1.6 Deliverables and knowledge/ research questions

The main research question that will be answered in this thesis is:

How can the generation of expert profiles, in an industrial environment, be executed with the use of heterogenous sources?

To answer this main research question, the problem is divided into the following sub questions, which together answer the main research question:

1. What is an expert finding system?

For a better understanding of this research field it is important to know how an expert finding system works and to what purpose it operates. The answer is based on literature research, interviews and the discussions on expert finding systems with several experts.

2. What information should be included in the expert profile?

This sub question will determine what aspects should be included in the expert profile and which should not. It will consist of different topics that are considered the knowledge and skills of this person. Besides this, personal preferences such as hobbies can also be considered. This information will be obtained through literature research and be complemented through interviews.

3. What employee expertise sources are available in companies?

This sub question will be answered through interviews. First a list of possible sources will be created. Subsequently, interviewees will be asked to confirm the existence of these sources and think of additional sources. This list serves as benchmark for the feasibility of the EFS's development, as the magnitude of the different formats determines whether Thales will pursue the actual implementation.

4. What text mining approach is most appropriate for transferring employee expertise found in company sources into an expert's profile?

To automatically obtain knowledge from these employee expertise sources, a proper software tool must be developed. To extract the information, the most appropriate text mining technique must be found. This question will be answered through a systematic literature review. A variety of techniques will be discussed and a recommendation for this particular application will be given.

5. What kind of techniques are available to visualize employee skills and knowledge?

The expert profile must be both machine and human readable. To make this profile clear and easy to read, a visual representation of the proficiency level can be used. This question will be answered by reviewing literature and summarizing possible visualization techniques.

6. How to design an expert profile based on various digital sources?

This question can partly be answered by literature research and partly by interviews. During the research, it will be become clear what information should be included in the expert profiles and what sources are available. Literature research on e-recruitment and user profiling is done and used besides the interview results to design the profile. This will determine how the expert profile should be designed.

7. Is the frequency of the availability of employee expertise management policies different for large companies, compared to small and medium sized companies?

Knowing what employee expertise management policies companies have, could provide insight into how employee expertise is documented. If there are similar policies, an approach to incorporating these policies into the EFS's automatic expert profile generation can be made. A difference of the availability of these policies between small/medium sized and large companies may influence the exclusion criteria for the companies. It is expected that the larger a company is, the more extensive the employee expertise management policy is.

Sub question 1 and 6 are answered through a mix of interviews and literature research. Sub question 2, 3 and 7 will be answered through research, and sub question 4 and 5 will be answered through a literature review.

The deliverables are the products that are provided to Thales at the end of the internship, and the thesis itself. For Thales, knowing what sources are available within companies, is the most important deliverable, as it is essential towards the further development of the EFS. These are gathered through interviews and the diversity of the formats corresponding to these sources will determine whether it is feasible for Thales to develop an EFS, that utilizes automatically generated expert profiles. Every different format requires a different piece of software and is therefore expensive. A recommendation on what the best method is to transfer the employee information into a profile will be given as well. This will be done in the shape of a systematic literature review. The design of an expert profile is also a deliverable. Finally, an overview of possible visualization techniques for the expert profile will be provided.

1.7 The scope

This section determines which aspects are researched and which are left out. In the development of an EFS lots of parts can be defined. The design of the profile, text mining techniques and available sources, that contain information that can be mined for the expert profiles, are aspects that are considered in this research. There are several obstructions towards the successful implementation of an EFS. In this research, only the path from the core problem towards the action problem is considered. Moreover, only EFS's that function automatically are considered, as implementing this on large scale will be infeasible for manual expert matching. Furthermore, the research is done in industrial context. Specifically, in the eastern part of the Netherlands, for companies small/medium and large that have human resources or software development employees.

1.8 Reliability and validity

Reliability means performing consistently. In this research a few factors can vary if performed several times. To create reliability, the research methodology is carefully constructed. Following this procedure will lead other researchers down the same path and therefore it is likely that similar results will be obtained. These results may vary slightly, as a result of different population individuals and interpretations, but overall the results are likely to be similar.

Three types of validity are discussed: internal, construct and external. Internal validity is concerned with the soundness of the research design. That means that the research questions are aimed at addressing the gap, specified in the problem analysis. The execution of the research allowed the research questions to be answered, confirming the validity of the research questions. The construct validity deals with the link between the scientific body of knowledge and the proposed research. The results from theory are validated during the interview stage. Due to contradicting interviews, the construct validity is slightly compromised.

The interview is validated in two steps, first the proposed questions are discussed with the supervisors from Thales Nederland and the University of Twente. Secondly, after three interviews a check is done whether the questions are yielding the desired results. This was the case, so the questions were not modified. The external validity determines whether the research holds outside the scope of the research. This research is executed in a specific region and therefore it is questionable if the results will be similar when the same research is executed in another region.

1.9 Disclaimer

Personal information such as names and pictures that are suggested for use in the expert profile require consent. Therefore, all the information discussed in this thesis should be checked with the GDPR guidelines.

1.10 Readers guide

This thesis will be structured according to a composite method, consisting of the design science principle and the managerial problem-solving method (MPSM). This choice is motivated by the fact that both methods partially fulfill the required structure. An overview of the composite method can be found in table 4. The creation of this combination of methods is explained in the appendix A.2.

Table 4: Composite method

Chapter/Section	**Research question**	**Composite MPSM/ Design Science**
Chapter 1.2, Chapter 2	RQ1	Problem identification/ Problem identification and motivation
Chapter 1.5, Chapter 3	RQ 4, RQ 5 and RQ 6	Solution planning/ Define objectives of a solution
Chapter 1.4, Chapter 2	RQ 1	Problem analysis
Chapter 4	RQ 4	Solution generation/ Design and development
Chapter 5	RQ 2, RQ 3 and RQ7	Solution implementation/ Demonstration
Chapter 6	Main RQ	Conclusion/ Evaluation
N.a.	N.a.	Communication

The first phase of this method identifies the problems and discusses the motivation for the research. The second phase plans the research, giving a detailed approach towards a solution. The problem analysis extracts the core problem from the problem cluster. The solution generation phase describes how the research design has been executed. It is explained how the interview questions are created. The design of an expert profile is the solution implementation. This design and results of the interviews are discussed in the evaluation phase. The communication phase consists of the colloquium, where the research is defended, and the publication of the thesis itself.

Chapter 2: Expert finding system

In this section, the research question: "What is an expert finding system?" is answered. The answer is based on literature, the interviews and discussion held with experts on expert finding.

Finding experts who have the appropriate skills and knowledge for a specific research field is an important task in academic activities (Yang et al., 2008). Most of the research on expert finding system is done in academic context. This research is focused on EFS's that operate in an industrial setting and can therefore be considered as pioneering. An EFS enables users to discover domain or subject matter experts in order to hire or acquire their knowledge (Maybury, 2006). This is a general description of an EFS' functioning. In this section, the EFS as seen fit for the purpose of this research is described.

The process of expert finding is depicted in the figure 4. The process is initiated when a problem description is filled out. This problem description is used to determine which expertise is required, this consists of fixed and unstructured textual data entries. The next step is for the system to retrieve the problem statement and analyze it. The problem statement's unstructured text is analyzed and converted into a criteria set of indices, that is used to search the expert profiles database, that is filled with individual expert profiles (Yang et al., 2008). This database may contain links to data sources such as office documents and resumes that provide more textual data that can be analyzed. Part of these data sources may be provided by the candidates, when the system is used to upload a profile. Other data sources may be added by the company and accessed by some EFS logic in the processes of trying to match a question with a profile. Using the criteria derived from the problem statement to search through the database, matches can be made. A list with the best candidates to answer the query are provided to the expertise seeker, based on a ranking algorithm (Kavitha et al., 2014). The strategy to follow during the matching step can be adjusted as needed, so that immediately available (but less competent) experts are preferred over more competent experts, which may be unavailable (Metze et al., 2007). This person can choose an expert and retrieve the coordinates of that expert to contact him/her. This will end the matching process. However, if the expertise seeker is not satisfied with the provided matches, a new problem statement can be entered, and the process will start again.

An EFS uses expert profiles to display the knowledge and skills of the expert. These profiles are set up through two flows of information. The experts manually put in information which is complemented with mining of employee expertise sources (Yang et al., 2008). Experts fill out fixed subjects such as name, education and contact information. Furthermore, they are invited to type a piece of text that they think covers their expertise. This unstructured text inflow is restricted with a minimum and a maximum of data entries. This allows the software to extract the information in a similar fashion between different expert entries. The inflow of information provided by the employee expertise sources is analyzed by means of text mining. These sources may differ for every company, causing the need for multiple approaches. These pieces of software combined with the manual inflow make up the expert profiles.

These profiles must be updated in periods of time. A time window of 2 years is proposed. The experts must update the part that they manually filled out. It seems unreasonable to bother experts with this task repeatedly, whilst their knowledge and skills have not changed significantly. On the other hand, knowledge fields are changing rapidly, and an up-to-date profile provides a better match (Cantwell & Salmon, 2018). Balancing these two factors results in a two-year window.

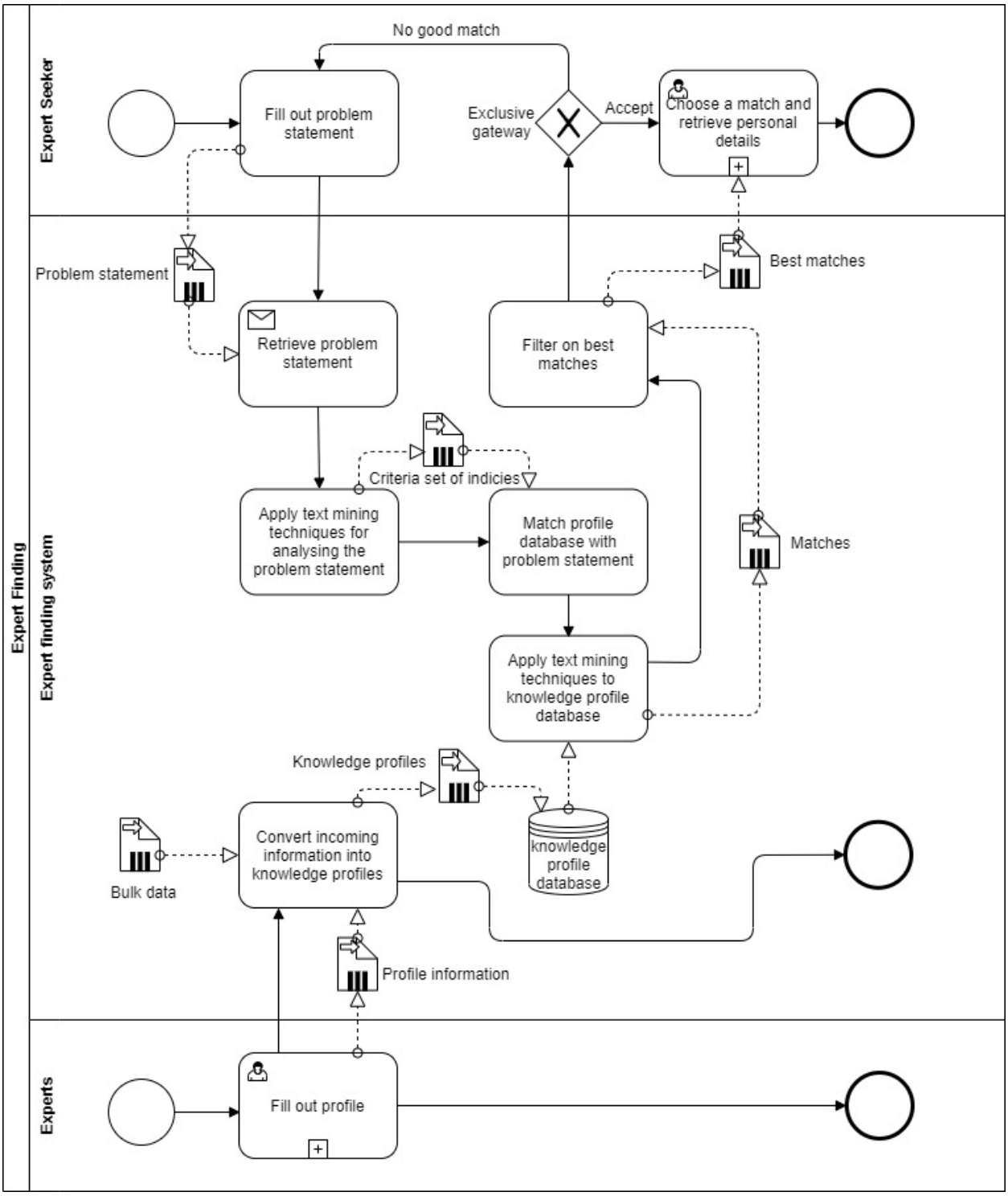

Figure 4: Overview expert finding

EFS are often used inside one company, if that company is big enough to have enough experts available (Metze et al., 2007). However, an EFS can also be used as a system across different companies, which is what Thales is looking into. The proposed EFS in that case is an external system, which means it does not only match within an organization, but it transcends these boundaries. However, this does not mean it

cannot match to an expert from the same organization. It merely finds the most suitable candidates for the problem. Take note that most suitable does not mean that always the same expert is found in the same area. Depending on the depth of the problem, a “lesser” expert can be suggested as this expert might be perfectly capable of providing the necessary assistance. This feature is added to system for user convenience, as it would be likely that an expert that is constantly shown as “best match”, will eventually develop an reluctant attittude towards the system.

Chapter 3: Theoretical perspective

To understand the context of a research, one should assume a theoretical perspective. This allows for better interpretation of possible situations. This section introduces the theoretical perspective that is used during this thesis. The theoretical perspective is based on the Task-Technology Fit (TTF) model and the UTAUT model. These models have been chosen as they ideally fit IT systems such as an EFS.

3.1 Task-technology fit model

The TTF is a highly influential model for the design of IT systems. An IT system is more likely to have a positive impact on performance if the capabilities of the IT system closely match the task that the user must perform (Goodhue & Thompson, 1995). The TTF model is depicted in figure 5.

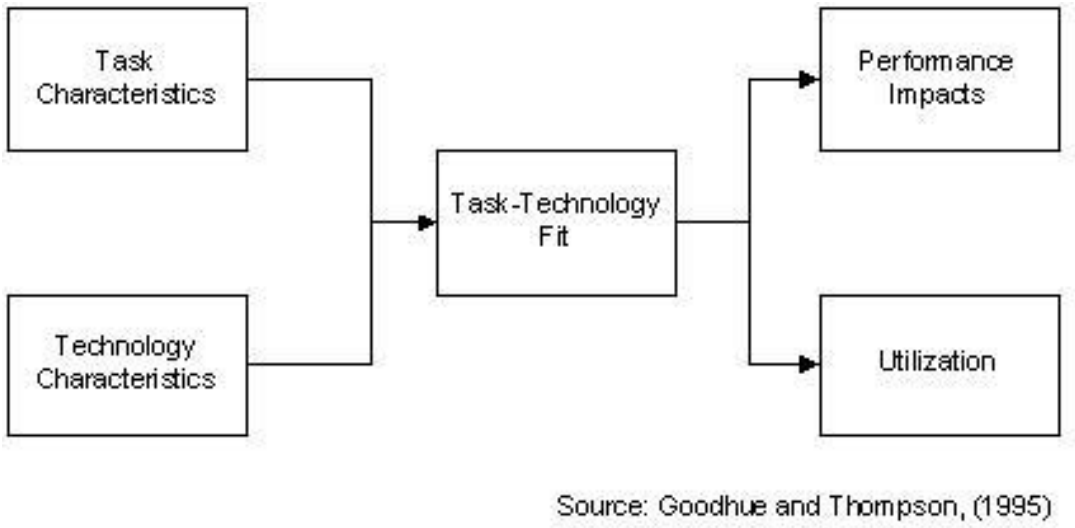

Figure 5: Task-Technology Fit

Five key concepts are used in this model and need to be defined. Tasks are broadly defined as the tasks carried out by individuals to turn inputs into outputs (Goodhue & Thompson, 1995). Task characteristics are the features involved with these tasks. Technology characteristics are defined as the features of the tools that are used to perform the tasks at hand. TTF is the degree to which a technology assists an individual in performing his or her portfolio of tasks (Goodhue & Thompson, 1995). Utilization is the behavior employing the technology in completing tasks. Performance impact refers to the accomplishment of a portfolio of tasks by an individual (Goodhue & Thompson, 1995). Performance has been broadly defined but relates to efficiency and quality.

The relations between these different concepts will now be discussed. If characteristics of a certain technology fit the characteristics of the task well, the performance impact will increase, meaning that efficiency/ quality are improved. Furthermore, it is argued that a good TTF also has a positive effect on the utilization, as a high TTF makes it likely that individual will adopt the technology (Goodhue & Thompson, 1995). Hansen argues that performance impact is directly related to TTF and utilization. An IT system with a good TTF is likely to exert a high impact on performance, as the tool that is used by the individuals is suited for the job. Similarly, a higher degree of utilization leads to a higher performance

impact. If an IT system task-technology fit is sufficient to positively contribute to performance, a higher degree of utilization will lead to a higher performance impact (Paulo Hansen, 2016)

This model will serve as theoretical framework, as a high TTF is desired. Characteristics of the tasks must be defined to properly fit the characteristics of the technology. In more practical terms, the design of the expert profile should fully comprehend the information required by the user of the EFS. This perspective is used to reflect on the expert profile.

3.2 UTAUT model

The unified theory of acceptance and use of technology (UTAUT) model provides a framework that helps to explain user intentions and the subsequent usage behavior. The model is built upon earlier models that had a similar purpose. Four key constructs are theorized to have a significant role as determinant of user acceptance and usage behavior; performance expectancy, effort expectancy, social influence and facilitating conditions. These four key constructs are given with their definitions (Davis et al., 2003):

- Performance expectancy: the degree to which an individual believes that using the system will help him or her to attain gains in job performance
- Effort expectancy: the degree of ease associated with the use of the system
- Social influence: the degree to which a person perceives that important others believe he or she should use the new system
- Facilitating conditions: the degree to which an individual believes that an organizational and technical infrastructure exist to support use of the system.

These four constructs are moderated by the factors: gender, age, experience and voluntariness of use. These moderators can bidirectionally influence the constructs and are used to explain the impact on behavioral intention and usage behavior (Davis et al., 2003).

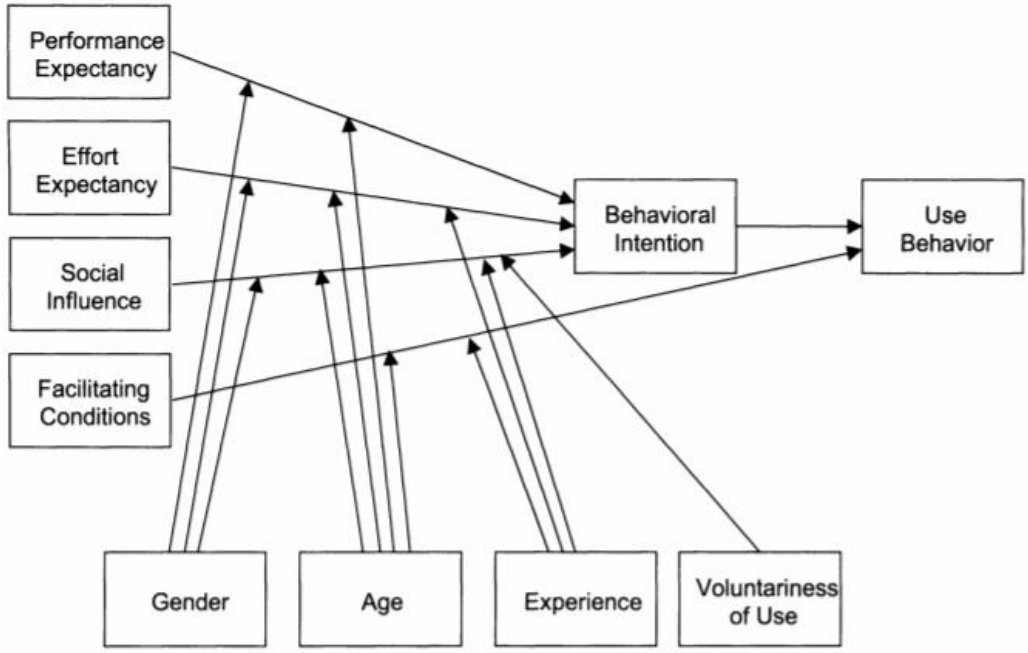

Figure 6: UTAUT model

This model is represented in figure 6 and provides a context for the acceptation of a new IT system. Relating to the constructs and their moderators can help make decisions in the design of an expert profile. The UTAUT model is used to evaluate the results of this thesis. The questionnaire provided by the UTAUT model is adjusted to fit this thesis and used to analyze the responses.

3.3 Literature review

This literature review consists of three sections. The first section will research different text mining techniques and tries to answer which technique is most appropriate in the scope of this research. The visualization section provides an overview of the available possibilities for employee skills and knowledge visualization. The third section focusses on e-recruitment and user profiling, and what contribution this makes towards the design of an expert profile.

3.3.1 Text mining

This section tries to answer the research question: "What text mining approach is most appropriate for transferring employee expertise found in company sources into an expert's profile?". Text mining is the process of deriving high-quality information from unstructured text. There are many text mining techniques that have been developed. Through extensive analysis of literature, a decision for an appropriate technique will be made.

There are several possibilities to improve the results of text mining. When analyzing huge amounts of data, various types of noise can be found. Lexical and syntactic noise, template reuse, self-plagiarism, plagiarism and irrelevant information needs to be filtered during the pre-processing phase (Palshikar, Apte, Pawar & Ramrakhiyani, 2018). Most techniques require pre-processing of a document since stopwords contain less information rules (Mohammad et al., 2018). These words can be filtered out, for example by using the python toolkit list of stopwords. Query expansion (QE) can be used to expand the query and yield more relevant information. QE establishes a correlation between query terms and document terms by analyzing provided relevant knowledge (Mohammad et al., 2018).

Existing state of the art methods for knowledge extraction can be categorized into three categories: keyword matching, grammar analysis and rule based regular expression methods. Keyword matching system assumes that all words in a document are independent. The performance of this approach depends on the entered keywords. Grammar analysis can find verb-adjective and noun-verb relations. Rule based regular expression methods can find closely related words such as price and payment. However, this approach is confined to a set of documents that follow the designed rules (Mohammad et al., 2018). This makes the approach not scalable and therefore not suitable for the generation of expert profiles. We continue this section by examining some techniques, comparing these on their concepts and determining their usability.

The traditional method used for knowledge extraction from online support groups (OSG), utilizes full text search. It is argued that this method leads to low relevance and low reliability, mainly because it is limited to matching terms in the query to the indexed post without consideration for the context introduced by these terms (Bandarogada et al., 2018). The use of a knowledge extraction-based structure is advocated. CogNIAC is used to convert the post in the OSG to pronouns. The mention of human nouns is counted and based on which type of noun is mentioned most, the type of narrative is determined. Multiple techniques are used for the extraction of age and gender. This information is then used in combination with a relevance formula to generate more valuable results. The use of a

knowledge extraction-based structure could help yield more valuable results in case of the desired EFS. Moreover, the method proposed is scalable, which is required.

Topic tracking systems makes use of user profile, keeps track of the documents the user views, and predicts documents of interest to a user. It enables the extraction of keywords from documents, which for humans is a time consuming and difficult task. These keywords are linked to the user profile and are used to recommend documents to the user. This allows a user to track a topic (Gupta & Lehal, 2009).

Information extraction identifies key phrases and relationships within text. It makes use of predefined sequences of text, a process called pattern matching (Gupta & Lehal, 2009). It is useful for large amounts of text, which in our case is needed. However, the method requires structured databases and is therefore not applicable for our cause.

Summarization can reduce the length and detail of large texts, while retaining its main points and overall meaning. Summarization tools often use sentence extraction by statistically weighing the sentences. Furthermore, heuristics are used to include, for example, the sentences following: “in short,” (Gupta & Lehal, 2009).

There are two possible strategies for using text mining to identify relevant documents. One uses automatic term-recognition approaches, and the other uses classification techniques that require classifier construction (training and testing). Classification algorithms can be divided into two categories: rule-based and active (machine) learning methods (Feng, Chiam & Lo, 2018). A similar subcategorization is made by Thangaraj, he argues that classification algorithms can be subcategorized in statistical and machine learning methods (Thangaraj & Sivakami, 2018). The statistical approach is described as executing the given instructions without any ability of its own (Srivastava, 2015). The terms classification and categorization are used interchangeably.

Categorization identifies main themes by placing the document into a set of predefined topics. It uses count to determine which topic is mostly discussed (Gupta & Lehal, 2009). Digital objects can go through a classifier, that applies a classification algorithm to determine the most likely category they belong to (Illari & Azon, 2018). Sentences can be Classified into topics that are of interest. There are multiple classifier methods that can perform such an action, such as logistic regression, multinomial Naïve Bayes, Random Forest, AdaBoost and pattern-based methods. In the latter, sets of patterns are used to identify a sentence and place determine its corresponding topic. Lemmatizing and stemming in the pre-processing stage lead to accurate classification. It implies that the classifier performance depends on the nature of data being analyzed (Thangaraj & Sivakami, 2018).

Clustering differs from categorization by linking the topics as the method goes through the text, instead of using a set of predefined topics (Gupta & Lehal, 2009). Clustering can be used to identify broad topics among the defined classifications (Palshikar, Chourasia, Pawar & Ramrakhiyani, 2018).

The articles are organized by relevant concepts in table 5.

Table 5: Systematic literature review

Author	Article	TM technique	Relevance-based	Scalibility	Usability
Bandaragoda, De Silva, Alahakoon, Ranasinghe & Bolton	Text mining for personalized knowledge from online support groups	Knowledge extraction-based structure	Aims to improve relevance of results	Can be applied to large amounts of documents	Can be used to improve relevance of queries
Mohammad, Kosaraju, Modgil & Kang	Automatic knowledge extraction form OCR documents using hierarchal document analysis	Query expansion	Improves relevance through more search terms	Needs to have a list of correlated queries, therefore not scalable	N.a.
Illari & Azon	Towards the development of a tool to keep track of interesting information in a sea of digital documents	Topic tracking and classification	Improving relevance by creating user profile and tracking interest	Able to handle large quantities, but requires predefined topics	N.a.
Feng, Chiam & Lo	Text-mining techniques and tools for systematic literature reviews: A systematic literature review	Classification	Impoving relevance by making catergories	Requires predefined topics	N.a.
Palshikar, Apte, Pawar & Ramrakhiyani	HiSPEED: a system for mining performance appraisal data and text	Noise elimination	Improving relevancy by eliminating the irrelevant	Used as pre-processing, used to improve scalability	Can be used to eliminate noise, improving relevance

Palshikar, Chourasia, Pawar & Ramrakhiyani	Mining supervisor evaluation and peer feedback in appraisals	Clustering	Improve relevance through clustering into topics	No predefined needs, highly scalable	Can be used to identify interests
Thangaraj & Sivakami	Text classification techniques: A literature review	Classification	Improving relevance by making categories	Requires predefined topics	N.a.
Gupta & Lehal	A survey of text mining techniques and application	Information extraction, topic tracking, summarization, classification and clustering	Aim to improve relevance	Topic tracking, summarization and clustering can be applied to larger scales	Identify interest and cluster topics

From this systematic literature review, it can be concluded that several text mining techniques can be combined to transfer employee expertise into expert profiles. Noise elimination can be applied to improve the relevance of the results. And clustering can be used to determine topics, which can contribute to the contents of the profile. For the general application of EFS, classification techniques require predefining of keywords and are therefore considered as exhaustive. However, in the scope of this research, classification techniques are a feasible possibility as keywords do not have to defined explicitly. Therefore, keyword extraction through classification is considered most appropriate.

3.3.2 Visualization techniques

In this section of the literature review, a short overview of available techniques to visualize employee skills and knowledge is provided, which is an answer to the research question: "What kind of techniques are available to visualize employee skills and knowledge?". This visualization can be used in expert profiles. As this visualization needs to be both machine and human readable, unclear visualization are not considered. The visual aid must simply show the skills and their corresponding level.

Expertise identification requires data which is usually scattered among different enterprise systems, such as groupware, address books or human resources systems. Enterprise people search is of critical importance when decisions during a business workflow require an expert (Brunnert, Alonso, & Riehle, 2007). A visualization through topic clustering is proposed.

A different view to competency visualization is offered by Law Sheng Xun. Four visualization techniques are used. A simple line graph showing the skills on the x-axis and a percentage from 0 – 100% on the y-axis is the first one. The category mapping by means of a spider chart is the second suggestion. The third method is the use of a pie chart. The metaphorical pie is divided by colors, where each color represents a skill. The last suggestion is the use of a histogram, where the skills are different bars and consist of different levels (Xun, Swapna, & Shankararaman, 2015).

In an article on lean competence, employee resource information was placed in a simple matrix of job function (skills) against employee name. This table made visible the skills required and identified how

many individuals currently held those skills. It also highlighted areas with insufficient cover, identifying training requirements (Parry, Mills, & Turner, 2010).

The skills matrix is a visualization that is both machine and human readable. The skills matrix sets out the skills against the people. Each skill is represented by a circle consisting of four quarters. This allows for the distinction of 5 levels. An empty circle, a circle with one quarter filled, with 2, 3 and 4 quarters filled, yielding five possible levels in a particular skill. An overview of the visualization techniques is given in table 6.

Table 6: Overview visualization techniques

Visualization technique	**Reference**
Topic clustering	(Brunnert, 2007)
Line graph	(Xun, 2015)
Spider chart	(Xun, 2015)
Pie chart	(Xun, 2015)
Histogram	(Xun, 2015)
Skills matrix	(Parry, 2010)

Several possible visualization techniques have been discussed. Multiple options meet the requirement of being both human and machine readable. Hence, these visualizations can be used in the scope of this research. An adaption of the histogram visualization proposed by Xun (2015) is used in the expert profile suggested in this research.

3.3.3 E-recruitment and user profiling

This section aims to answer the research question:" How to design an expert profile based on various digital sources?". The literature study is meant to contribute to an answer, besides the interviews.

E-recruitment is a development from the last decades that helps companies select their job applicants. Pre-screening of applicants is often done by an e-recruitment system. To conduct such a pre-screening, certain characteristics must be pre-defined that are used for profiling of the applicants. This section aims to identify and discuss these characteristics that are used in the field related literature of e-recruitment and profiling.

Online recruitment processes are two sided; the seeker- and company-oriented sides (Faliagka et al., 2012). An expert finding systems is an example of a company-oriented e-recruitment system. The purpose of e-recruitment is to reach a larger audience in a shorter time frame, thus increasing efficiency in this process. A competency is the effect of combining and implementing resources in a specific context for reaching an objective (Radevski & Trichet, 2006). This definition has been created to fit the purpose of matching from the seeker-oriented side. In this process, three types of resources are distinguished: knowledge, skills and behavioral aptitudes. These resources must be measured to be able to match with the demand-side of an EFS. Knowledge and skills are determined by the seeker, who is offered a list of possibilities. This person chooses which options describe him or her best.

Personality is often neglected during pre-screening processes. Ordinarily, interviews are conducted with the selected candidates that have passed the pre-screening phase, to assess their personality, among other things. Including personality traits in the pre-screening phase would eliminate certain candidates

for interviews, which would save time and costs. Two methods towards including personality traits in the pre-screening phase are discussed.

Personality traits can be determined through a questionnaire. Such a questionnaire is designed to identify these personality traits. A common option is to arrange the questions around the big five dimensions of personality; openness to experience, conscientiousness, extroversion, agreeableness and neuroticism. The questionnaire yields a result, in terms of a percentage for each dimension. These five personality traits can be combined to determine a behavioral aptitude (Radevski & Trichet, 2006).

An alternative to this method is personality mining. Using web mining techniques and text analysis, a personality can be derived from unstructured data (Oberlander and Nowson, 2006). In this research the test subject is asked to provide a blog, which is assessed using text analysis programs such Word Inquiry and Word Count (LIWC) to extract linguistic features that act as markers for a personality. LIWC analyses unstructured texts by counting relative frequencies of words that belong to a specific category. Significant correlations between these frequency counts and the big five dimensions of personality have been found (Pennebaker and King, 1999).

Not every expert that is connected will be available. Social profiles are described as having the ability to increase the likelihood of a good reference. The creation of a collaboration network provides an overview of a person's connections (Balog & De Rijke, 2007). An expert that has a lot of connections with people that operate on the same topic should have a higher ranking than an expert that has a similar level of expertise but lacks these connections. Numerous different user profile characteristics are mentioned in literature. An overview of these are given in table 7.

Table 7: User profile characteristics provided by literature

User profile characteristic	**Reference**
Loyalty (months spend per job)	(Faliagka et al., 2012)
Work experience (months)	(Faliagka et al., 2012)
Education	(Faliagka et al., 2012), (Kanoje et al., 2014)
Personality	(Oberlander and Nowson, 2006), (Radevski & Trichet, 2006), (Faliagka et al., 2012)
Abilities	(Pennebaker and King, 1999)
Professional and academic experience	(Pennebaker and King, 1999)
Needs and interest	(Pennebaker and King, 1999), (Radevski & Trichet, 2006)
Resume	(Pennebaker and King, 1999), (Radevski & Trichet, 2006)
Field of activity	(Pennebaker and King, 1999)
Skills	(Pennebaker and King, 1999)
Job title	(Chenni et al., 2015) (Balog & De Rijke, 2007)
Sector	(Chenni et al., 2015)
Keywords from job description	(Chenni et al., 2015)
Location	(Kanoje et al., 2014)
Age	(Kanoje et al., 2014)
Gender	(Kanoje et al., 2014)
Collaboration network	(Balog & De Rijke, 2007)

Chapter 4: Solution generation

This chapter explains how the research has been designed and executed. The design of the interviews and survey are discussed. Moreover, the acquisition of the research population is discussed as well.

4.1 Acquisition research population

The research population, as discussed earlier, consist of companies that employ software engineers from the eastern part of the Netherlands. Companies that employ software engineers have been chosen, as these are expected to have a better sense of empathy towards the implementation of an EFS. The eastern part of the Netherlands has been chosen, as this is the Thales Hengelo's location. In an early version of an EFS, they are looking at an implementation is this region. For privacy reasons the companies have been anonymized and are represented as companies 1 to 10. Lots of companies have been approached, the ones that made themselves available have been interviewed. These companies were contacted via email. In total, 10 companies have been researched, including Thales.

4.2 (Phone)interview design

In general, the interviews start with a discussion on the companies' business and recent developments, including the categorization of the company, e.g. small/medium or large. After having gained insight into the day-to-day activities of the company, the second phase of the interview would start. Questions, containing three main topics, are asked to the interviewee. First, the expertise topic would be discussed. The purpose of this line of questioning was to identify what should be included in the expert profile. Secondly, the purpose of an EFS would be described by the interviewer. Subsequently, the implications and opportunities regarding an EFS were discussed. These questions served as a method to gauge the perspective of companies towards an EFS. Lastly, the interviewee was asked about potential employee expertise sources within their company. The purpose was to identify commonalities in different categories. The line of questioning was discussed with an expert on this topic. This resulted in some changes to the questions. After the first three interviews, a check has been done to verify if the gained knowledge resembled the needed information. This turned out the be the case. The interview set up can be found in the appendix A.4.

4.3 Survey design

The survey was created in Google Forms[3]. The purpose was the same as the purpose of the regular interviews, hence the same line of questioning was used. However, due to sectional ordering some changes to the question formulation were made. The content of the question has not changed as a result of the alterations. The survey was used to complement the interviews, as companies are not all available for an interview, for various reasons. The results collected are not as extensive and elaborate compared to the interview results. This is caused by the fixed questioning and inability to respond or ask for clarification. However, the results do help fulfill the aims of the research, as the important questions are reflected in the results.

[3] Google Forms, Retrieved from URL: https://docs.google.com/forms/d/1IAKJSBEm5NwuXfw37g2eZn75mFm478VGFxOsRev12F0/edit

4.4 Research analysis

The results from the interviews are both qualitative as quantitative due to the multi-purpose interviews. The line of questioning aimed at the availability of employee expertise sources are quantitative, as it merely counts the different employee expertise sources and their diversity over the different categories. These are represented in the tables in the chapter: results. For each category, the sources are listed with their count and density. The density is determined by the count, divided by the number of companies interviewed in the corresponding category.

$$D = \frac{X}{N}$$

Where,

D: density
X: the count of a source in the corresponding category
N: the number of companies interviewed in the corresponding category

The density index allows an easy insight into what sources are often available in the corresponding category.

The interviews have been processed into short summaries and two of them have transcribed completely, these can be found in the appendix's A.5 and A.6. The line of questioning focused at the inclusion criteria of the expert profile yields qualitative results. These results are cross-checked with Thales' vision for the EFS and considered with the design of the expert profile.

Chapter 5: Results

In this chapter, the results will be discussed. For every aim, there is a result to be discussed. The inclusion criteria of an expert profile, employee expertise sources and presence of an employee expertise management policies are discussed respectively.

5.1 Expert profile

The results from the interviews concerning the contents of an expert profile varied widely and were often contradicting. The aspect all interviewees agreed on, was the inclusion of knowledge and skills with the corresponding proficiency level. The opinions varied widely on the inclusion of name, photo, contact information, personality traits, geographical location, hobbies and interests. Although, the results were contradicting, guidelines have been extracted from these interviews.

The person who decides to contact an expert, should end up with the best match, were the hard factors are concerned. The hard factors are the overlap between the requested knowledge and skills in the query and the expert's knowledge and skills. Soft factors are hobbies, interest, personality traits, etc. The expertise seeker should have to choose between three experts, which approximately have the same match quotient. This is where the soft factors come into play. Certain character types are known to cooperate better than others. Moreover, having the same hobby for example could make a better match at a personal level, which is likely to yield a higher success rate.

From this line of reasoning directly follows that factors such as names, photos and geographical location should be excluded from the expert profile. It is natural to seek an expert that is geographical close, as a face-to-face meeting is often preferred. Yet, the EFS is meant to provide the best matches and transcend geographical boundaries. Besides the potential GDPR issues that are prevented by excluding these aspects from the expert profile, the preference for face-to-face meetings is countered. Hence, this is excluded from the expert profile. Photos contain an abundance of information, which will influence the decision. Names can often be used to derive ethnical ancestry and religious orientation. These factors should not influence the decision process and are therefore excluded (Murillo et al., 2012).

For each profession, the hard factors differ. For example, for a programmer it is important to know which coding languages are mastered. As for a software engineer, aspects such as databases, software architecture, tooling, debugging and agile working might be important factors. Each profession has these hard factors, and these form the basis for every match.

The literature study conducted on the subject of e-recruitment and profiling provided a few insights, that combined with the results from the interviews, will complement the expert profile. Literature suggest different options for including personality traits in user profiles. Depending on the job, this could be an addition that increases the effectiveness of the EFS. Some jobs are performed under difficult situations, which causes some people to be more suitable for a job than others. Education, work experience, resume, abilities/skills, collaboration network, gender, age, location, sector, job title, needs, interests and loyalty (months per job) are characteristics of the user profile suggested in literature. On page 25, a potential design is made to illustrate how an expert profile could be presented. The contact information section will only be shown, after a choice for an expert has been made.

Contact information

Name

Gender

Date of Birth

Geographical location

Email

Phone number

Job

Department

Company

Photo

* Only visible after expert choice has been made

Current situation

Sector

Fields of activity

Background

Education

Former job

Hard factors	**Proficiency level**
Expertise 1	
Expertise 2	
Expertise 3	
Expertise 4	

Soft factors

Personality traits (for example Belbin)

Needs and interests

Ambitions

The three features of the expert profile that are written in italics, have been moved from the "current situation" to the "contact information". Moreover, the feature "collaboration network" has been deleted from the "soft factors". These changes are done after evaluation with Thales. The expert profile is designed with the use of the Task-Technology Fit model. The tasks that are needed to use the expert profile are the manual input of information (by both the expert and expert seeker), the analysis of the profile and the expert choice, carried out by the expert seeker. The technology characteristics are the features of the expert finding system. These are the text mining tools, the matching engine, the interface and the expert profile database. The proposed technologies enable the user to carry out the tasks, resulting in a good task-technology fit. This will have a positive influence on both the performance impact and the utilization.

5.2 Employee expertise sources

This section is an answer to the research question: "What employee expertise sources are available in companies?". In every interview, the interviewee was asked about what employee expertise sources they thought were available within their company. These were counted and listed, as shown in Table 8: employee expertise sources. Some employee expertise sources are specific and may not be known, therefore an explanation of these sources is added in the appendix A.9.

Table 8: Employee expertise sources

Category	Company	Source	Cumulative count
Small	Company 1	CV	1
		EasyFlex	1
	Company 2	Certificate of conduct (COC)	1
		Debts	1
		Social Media	1
		Questionnaire	1
		Certificates/ Degrees	1
		CV	2
	Company 3	SAP Fieldglass	1
		CV	3
		ERP SAP	1
		Office documents	1
		Career plan	1
		Evaluations	1
		Email	1
		LinkedIn (social media)	2
	Company 4	LinkedIn (social media)	3
		Office documents	2
		Certificates/ Degrees	2
		COC	2
	Company 5	CV	4

		Certificates/ Degrees	3
		Office documents	3
	Company 6	SharePoint	1
		Office documents	4
		Personnel files	1
		Enneagrams	1
		Mendix quality software	1
		CV	5
Large	Company 7	SharePoint	2
		Afas Insite	1
		Afas profit	1
		Solidworks PDM	1
		Office documents	5
		Email	2
		Jira	1
		CV	6
	Company 8	Workplace by Facebook	1
		Microsoft Who chatobot	1
		OneNote	1
		SharePoint	3
		Slack	1
		Office documents	6
		Email	3
		Microsoft Teams	1
		OneDrive	1
		Atlas.ti	1
		CV	7
		Certifications/Degrees	4
		Azure	1
		COC	3
		LinkedIn (social media)	4
	Company 9	Jabber	1
		Orcale	1
		LinkedIn (social media)	5
		Office documents	7
		Email	4
		CV	8

		COC	4
	Company 10	CV	9
		Imply	1
		Cobra	1
		Certificates/ Degrees	5
		Connexx	1
		Office documents	8
		Evaluations	2
		Email	5
		Competences per function	1

For the ease of analysis and to provide a better overview of the implications, subdivisions of the table 9: employee expertise sources into category small/medium and large have been made.

5.2.1 Category small/medium

In category small/medium, 6 companies have been interviewed. 15 different sources have been identified. The source with the highest density is the most commonly occurring source. Most small/medium companies store their employees' curriculum vitae. However, few take personality test and store these. The three most occurring sources in the category small/medium are CV, office documents and certifications/degrees. These sources can be valuable assets for the generation of expert profiles.

Table 9: Category small/medium; sources and count

Source	**Count**	**Density**
CV	5	0.83
Office documents	4	0.67
Certificates/ Degrees	3	0.5
Certificate of conduct (COC)	2	0.33
EasyFlex	1	0.17
Intake questionnaire	1	0.17
SAP Fieldglass	1	0.17
ERP SAP	1	0.17
Career plan	1	0.17
Evaluations	1	0.17
Email	1	0.17
SharePoint	1	0.17
Personnel files	1	0.17
Enneagrams	1	0.17
Mendix quality software	1	0.17

5.2.2 Category large

In the category large, 4 companies have been interviewed. 25 different sources have been identified. Similar to category small/medium, office documents and curriculum vitae have a high occurrence density. However, email has an increased density is this category compared to the category

small/medium. Emails exchanges between colleagues can contain project related information and may therefore be useful for analysis.

Table 10: Category large; sources and count

Source	Count	Density
Office documents	4	1
Email	4	1
CV	4	1
SharePoint	2	0.5
Certifications/Degrees	2	0.5
COC	2	0.5
Afas Insite	1	0.25
Afas profit	1	0.25
Solidworks PDM	1	0.25
Jira	1	0.25
Workplace by Facebook	1	0.25
Microsoft Who chatbot	1	0.25
OneNote	1	0.25
Slack	1	0.25
Microsoft Teams	1	0.25
OneDrive	1	0.25
Atlas.ti	1	0.25
Azure	1	0.25
Cobra	1	0.25
Imply	1	0.25
Jabber	1	0.25
Orcale	1	0.25
Connexx	1	0.25
Competences per function	1	0.25
Evaluations	1	0.25

5.2.3 External sources

Two sources have been mentioned by both categories that are 'external' sources. That means these sources are not stored within the company but can be found elsewhere. The total of 10 companies mentioned debts once, and social media five times. The overview is given in table 11.

Table 11: External sources

Source	Count	Density
Debts	1	0.10
LinkedIn (social media)	5	0.50

5.2.4 Recommendation sources

In general, the sources with a high density should be considered for mining purposes. This would mean that office documents, curriculum vitae, email, SharePoint, certificate of conduct and certificates and

degrees should be considered. However, due to the small sample, this may exclude potential valuable sources. Sources such as Workplace by Facebook were used once in this research population but are likely to be used more often in large companies, as this is a communication platform for companies. Hence, the sources: OneNote, Slack, Microsoft Team and OneDrive are also recommended for mining. The social media sources potentially contain a lot of valuable information, but are especially difficult, as these are external sources. Therefore, explicit consent from both the developing company and the users is required.

5.3 Employee expertise management policies

As discussed in the chapter: solution generation, the goal is to identify commonalities in the different categories. In each interview, it has been determined if the company has an employee expertise management policy. An overview is given in table 12: employee expertise management policies, sorted by categories.

Table 12: Employee expertise management policies

Category	**Company**	**Employee expertise management Policy (Yes/No)**
Small/medium	Company 1	No
	Company 2	No
	Company 3	No
	Company 4	No
	Company 5	Yes
	Company 6	No
Large	Company 7	No
	Company 8	No
	Company 9	Yes
	Company 10	No

In the category small/medium, 5 out of the 6 do not have an employee expertise management policy. Company 3 has an employee expertise management policy, but an analog one. The manager has the knowledge, whilst the EFS requires a digital paper trail. Hence, this is counted as a “No”. Company 5 has an EEMP. This policy is a combination of multiple activities, which are written down in the employee guidebook. The activities include pair programming (experienced programmers mentor others) and a dedicated week, once every 8 weeks. In this week, the employee can decide what skills he or she wants to improve. Company 6’s competence center is not an employee expertise management tool, but an expertise management tool and is therefore counted as a “No”.

In the category large, 3 out of the 4 companies do not have an employee expertise management policy. Most interviewees from large companies had a vague idea of how they manage their employee expertise, but an explicit EEMP is not present. Company 9 has had multiple systems that should have met purpose of an EFS. The interviewee explained that earlier systems had failed because the systems did only meet the technical requirements, not the user requirements. The systems connected the digital paper trail, which supported their policy of documenting employee expertise.

Chapter 6: Conclusion

In this chapter, the discussion, an evaluation with Thales, contributions to theory and practice and the limitations are discussed. Furthermore, a recommendation concerning the future steps is made for Thales and possibilities for future research is discussed.

6.1 Discussion

In this thesis, a schematic overview of the expert finding system as described in chapter 2 is given. This overview shows how the EFS operates and serves as answer to research question 1. In the literature study in chapter 3, an overview on literature of e-recruitment and profiling, that can be used for the expert profile is given. This is an answer to the research question: “What information should be included in an expert profile?”. In the section “Employee expertise sources” an overview of the available sources is given with the corresponding count. A division between small/medium sized and large companies is made. The interviews revealed that larger companies utilize more commonly used software tools, such as SharePoint, which allows for a general approach towards integration. Software tools such as Microsoft Teams are used by multiple companies. This means that, if a software tool is created to automatically extract information from Microsoft Teams, companies that use Microsoft Teams can join the EFS more easily, as the cost for developing the extraction tool is lower. Larger companies use these programs more often than companies from the category small/medium, as cost for these licenses can be high.

In chapter 3, research questions 4 and 5 are answered through literature research. Text mining and visualization techniques are organized around concepts and a recommendation for which technique to use is made at the end of the section. Keyword extraction through classification was found to be most appropriate. An adapted version of the histogram visualization proposed by Xun (2015) was implemented in the expert profile prototype. The sixth research question: “How to design an expert profile based on various digital sources?” is answered by a mix of literature study and interviews. This results in chapter 5 section 1, were the features of the expert profile are discussed, and a prototype is shown.

A context analysis of the implementation of expert finding systems in an industrial setting was made. The context analysis showed that research into the availability of employee expertise sources and employee expertise management policies was needed. The last research question: “Is the frequency of the availability of employee expertise management policies different for large companies, compared to small and medium sized companies, and what do these policies entail?” is derived from the context analysis and is answered through interviews. Prior to the interviews, an expectation of the outcome was made. It was expected that the larger a company got, the more extensive the employee expertise management policy would be. The interviews did not confirm this expectation. It turned out that larger companies have a higher awareness of the need for an employee expertise management policy. However, 3 out of the 4 large companies did not have an explicit policy in place, but where considering options on how to tackle this opportunity. This can be advantageous for Thales, as these approaches are not yet set in stone, and can be adapted to fit an EFS.

6.2 Recommendation

The research into the availability of employee expertise sources showed several sources that should be considered for the generation of the expert profile. The sources: office documents, curriculum vitae, email, SharePoint, certificate of conduct and certificates and degrees should be considered.

The most appropriate method to automate the process of extracting information from employee expertise sources would be keyword extraction through classification. Automatically generating the expert profiles requires software that can mine sources, and each different source requires a different piece of software. Developing such software is an expensive process and while considering this, a recommendation is made. The use of automatic generation of expert profiles should only be implemented for large companies that utilize widely used software tools, such as Workplace by Facebook. As small/medium sized companies have a wide variety of software and sources they use, it is highly expensive to automate this process. Moreover, smaller companies have less sources available, which causes the profiles to not be accurate and comprehensive enough. Therefore, small/medium sized companies should manually fill out the expert profiles, if they were to participate in an EFS.

The research into the employee expertise management policies showed the lack of such policies and this presents an opportunity for Thales. If Thales were to construct a universal EEMP, that could be implemented at a wide variety of companies, that would fit the mining process that comes with the EFS, great progress towards a realization of the EFS would be made. However, companies competing for the same employees might be reluctant to adopt an EEMP created by Thales, as they do not wish to allow competitors to locate their expertise freely. This can be avoided by collaborating with the companies that would want to implement an EEMP, to together develop the policy. If several companies use this policy, that “scare” factor is likely to be less important, and more companies might join. A different approach could be for an independent company to construct this universal EEMP, the likelihood of successful adaptation by companies would increase.

If Thales decides to implement an EFS, much developing time can be saved by acquiring an existing EFS and tailoring it to Thales’s specifications. However, considering the sensitivity of information that is used at Thales it must be verified that the EFS’s vendor, and all other parties, do not have access to the system. If this cannot be insured, Thales should build the EFS themselves.

6.3 Evaluation

The results of this thesis have been presented at Thales and evaluated through a questionnaire. The presentation gave insight into the problem analysis, research design and it’s the findings of the research. After the presentation the suspects were provided a questionnaire, that is based on UTAUT’s method for determining usage behavior. The questionnaire can be found in the appendix A.7. The responses have been analyzed with simple statistics, as there were merely two respondents to the questionnaire. The respondents are asked to circle what best describes their view, on a Likert scale from 1 to 5. The meanings are linked to numbers, depicted in table 13. These number are used for statistical analysis.

Table 13: Scale questionnaire

Number	Meaning
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

The following hypotheses are created to evaluate the expert finding system and the expert profile:

H1: Performance expectancy will have a positive influence on behavioral intentions to use the expert profile.
H2: Effort expectancy will have a positive influence on behavioral intentions to use the expert profile.
H3: Social influence will have a positive influence on behavioral intentions to use the expert finding system.
H4: Facilitating conditions will have a positive influence on usage behavior of the expert profile.
H5: Behavioral intention will have a positive influence on usage behavior of the expert finding system.

The statistical analysis is depicted in the table 14.

Table 14: Statistical analysis questionnaire

Statement / Measure	Mean	Mode	Median	Standard deviation
PE	4	4	4	0.202030509
PE1	4.5	n.a.	4.5	0.707106781
PE2	4	4	4	0
PE3	4	4	4	0
PE4	3.5	n.a.	3.5	0.707106781
EE	4.166667	4	4	0.336650165
EE1	5	5	5	0
EE2	3.5	n.a.	3.5	0.707106781
EE3	4	4	4	0
SI	3.5	n.a.	3.5	0.244948974
SI1	3.5	n.a.	3.5	0.707106781
SI2	3.5	n.a.	3.5	0.707106781
SI3	3.5	n.a.	3.5	0.707106781
FC	4.166667	5	4.5	0.522812905
FC1	4	4	4	0
FC2	5	5	5	0
FC3	3.5	n.a.	3.5	2.121320344
BI	4.166667	4	4	0.182574186
BI1	4.5	n.a.	4.5	0.707106781
BI2	4	4	4	0
BI3	4	4	4	0

The statistical analysis serves to either accept or reject the hypotheses. However, as a consequence of the small research population and a lack of an appropriate probability distribution of the responses, the proper procedure to either accept or reject a hypothesis would be insignificant. Therefore, it is decided to judge a hypothesis by its mean. If the mean of a hypothesis has a minimal mean score of higher than 3.0, it means that the respondents on average believe that the construct is of positive influence. 3.0 means that the respondents believe that the influence of the construct is neutral. If the results are lower than 3.0, the respondents believe on average the construct is of a negative influence. The results can be seen in table 15.

Table 15: Hypotheses results

	Mean score	**Influence of construct**
H1	4	Positive
H2	4.166667	Positive
H3	3.5	Positive
H4	4.166667	Positive
H5	4.166667	Positive

The evaluation has shown that performance expectancy and effort expectancy have a positive influence on behavioral intention towards the expert profile. Moreover, it is shown that social influence has a positive influence on the behavioral intentions towards the use of an expert finding system. The facilitating conditions have a positive influence on the usage behavior of the expert profile. Lastly, the behavioral intention will have a positive influence on the usage behavior of the expert finding system.

There was one datapoint that clearly differed from the others. This can be observed by the high standard deviation found at FC3 in table 14. The third statement in the fourth hypothesis is: “The expert profile is not compatible with other computer systems I use.”. The variation in the answers can be explained by the level of experience of both respondents. The respondent that believed it was easily compatible was an intern at Thales. This could lead to an underestimation of the issues involved with connecting the expert profile to the systems.

The evaluation with Thales also yielded open feedback. This feedback resulted in a change in the design of the expert profile. The features: job, department and company have been moved to the contact information section, which is only visible after the choice for an expert is made. Moreover, the collaboration network feature has been deleted from the profile. These changes have been made to preserve the anonymity of the expert, as these features can be used to trace the identity.

6.4 Limitations

The data gathering methods have several limitations. The analysis of the interviews depends on human interpretation. Interpretation can be done differently by different people and therefore the outcome will not be a universal truth. Furthermore, interviewers can subconsciously push the interviewee towards a direction, this phenomenon is known as interviewers bias. Moreover, these interviews are held with companies from the categories small/medium and large in the specified region. This means that the findings may differ for other regions. The theoretical perspective that is adapted provides a contextual understanding for the research. However, conforming to this perspective might cause the exclusion of different interpretations thereby limiting a complete comprehension of the research. Furthermore, the literature review means to answer three knowledge questions. Yet, the information

that is chosen to represent this answer is based on the interpretation of the priorities. Reviewing different articles can yield different information, yielding different answers. The evaluation of the research has been properly executed, but with a small research population. The results of the evaluation may therefore be unreliable.

6.5 Contribution to theory and practice

The literature review of an overview of available visualization techniques and text mining techniques can be considered as a contribution to theory. The research on e-recruitment and profiling, combined with the interview research is combined to form a prototype of an expert profile. A similar profile, with specifications on directly accessible data and information that will be available after the expert choice, has not been suggested in literature before and can therefore be considered as a new concept. Moreover, research into EFS's that operate in industrial context, are little described in literature, as most research on EFS's is connected to an academic capacity. Therefore, the research into EEMP's and EES's provides insight in the current situation and can be considered as pioneering research.

The contribution to practice is mostly for companies that consider building or acquiring an EFS. The model of expert finding can be used for a company to get an idea of what needs to be considered, if they were contemplating building an EFS. The model shows the process of expert finding by means of an expert finding system. The suggested expert profile could be used as a starting point for a company that is building a system with an expert profile. The lack of employee expertise management policies that has been uncovered in this research could make companies aware the competitive edge that could be acquired by implementing such a policy. Companies that have decided that they want an EFS, can use the information to make the make-buy decision.

6.6 Future research

The expert profile created from the interviews and literature research has not been tested. Future research could investigate the use of the design, which will yield feedback that could lead to either inclusion of exclusion of aspects. Moreover, the research into the employee expertise management policies showed that awareness is increasing. The possibility of creating a general EEMP that fits the EFS can be investigated. This would pave the way for a widely implemented EFS, that operates automatically. Furthermore, the research into the availability of employee expertise sources showed a great diversity. However, the research population was small and therefore the results could be verified by increasing the research population in a similar study. Finally, the UTAUT-questionnaire that is used has only been answered by two respondents. Hence, the statements are not properly validated, and this should be done by increasing the number of respondents.

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Appendix

The appendix consists of all the attachments that are used in this thesis; containing for example the approach towards the systematic literature review, an extensive comparison between the MPSM and Design Science and the interview summaries. An overview of the appendix is given.

A.1 Approach systematic literature review
A.2 MPSM and Design Science extensive comparison
A.3 Definitions
A.4 Interview design
A.5 Interview summaries
A.6 Transcripts
A.7 UTAUT-questionnaire
A.8 Survey expert finding systems
A.9 Explanation employee expertise sources

A.1 Approach systematic literature review

To answer the question: "What text mining approach is most appropriate for transferring employee expertise found in company sources into an expert's profile?", a systematic literature review will be executed.

The inclusion and exclusion criteria for the search terms must be defined. As the digital world is developing fast, the search is limited to publications from the years 2019, 2018 and 2017. Publications that are not in the final stage are excluded. The results are filtered for their written language; English. Finally, the term "text mining techniques" is used as limitation key word. The databases that are used are Google Scholar and Scopus. Google Scholar has been used to find the proper search terms needed for the search in Scopus. In Google Scholar a search was executed with the terms: Text mining techniques. An article titled: "A survey of text mining techniques and applications" was found, which provided alternatives to the term "text mining", being: "Intelligent Text Analysis", "Text Data Mining" and "Knowledge-Discovery in Text (KDT)". Moreover, nine text mining techniques were described. As listing all these techniques in the search query under an "OR" command is too long, the search term "approach" is used in addition the term "techniques". Combining these search terms and inclusion and exclusion criteria in Scopus yields a total of 139 document results.

By scanning the titles, a list of relevant articles is crafted. Results will be excluded from the final set if the title does not suggest a relevance to the research question. Furthermore, the terms: "employee", "skill", "personnel" and "keyword extraction" are used to search within these 139 results. This yields 5, 5, 4 and 4 results respectively, containing 8 duplicates. These titles are examined more closely as these have a higher potential for a better match. The list contains 28 documents in total. The next step will be the abstract analysis of the documents. Documents are rated for their relevance on a score from 1 to 5, 1 being irrelevant and 5 being most relevant. Documents that score above a 3 are selected in the final set. Furthermore, the article retrieved from Google Scholar is added to the final set.

The final set consists of these 8 articles:

Bandaragoda, T. R. (2018). Text Mining for Personalized Knowledge Extraction From Online Support Groups. *Journal of the Association for Information Science and Technology*, 1446-1459.

Mohammad, M. K. (2018). Automatic knowledge extraction from OCR documents using hierarchal document analysis., (pp. 189-194).

Illari, S. A. (n.d.). Towards the development of a tool to keep track of interesting information in a sea of digital documents. *ACM International Conference Proceedings Series Part F137707.*

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A.2 MPSM and Design Science extensive comparison

In this section, an extensive comparison between the design science and the managerial problem-solving method is made. The composite method, which this thesis is built upon, is extracted from this comparison.

A.2.1 Managerial problem-solving method (MPSM)

The MPSM provides a step by step structure to tackle business related problems through research. This method consists of seven steps. These are discussed one by one. This method is developed by Heerkens and Van Winden.

Problem identification

The problem identification phase consists of four different steps. First an analysis of all the problems at hand should be made. Subsequently, the causes and consequences should be identified. These problems with their relations are put in a logical overview, called a problem cluster. The core problem must be identified from this problem cluster. The last step is to make the problem measurable. The problem is expressed through variables. If these variables are not measurable, they need to be operationalized. To do this, indicators are created. There can be multiple indicators to fully cover the load of one variable.

Solution planning

The solution planning phase is mostly concerned with the plan of approach. It focusses on making a detailed systematic approach. The planning should be focused to the people concerned with the problem.

Problem analysis
The problem analysis phase is about digging deeper into the core problem. The causes and consequences will be further analyzed. Questions such as: Why haven't earlier solutions caught on?

Solution generation
The actual solutions to the problem are generated in this stage. There are several steps to take to come orderly to proper solutions. The decision and decision process must be described. Criteria are defined, weighed and scaled. This allows for a ranking of the solutions. Alternative solutions should be generated as well. These should be ranked and compared to the created solution.

Solution choice
The generated solutions from the previous are evaluated and a solution choice is made. There are several factors to consider when deciding. The stakeholders, shareholders, people responsible for the choice or other people involved may have other perspectives to consider and therefore will not always decide for the best option.

Solution implementation
To implement a solution, two steps need to be defined. The technical side of the implementation needs to be addressed. A technical report must be written with the activities that need to be executed for successful implementation. The social aspects need to be described as well, such as the roles people have.

Solution evaluation
An evaluation of the process that has been executed should be made. Checking every step, considering choices that have been made but mostly evaluating the implementation. The functionality of the solution might be properly. Yet, further improvements can be made.

A.2.2 Design science
Design science is a method designed for the creation of constructs, methods, models and instantiations (Peffers et al., 2008). Many researchers have investigated the application of design science within engineering context. Ken Peffers has made a commonly accepted framework for design science within the information system industry. He proposes a mental model to structure a research. This design science consists of seven steps.

Problem identification and motivation
The first step is the problem identification and motivation. This step involves defining the research problem specifically. To properly motivate the research, a justification of solution's value should also be done in this step. This justification serves multiple purposes. It motivates the researcher and the readers of the research to pursue the right solution. Moreover, it helps to accept the results of the research and to understand the reasoning of the chosen approach.

Define objectives of a solution
The objectives of the solution should be defined in this step. These objectives must be logically derived from the problem statement. The deduced variables should be operationalized through indicators. These indicators can be quantitative or qualitive.

Design and development
The actual creation of the artifact. As mentioned before, this can be a construct, method, model, instantiation or other kind of concepts. This will be the designed artifact including the research contribution. This stage should include the determination of the functionality, the architecture and the actual artifact.

Demonstration
In this stage, a demonstration of the method is executed. This can be any kind of utilization of the artifact. Exact knowledge of the artifact's use should be mastered.

Evaluation
In this stage the solution to the problem is measured. This would involve the comparison between the made solution and the predefined objectives. This stage requires knowledge of relevant metrics and or data analysis methods. Because of the many different forms of the designs, different measurement techniques can be needed. A researcher should decide whether to iterate back stage to try to improve the effectiveness of the produced artifact.

Communication
The contents of the research should be communicated to relevant audiences. The results of the research done might be used by other parties that have similar interest in their discipline.

A.2.3 Comparison

The first stage is similar for both methods, as is the second. The third stage is a more detailed analysis of the problem, which is included in the first two phases of the design science approach. The fourth stage is where the purpose of both methods gives way for differences. The development of an artifact needs more emphasis on the actual design and development. More specifically, the design of one solution. The MPSM focusses on more than one solution. This causes the next phase to be different as well. A solution choice must be made in the MPSM approach, this is not needed in the design science approach, as there is just one solution. The demonstration and solution implementation phase are similar. The communication phase is solely implemented in the design science. An overview is given in table 16.

Table 16: MPSM compared with Design Science

	MPSM	**Design Science**
Phase 1	Problem identification	Problem identification and motivation
Phase 2	Solution planning	Define objectives of a solution
Phase 3	Problem analysis	**X**
Phase 4	Solution generation	Design and development
Phase 5	Solution choice	**X**
Phase 6	Solution implementation	Demonstration
Phase 7	Evaluation	Evaluation
Phase 8	**X**	Communication

A.2.4 Conclusion

Both approaches have characteristics that the other does not. As this thesis is concerned with the actual design of a method, the design science is the more logical choice. However, the MPSM could complement the design science such that it will be more comprehensive. Therefore, a composite of both methods will be utilized in this research. This composite will consist of phase 1, 2, 3, 6 and 7 of the MPSM, and phase 1, 2, 4, 6, 7 and 8 of the design science. This approach is showed in Table 17.

Table 17: Composite method

	Composite MPSM/ Design Science
Phase 1	Problem identification/ Problem identification and motivation
Phase 2	Solution planning/ Define objectives of a solution
Phase 3	Problem analysis
Phase 4	Solution generation/ Design and development
Phase 5	Solution implementation/ Demonstration
Phase 6	Evaluation
Phase 7	Communication

A.3 Definitions

In this chapter, terms that are often used throughout this thesis will be clearly defined.

Expert finding system

An Expert Finding System (EFS) enables users to discover domain or subject matter experts in order to hire or acquire their knowledge (Maybury, 2006). For a more elaborate description of the EFS, as used in this research, see the section Expert finding system described.

Employee expertise management policy vs. expertise management policy

An employee expertise management policy is a fixed system/protocol/procedure in which the expertise, i.e. the knowledge and skills, of an employee is stored and anticipated for the purpose of creating value and meeting tactical and strategic requirements.

An expertise management policy is defined as the systematic management of an organization's knowledge assets for the purpose of creating value and meeting tactical & strategic requirements; it consists of the initiatives, processes, strategies, and systems that sustain and enhance the storage, assessment, sharing, refinement, and creation of knowledge.

The difference is the focus on knowledge assets and employees' knowledge and skills. An employee can be a knowledge asset, yet this term is much broader and focusses on organizational value.

The term "knowledge assets" refers to the accumulated intellectual resources of your organization. It is the knowledge possessed by your organization and its workforce in the form of information, ideas, learning, understanding, memory, insights, cognitive and technical skills, and capabilities. Your workforce, databases, documents, guides, policies and procedures, software, and patents are repositories of your organization's knowledge assets. Knowledge assets are held not only by an organization but reside within its customers, suppliers, and partners as well.

Knowledge assets are the "know how" that your organization has available to use, to invest, and to grow. Building and managing its knowledge assets are key components for your organization to create value for your stakeholders and to help sustain overall organizational performance success (Baldridge Glossary Business Intelligence, 2003).

Employee expertise sources

The term employee expertise source is defined as digital information concerning the expertise of an employee. Employee expertise sources are used to mine for the purpose of automatically generating expert profiles.

Expert profile

The profile of an individual is a record of the types and areas of skills of that individual ("topical profile") plus a description of her collaboration network ("social profile") (Balog & De Rijke, 2007). An expert profile represents the knowledge and skills of an individual. The "hard factors" are a requirement for the profile. The "soft factors" are debatable, as different aspects can be more important for others. In this thesis, a design is proposed with the hard and soft factors that are considered important towards the purpose of this thesis.

Hard and soft factors
For this thesis, the hard factors are defined as the overlap in the required expertise and skills. These are the essential aspects of the match. The soft factors are aspects such as hobbies that can facilitate a better personal match but are not essential for the required expertise.

Expertise
A high level of knowledge or skill (Cambridge dictionary).

A.4 Interview design

This appendix shows the pre-fixed setup of the standardized open-ended interviews.

Start

How many employees does your company have?
Is there an expertise management policy? What does it entail? - Check Small/medium or Large for policy

Introduction Thales EFS - Expertise questions

What company do you work for?

What would you call your area of expertise?

What do you think others would think what your expertise is?

What education did you follow?

How long have you been doing this work?

What would you say are the main elements of your profession?

EFS general 2 causes: 1 Efficiency, 2 Networking

Can you see the usefulness of an EFS system?

To what extend do you think it can be used?

What should definitely be included in the expert profile?

What should not be included in the expert profile?

Do you think anonymity should be maintained in the expert profile?

What information would you consider as privacy violating?

Sources - Explain purpose sources and show list of sources

Which sources are familiar?

Which sources do you think will be useful? / Which sources do you think contain the most information?

Can you think of any sources that are not included in this list but do serve this purpose?

What format are these sources? Can these sources be mined with keyword extraction?

Are these private sources or public?

What sources do you use the most?

Are these sources up to date?

A.5 Interview summaries

In this part of the appendix, the interview summaries are given. The names of the companies and interviewees are anonymized for privacy reasons.

A.5.1 Interview Company 1 summary

Company: X

Business: Secondment

Category: Small/medium

Interviewer: Wouter Heijs

Interviewee: X

Employee expertise sources: CV, EasyFlex,

Summary:
The interviewee sees the usefulness of an EFS. The profiles should include the geographical element, the price per hour of the employee and exclude elements such as names, photo's, gender and race. The interviewee argues that personality traits are less relevant, because experts are attracted purely for their expertise and not for working within a team. It should be prevented that employees can be contacted outside the EFS. The system operates on trust; hence it is risky to participate. The company uses an HRM/CRM system called EasyFlex, this system stores information such as CV, work experience, relevant job titles, desires (jobwise) and education. For the personnel of company 1 itself there is no employee expertise management policy. The interviewee believes that employees of small companies should enter the profile information themselves, instead of automatically, as most small companies still have their employee administration put away in binders. The interviewee warns for the risks of the new GDPR and recruitment issues.

A.5.2 Interview Company 2 summary

Company: X

Business: Secondment

Category: Small/medium

Interviewer: Wouter Heijs

Interviewee: X

Employee expertise sources: questionnaire, CV, feedback interview, social media, background checks and loans

Summary:
Company 2 does not use an employee expertise management policy. However, they use this for their secondment program. Job applicants that enter their system are asked to supply their CV and to fill out a questionnaire. Subsequently, an interview is held with the applicant, to determine the 'soft' factors. For example, (dis)preferences that do not appear in a CV. The proficiency level is based on the education combined with the experience. By means of fuzzy logic, artificial intelligence will be implemented to add feedback into the system. Besides competences, needs are included in the profile as well.

The interviewee suggested that the EFS must work in different levels, for example, first internal, then within the supply chain, next the branch, and finally within a region. It was suggested that the system must reach to an intermediate person, and not directly to the expert, as it this intermediate person determines whether the expert is available. The EFS can play an important role in motivating people. For a well-educated person, 3 factors are needed to create motivation: craftmanship, self-determination and a sense of greater good. If one finds these 3 factors in a job, one might be willing to work harder.

The interviewee suggested the following employee expertise sources: CV, social media, background checks and loans. Finally, he recommended that Thales should built upon an existing system, instead of creating it from scratch. He warned for the new GDPR as well.

A.5.3 Interview Company 3 summary

Company: X

Business: IT automating

Category: Small/medium

Interviewer: Wouter Heijs

Interviewee: X

Employee expertise sources: CV, SAP ERP, Fieldglass SAP, Office documents, career plan/ evaluations, emails, LinkedIn,

Summary:
Company 3's management policy is maintained by the manager. The interviewee mentioned that it is impossible to integrate the EFS with all different companies' systems. Therefore, he suggested a portal is the answer. Different categories should be applied in the profiles, and people should choose which categories belong to them. Free format text should be complemented with fixed questions. Free format is important for giving nuance to a profile. The interviewee argues that matching should not only focus on the past of an employee, but also on the future. The development plans of an employee can be taken into account for the matching.

Privacy of the employees should be taken into account for the development of an EFS. Be careful with the access to sources, so that the combination of different sources does not divulge any classified information. Personality classifications such as the Belbin roles are a good addition to the profiles, as this can improve the match. Internal matching will be better, as more sources are available. Reevaluation of personality should be done every 5 years, as people can take on a second nature.

The query can be very detailed, but the client does not always know what he needs. Good matches are important for continuity of the system. Good matches will yield repetitive users. Matches are best possibilities given the state of things, but not absolute. Therefore, interviews are should be conducted to guarantee a good match.

A.5.4 Survey Company 4 Summary

Company: X

Business: Software development

Category: Small/medium

Responder: X

Employee expertise sources: LinkedIn, Office documents, Education, Degrees, Certificates of conduct and licenses

Summary:
Company 4 does not use an employee expertise management policy. The interviewee argues that the expertise area will be the most important part of the profile. Furthermore, he believes that an EFS can be used to every extend. He recognizes the above-mentioned documents as having employee expertise.

A.5.5 Survey Company 5 Summary

Company: X

Business: Software development

Category: Small/medium

Responder: X

Employee expertise sources: CV, Degrees and work documents

Summary:
Company 5 has become increasingly aware of the importance of expertise sharing. Currently, they are developing an employee guidebook, but it is in the starting phase. The interviewee acknowledges the usefulness of an EFS. She believes levels of proficiency are a crucial part of the profiles. For small companies, the profiles will have to be filled in by people, as not enough sources will be available. She argues that a lot of sources can be used, but that does not mean all of them should be used, related to privacy legislation.

A.5.6 Interview Company 6 summary

Company: X

Business: IT Consultancy

Category: Small/medium

Interviewer: Wouter Heijs

Interviewee: X

Employee expertise sources: Mendix quality software tracker, SharePoint, personnel file and enneagrams.

Summary:
Company 6 uses a system that has a competence center. This system is used to spread information throughout the company. This is more a communication channel, than it is an employee expertise database. The interviewee suggests that the expert profiles should include experience, length of experience, hobbies and personality traits. The interviewee thinks that an EFS could be useful for all categories of companies, if it were an external system. The following employee expertise sources are suggested: Mendix quality software tracker, SharePoint, personnel file and enneagrams.

A.5.7 Phone interview Company 7 summary

Company: X

Business: System supplier

Category: Large

Interviewer: Wouter Heijs

Interviewee: X

Employee expertise sources: SharePoint, Project documents, Solidworks PDM, Afas Insite, Afas profit, Jira, Outlook

Summary:
Company 7 is developing an employee expertise management policy. However, this is not active yet. Currently, it is not much more than storing a CV and managers who know which expertise resides where. However, they are aware that there is much to be gained from an employee expertise management policy.

A.5.8 Interview Company 8 summary

Company: X

Business: 7 business units, different markets, high tech solutions

Category: Large

Interviewer: Wouter Heijs

Interviewee: X

Employee expertise sources: Microsoft Who, CV, certifications, Facebook at Work/ Workplace by Facebook, Slack, Office documents, Microsoft Teams, SharePoint, OneNote, OneDrive, Certificate of Conduct and LinkedIn

Summary:
There is a beginning of an employee expertise management policy, but it is not far enough developed. Company 8 does use communication tools such as Workplace by Facebook, Slack and email to share knowledge. These can be used to mine employee expertise. Moreover, Office documents contain loads of information and these documents are uploaded to the cloud. Therefore, these can be mined as well. HR systems are not as advanced as they should be, but they are developing some systems.

The interviewee argues that standardization offers flexibility. He elaborates on this by saying that if the common parts of the different business units are standardized, one can react more quicker to for example a GDPR change, as only one adjustment is required, instead of adjustments for every business unit. The interviewee believes that in theory, the implementation of an EFS could be very beneficial for the region. However, in practice he believes it will be very difficult, as managers do not want to lose employees.

Furthermore, he believes the profiles should include whether the employees' expertise is up to date. The matches should ideally exclude the names and photo's, as the match will be made purely on expertise overlap.

A.5.9 Phone interview Company 10 summary

Company: X

Business: Machine supplier

Category: Large

Interviewer: Wouter Heijs

Interviewee: X

Employee expertise sources: Recruitment system Imply, CV, Cobra, Certificates, Courses, Connexx, external drives with project information, evaluations/functionality, email and competences per function

Summary:
The interviewee considers the development of an EFS useful, especially as an internal system for large businesses. Company 10 has 2 systems that are used as employee expertise storage systems. The recruiting system Imply stores the starting expertise of the employee in files such as CV. The system Cobra contains employee achievements such as certifications, licenses and courses acquired. The interviewee warns for abuse of the system with recruitment purposes. She argues that a profile for internal matching should be different than a profile for external matching. In a general profile the following aspects should be included: education, specialty, projects done, courses taken, number of years of experience in the corresponding field and different departments worked. The interviewee believes that gender and company should not be included in the profile. However, the profile should show the branch.

A.6 Transcripts

In this part of the appendix, two transcripts of the interviews are represented.

A.6.1 Transcript Company 6

Interviewer: Wouter Heijs

Geïnterviewde: X

Datum: 5 juni 2019

Begin opname

Wouter Heijs: Hoe veel man werkt er bij Company 6?

Geïnterviewde: Ik denk dat er inclusief afstudeerders z'n 80 - 90 man aan het werk zijn hier.

Wouter Heijs: Hebben jullie een kennismanagement beleid? Zeg maar van waar iedereen goed in is, wat iedereens specialiteiten zijn. Dat je dat ergens bij houdt in een systeem.

Geïnterviewde: Nou, wij hebben eigenlijk 2 systemen waar we mee werken en we hebben daar een soort competence center van waar de kennis wordt verspreid, van beide systemen hebben we dat.

Wouter Heijs: En hoe ziet dat competence center eruit? Hoe zit dat in elkaar?

Geïnterviewde: Ja nou ja, zij houden zich bezig met de ontwikkelingen op beide platformen en ook de nieuwst ontwikkelingen hoe die het beste verspreid kunnen worden. We zijn nu ook bezig met het geven van trainingen en daar wordt dan ook gebruik gemaakt van competence centers met hoe kunnen we dingen voorbereiden. Wat moet daarin komen? Wie gaat die geven? Vaak wordt dat ook door hun verzorgd.

Wouter Heijs: Oke. Ik ga dus aan de slag met een ontwikkeling van een expert finding system, dat is een systeem dat matcht iemand met een vraag, aan iemand die kennis zou moeten hebben van die vraag. Dat wordt gedaan door middel van indexen en dan zoekt het systeem een geschikte candidaat erbij. Dat heeft 2 grote doelen. Dat is 1: je kan heel veel tijd besparen. Stel je krijgt een grote opdracht en je moet iets helemaal uitzoeken en je kan dat in het systeem zetten en je komt erachter dat Jantje daar heel veel verstand heeft van dit probleem. Dan kan je hem een paar vragen stellen en dan kan je veel eerder bij je oplossingen komen. Dus het zou heel veel tijd kunnen besparen. Daarnaast is het op hele grote schaal, dus niet alleen binnen het bedrijf maar ook over bedrijven heen. Het verbreid dus ook je netwerk. Je komt met mensen in contact waar je normaal gesproken nooit mee in contact zou komen. En daarvoor moet ik dus de inrichting van het profiel voor expert samenstellen. Als je die vraag invult komen er 3 geschikte opties naar voren en je kan dan een keus maken tussen die 3 en dat is dan degene waar je mee in contact komt. En mijn onderzoek gaat over wat moet er nou in dat profiel staan. Dat gaat dus over de expertise van die persoon vastleggen. Wat denk jij dat absoluut in dat profiel zou moeten staan?

Geïnterviewde: Eehm ja, dat is lastig, eehm ik denk sowieso de onderwerpen gespecificeerd van welk ondereel heeft een persoon ervaring mee en misschien ook hoeveel ervaring in hoeveel tijd. Misschien kun je een soort schaal maken van hoe ervaren is iemand, hoe veel kennis heeft iemand? Wij werken bijvoorbeeld met certificaten, heeft hij een basis certificatie of advanced gecertificeerd? Dat zou je bijvoorbeeld allemaal kunnen meenemen. En ook specialisaties inderdaad. We hebben hier bijvoorbeeld

mensen die zijn gespecialiseerd in certificaten, dat je bijvoorbeeld kunnen meenemen. Dat zou in z'n profiel wel goed passen.

Wouter Heijs: Denk je ook dat dingen als hobbies, want je maakt een keuze tussen 3, stel ze hebben alle 3 dezelfde kennis, dat je dan gaat kijken welke persoon je op een persoonlijk level meer mee klikt. Zou dat ook in het profiel moeten staan denk je.

Geïnterviewde: Ja dan zou ik inderdaad wel naar persoonlijke eigenschappen gaan kijken. Wij werken hier met een soort label; van wat voor soort persoon ben jij. Daar zijn ook, ik weet dat daar studies naar zijn. Je kan mensen verdelen in een soort groepen.

Wouter Heijs: Je bedoelt die Belbin teamrollen?

Geïnterviewde: Ja zulke dingen. Je hebt volgens mij 9 verschillende typen en je kunt dan gaan kijken welk type ben ik. En er is dan ook weer wetenschappelijk uitgezocht welke types het beste samen kunnen werken. Zo zou je bijvoorbeeld ook een match kunnen maken.

Wouter Heijs: Dat is inderdaad wel handig, daar had ik nog niet aan gedacht. Die ga ik meenemen.

Geïnterviewde: Tenminste, ja als zeg maar alle andere factoren gelijk zijn en je moet iemand hebben dan zou ik wel kijken naar met wie kun jij het makkelijkst communiceren.

Wouter Heijs: Ja, en al helemaal als daar een wetenschappelijke basis voor is. Eh, wat is jouw functie hier binnen dit bedrijf?

Geïnterviewde: Ik ben consultant. Op dit moment houd ik me bezig met integraties, ik ben integratie consultant. Straks ga ik ook met Mendix, dan ga ik ook applicaties bouwen. Wij zitten eigenlijk bij een klant, en die klant heeft een vraagstuk en wij gaan daar een oplossing voor bieden. En dat doen wij middels E-magiz aan de integratie kant.

Wouter Heijs: En als je straks dan ook echt in Mendix dingen gaat bouwen, gaat dat dan ook meer richting de software engineer kant?

Geïnterviewde: Ja, ja.

Wouter Heijs: En waar bestaat dat dan vooral uit, wat voor stappen moet je dan zetten?

Geïnterviewde: De basis is natuurlijk de technische kant, hoe werkt überhaupt de software. Daarnaast zit er een stukje kennis van organisaties bij, hoe werken organisaties. Je gaat niet alleen uitvoeren wat er gevraagd wordt, maar je gaat ook meedenken van hoe zitten processen in elkaar. Daarnaast ook communicatief, hoe ga ik met de klant om, hoe kan in die het beste adviseren. Ik denk dat dat wel de belangrijkste factoren zijn.

Wouter Heijs: En heb jij daar al ervaring mee, met Mendix?

Geïnterviewde: Eh nee nog niet. Ik krijg over 2 weken trainingen.

Wouter Heijs: Nu weer even over het expert finding system. Zie jij de zin van z'n systeem in?

Geïnterviewde: Eh, ik denk zeker, met name als ik vanuit Company 6 praat. Met name voor Mendix, omdat Mendix gewoon heel veel gebruikers heeft. Maar met E-magoz, die manuals zijn relatief klein, we

zijn nog een beginnend platform. Dus er zijn nog niet zoveel experts, waarvan de meeste experts in-house zijn, dus als ik een vraag heb weet ik zelf wel bij wie ik moet zijn.

Wouter Heijs: Ja zo ja, dan heeft dat systeem weinig toegevoegde waarde.

Geïnterviewde: Weinig toegevoegde waarde inderdaad, dan heeft het geen zin om in het systeem te gaan zoeken terwijl je eigenlijk al weet bij wie je moet zijn. Maar als je het hebt over Mendix, ja dat is zo groot, dat wordt door zoveel mensen gebruikt. Dan is het denk ik heel nuttig.

Wouter Heijs: Zeker als je dan ook bij mensen buiten Company 6 terecht komt.

Geïnterviewde: Ja precies, dat kan je ook op nieuwe inzichten brengen, omdat zoals ik zei, we hebben een Mendix competence center waarbij dus binnen Company 6 nog informatie wordt gedeeld. Maar het is ook wel eens goed om van buitenaf ideeën te krijgen.

Wouter Heijs: Met een hele andere kijk?

Geïnterviewde: Ja precies, dat zo wel een voordeel kunnen zijn.

Wouter Heijs: Oke, denk je dat anoniem zijn in dat profiel, is dat van belang? Of zou je gewoon je naam erbij zetten.

Geïnterviewde: Dat hangt denk ik af van de persoon. Ik kan me voorstellen dat er een personen zijn die die daar niet met hun naam in zouden willen staan, maar dat is denk ik niet voor iedereen hetzelfde.

Wouter Heijs: En wat zou je in dat profiel als privacy schendend ervaren?

Geïnterviewde: Bijvoorbeeld mijn als mijn telefoonnummer erin zou staan, mijn contact gegevens. Dat je ook wordt benaderd buiten dat systeem om. Dat zou als vervelend ervaren kunnen worden. Dat je dan constant misschien wel benaderen, als ze je eenmaal weten te vinden.

Wouter Heijs: Oke, en we kijken ook naar dat dat profiel automatisch ingericht kan worden, er zijn al werkende versies van. Maar die profielen worden allemaal door mensen zelf ingevuld. Als je dat dus op grote schaal wilt implementeren dan is dat dus een immens werk. Dus we kijken of het soort van automatisch kunnen laten genereren die profielen, op basis van documenten waar al aan gewerkt is. We willen dus een soort tekst mining achtig iets dat dus door die bronnen heen gaat en dat dus omzet in een profiel. Dat op een automatische manier en dan zou het dus makkelijker op grote schaal kunnen worden gebruikt. Dat heeft dus bronnen nodig in de vorm van bijvoorbeeld documenten waarin jij hebt gewerkt, waar jouw naam op staat bijvoorbeeld. En dat hij daar dan doorheen gaat en hij dan opmaakt dat je daar verstand hebt, want jij hebt hier zoveel uur ingestopt. Ken jij dit soort bronnen binnen Company 6 die kennis van jou zouden kunnen bevatten?

Geïnterviewde: Ehm, wij hebben sowieso op Mendix software die kijkt naar de kwaliteit van een applicatie, en daaraan kun je dus ook afmeten iets van hoe goed is die persoon in een bepaald onderwerp? Als je bijvoorbeeld ziet dat het een heel goed systeem is want dit werkt heel mooi en dit werkt heel mooi, dan zou je dat misschien kunnen meenemen als een meting voor waar een persoon goed in is, want hij heeft dat in de praktijd bewezen. En hoe meer je dat ziet, hoe betrouwbaarder die informatie is natuurlijk.

Wouter Heijs: En qua human resources document? Ik weet niet of jullie een aparte afdeling hebben?

Geïnterviewde: Eh, wij hebben een academie waarin je wel een dossier hebt, waar dus wel instaat bijvoorbeeld wat voor persoon je bent. Dat zal op SharePoint staan, ik weet niet precies waar wij dat hebben vast gelegd, dat durf ik niet te zeggen, of dat een Word-document is of iets.

Wouter Heijs: Ja, dat was de volgende vraag, wat voor format het heeft.

Geïnterviewde: Ja dat zal Word of Excel of iets zijn.

Wouter Heijs: Maar jij zegt, waarin is vast gelegd wat voor persoon jij bent, wat bedoel je daarmee?

Geïnterviewde: Ja wij hebben iemand van buiten die gaat met je in gesprek. Die gaat aan de hand van heel veel vragen, en dan komen we weer bij dat wetenschappelijk bewezen, de 9 enneagrammen. Dat moet je maar eens opzoeken, de 9 enneagram types. Dat is waar wij nu mee werken. En dat wordt dan bepaald met bijvoorbeeld, voor 90% zeker val jij binnen dit type. Of met een mix van die en die. Dat wordt dan vast gelegd en z'n stempel krijg je dan als het ware. Het is meer zoiets daar wordt rekening mee gehouden bij het samenstellen van team.

Wouter Heijs: Maar dit is op basis van privé bronnen neem ik aan?

Geïnterviewde: Ja die zijn, in principe weet iedereen wel van elkaar wat voor soort persoon ze zijn, maar als je dat voor je wilt houden dan kan dat. Het is wel vertrouwelijke informatie. Het zegt wat over jou als persoon.

Wouter Heijs: Zijn deze bronnen up-to-date? Deze zijn namelijk in het begin een keer gedaan.

Geïnterviewde: Sowieso voor de mensen die een traineeship volgen, anderhalf jaar kom je daarop terug. Je hebt 6 sessie dan.

Wouter Heijs: Ah het is in 6 sessies, maar stel je blijft hier 10 jaar werken, moet je dan over 5 jaar weer opnieuw zoiets doen?

Geïnterviewde: Ik vraag me af of jouw persoonlijkheid kan veranderen. Als ik die man moet geloven dan niet. Hij zegt dat dat in je eerste levensjaar al bepaald wordt. Ik weet niet of hij dat opnieuw getest wordt.

Wouter Heijs: Oke, dus het wordt 1 keer ingezet en dan blijft dat zo.

Geïnterviewde: Ja in dit geval wel, maar dat is natuurlijk voor jouw skills in de techniek wel anders, want daar ontwikkel je wel. Als jij in Mendix werkt, word je door de jaren heen wel beter, dus dat zul je wel zien veranderen als het goed is.

Wouter Heijs: Ok, nog 2 vragen en dan zijn we er al bijna. Wat zie jij als jouw expertise?

Geïnterviewde: Op dit moment ben ik bezig geweest met de integraties, ik ben een integratie consultant. Dus mijn expertise is dus integratie, met name E-magiz. Maar om dan een specifiek onderdeel daar uit te noemen, ik ben nog niet zo lang bezig dat ik mezelf daar al expert in zou noemen.

Wouter Heijs: Oke, want denk je dat andere jouw expertise vinden? En denk je dat verschil in zit met wat jij denkt dat jouw expertise is?

Geïnterviewde: Dat vind ik lastig.

Wouter Heijs: Daar zit namelijk de link met het automatisch laten genereren van de profielen en het de bedrijven zelf in laten vullen. Of dat hetzelfde zou zijn of dat daar verschil in zou zitten.

Geïnterviewde: Dat is wel interessant, ik denk dat daar wel verschil in zou zitten. Ik durf dat niet te zeggen.

Wouter Heijs: Dan zijn we door de officiële vragen heen, dus bij deze hartstikke bedankt dat ik je heb mogen interviewen. Heb jij nog vragen voor mij?

Geïnterviewde: Graag gedaan, nee hoor.

Einde opname

A.6.2 Transcript Company 2

Interviewer: Wouter Heijs

Geïnterviewde: X

Datum: 6 juni 2019

Begin opname

Wouter Heijs: Allereerst, hebben jullie iets van een kennismanagement beleid hier?

Geïnterviewde: Beleid? Wat bedoel je met beleid?

Wouter Heijs: Iets met een vast proces voor opslaan van data, en kennis van de werknemers.

Geïnterviewde: Eh ja, wij hebben onze eigen software ontwikkelt waarbij wij alle kennis en achtergrond van de medewerkers opslaan. Dat begint met een CV, daarvoor een profiel aangemaakt van een kandidaat. Wij noemen dat dan kandidaten of sollicitanten. Dat is 1, daarna vragen wij die persoon om de data te verrijken. Wij kunnen een vragenlijst samenstellen, meestal gebeurt dat per organisatie of per vacature. Meestal heeft een organisatie die elke sollicitant gevraagd moet worden, daar wordt informatie over vast gelegd. Per vacature kan hij dat aanvullen, dus die data wordt door die persoon verrijkt. Dan hebben wij meestal nog een persoonlijk interview. Dus die data vullen wij ook aan. Dat is data als zijnde: Wanneer ben je beschikbaar, wat is je opzegtermijn, waarom ben je op zoek naar wat anders, wat zoek je in een baan, waarom zoek je dat, wat zijn push factoren, waarom zou iemand een andere baan willen, wat zijn push factoren, wat zou een duurzame match zijn? Als jij weg wilt omdat het bedrijf waar je nu werkt een chaos is, niks wordt vast gelegd en je hebt daar een hekel aan. Dan moet je niet een bedrijf hebben dat ook zo opereert. Dan wil je gestructureerde, dat is een heel simpel voorbeeld. Wij kunnen dus die push en pullfactoren in kaart brengen op basis van de behoefte van een mederwerker. Dan krijg je dus ook de softe factoren die een belangrijke rol gaan spelen. Dan krijg je nog wat hardere criteria al zijnde: salaris indicatie, expertise niveau en hoe veel ervaring heeft hij daarin.

Wouter Heijs: Hoe leggen jullie dat niveau vast? Is dat op een schaal of met advanced en dergelijke?

Geïnterviewde: In eerste instantie gaan we uit van het opleidingsniveau. Dat gecombineerd met de ervaring. Dus iemand heeft een Hbo-opleiding of universitair in een vakgebied engineering. Als die universitair geschoold is in engineering en hij heeft technische bedrijfskunde als achtergrond, dan heb je een bepaald uitgangspunt. Dan ga je kijken hoe lang zit hij al in die functie, en daarna ga je verder kijken. Stel ik ben nu op zoek naar een manager in engineering, dan zou het makkelijker zijn als die manager ook als engineer heeft gewerkt. Dan weet hij wel een beetje wat er speelt, en we zoeken iemand op academisch niveau. Dan ga je kijken: wat is de huidige functie, bij welke organisatie heeft hij dat gedaan, is dat een soortgelijke organisatie qua cultuur en achtergrond en werkwijze? En hoe ver staan bepaalde werkaspecten verwijderd van zijn huidige functie. Dus iemand die voor z'n pensionering zit en bij Thales werkt en een afdeling van 100 man heeft aangestuurd, die heeft niet meer heel veel relatie met huidige gang van zaken vergeleken met toen hij begon als engineer. Toen zaten ze nog met potlood achter de tekentafel.

Wouter Heijs: Dat is inderdaad wel veranderd.

Geïnterviewde: Zeker, dus dan zeg je deze man heeft meer managerial ervaring, de mensfactor zou daarin belangrijk zijn, dus hij weet hoe hij mensen en processen moet aansturen. Maar niet meer in relatie tot echt de werkplek. Maar je kunt als organisatie zeggen: we zoeken een wat jongere werknemer, die wel nog die ervaring heeft omdat dat belangrijk is in het huidige project. De huidige functie en de vorige functie in relatie met de afstand daartoe, wordt meegewogen.

Wouter Heijs: En hoe wordt dat dan meegewogen, in een cijfer of iets dergelijks?

Geïnterviewde: Nou dat wordt meegegeven in een ranking, die iemand krijgt. Dus je hebt een bepaalde vraag die iemand in het systeem meegeeft, en dan komt de best matchende persoon bovenaan. Je kan criteria meegeven als: verplicht, nice-to-have en uitsluitende criteria. En ook wat meer operators daarin, dus: and, or, nor en dat soort dingen. Dat zijn wel allemaal systemen die niks doen met je feedback.

Wouter Heijs: Hoe bedoel je dat?

Geïnterviewde: Het systeem houdt rekening met afstanden, ervaringen, niveaus en dat soort zaken. Het systeem doet dat ook op basis van fuzzy logic, dus: klinkt als, lijkt op etc. Dus als ik zoek op: iemand met pc-ervaring, dan komt er ook iemand met computerervaring. En dat doe hij ook op opleidingen en dat soort dingen, maar hij doet niks met de feedback van mij.

Wouter Heijs: Bedoel je wat je net zei, dat iemand niet in chaos wil en vervolgens match het systeem de kandidaat daar toch mee?

Geïnterviewde: Nou ik ga bijvoorbeeld zeggen van: die persoon is niet geschikt voor de functie. Ik krijg die resultaten en ik akker daardoorheen. Dat gebeurt nog met de hand. Je krijgt dus de beste resultaten te zien, ik krijg zeg maar 50 resultaten en de beste match staat bovenaan, in de ogen van het algoritme dan. Dan moet ik daar toch nog met hand door heen. Je gaat kijken naar het commentaar van de persoon, is alles op de juiste manier meegenomen, dat soort dingen. Er zit ook heel veel onderbuikgevoel in, in de zin van: he, zou hij het leuk vinden om elke dag van Amsterdam naar Hilversum op en neer te rijden. Jij komt niet zo vaak op snelweg, maar het systeem zegt niet of jij dat leuk vindt of niet. Het zegt alleen maar wat over de ervaring. Wat het systeem ook niet is als jij bijvoorbeeld een Excel expert zoekt, stel dat jij dat de afgelopen 3 jaar hebt gedaan, maar jij hebt dat gedaan omdat niemand in dat team dat leuk vond of niet kon. Dan heb je die taak wel gedaan, maar eigenlijk tegen je zin in. Het systeem doet daar niks mee. Het systeem zegt alleen: he, Excel expert, 3 jaar ervaring, een topper, dus die moet je hebben. Hij houdt wat minder rekening met de zachte criteria, dus hoe jij er als persoon in staat. En we zijn bezig met het volgende, waarbij op basis van AI hij rekening gaat houden met de feedback die hij krijgt. Dus dan kan ik zeggen: hij is wel een Excel expert, maar daar ligt niet zijn voorkeur. De volgende keer als hij opnieuw naar boven komt, is die feedback daarin meegenomen. En ook welke aspecten belangrijk zijn bij een bepaalde opdracht, dus dan krijg je een stukje AI.

Wouter Heijs: Dat doet het systeem nu niet?

Geïnterviewde: Nee, op dit moment is het een zeer geavanceerde zoekmachine. Maar die leert niet van mijn feedback. Het punt is ook als ik de feedback ga geven, is deze feedback ook anders dan de feedback die jij geeft. Ondanks, dat we wellicht dezelfde training hebben gedaan om feedback te geven, er zit altijd een stukje subjectiviteit in. Wat we nu aan het doen zijn en wat we gaan implementeren, is dat we

gaan leren van de feedback die erachter zit, rekening houden met een stukje subjectiviteit. En daar heb je ook weer wat grotere aantallen voor nodig anders heeft AI niet zo veel zin.

Wouter Heijs: Dat klopt ja, en gebruiken jullie ook als de persoonlijkheidseigenschappen, zoals de Belbin teamrollen?

Geïnterviewde: Ja, wij gebruiken ook assessments en die worden ook daarin meegewogen. Dan krijg je zeg maar dat je op harde criteria gaat matchen, dus heeft hij het niveau en ervaring, dus op CV zeg maar. De softe criteria, dus de feedback van de PNO-er/ recruiter, plus de terugkoppeling uit de assessment. Dus heeft hij de compententies om dit te doen, en vindt hij dit ook leuk? Dus je krijgt bijvoorbeeld: ik zoek een afdelingsmanager en ik heb er 2. Die het in principe zouden kunnen, maar wie heeft er meer affiniteit met een veranderingstraject. Je kunt een manager hebben die een shopkeeper is, het team draait goed, en vooral zou laten draaien, en zorgen dat team goed blijft draaien, maar je hebt ook de verandermanager die ziet dat het team niet goed draait en dat wil veranderen.

Wouter Heijs: Dat zijn eigenlijk 2 hele andere dingen.

Geïnterviewde: Precies, terwijl de achtergrond van deze mensen precies hetzelfde kan zijn. Allebei afdelingsmanager, allebei het eerder gedaan.

Wouter Heijs: En nu maakt het systeem daar dus nog geen onderscheid tussen, maar willen dat dat wel komt?

Geïnterviewde: Wat wij nu doen is dat wij onderscheid maken door de interpretatie van een persoon. En we hopen dat dat straks goed terugkomt uit het systeem.

Wouter Heijs: Hoe spoedig denken jullie dit te kunnen verwezenlijken?

Geïnterviewde: We gaan de implementatie van het nieuwe systeem doen. Dus dan komt het als een module in de software, en dan kun je als klant daarvoor kiezen, of je daar gebruik van wilt maken.

Wouter Heijs: Over Company 2 zelf, hoe veel werknemers hebben jullie ongeveer?

Geïnterviewde: Nu hier 6.

Wouter Heijs: En in totaal ook?

Geïnterviewde: Ja

Wouter Heijs: Oke, wat zij jij jouw expertise noemen?

Geïnterviewde: Ehhhhm, kwartier maken. Kun je daar wat mee?

Wouter Heijs: Nee, wat is dat?

Geïnterviewde: Ik ben goed in de hoofdlijnen, waar moet het naartoe met het systeem of andere dingen. Ik ben goed in de analyse daarvan, wat zijn de huidige uitgangspunten, welke materialen zijn er beschikbaar etc. En ik denk dat ik goed ben in het motiveren van mensen om die verandering tot stand te brengen.

Wouter Heijs: Dus meer van bovenaf?

Geïnterviewde: Iets meer van bovenaf ja, maar waarbij ik wel weet hoe ik de theorie en de praktijk moet verbinden. Dus ik weet vaak wat er op de werkvloer speelt en hoe verbind ik dat aan de hoofdlijnen.

Wouter Heijs: De strategische keuzes dus?

Geïnterviewde: Strategisch, en tactisch en operationeel aan elkaar koppelen.

Wouter Heijs: Hoe denk je dat anderen uw expertise zien?

Geïnterviewde: Met name netwerken, zaken opzetten, dus dat is ook kwartier maken. En het matchen zeg maar, dus de juiste match tot stand brengen.

Wouter Heijs: Als je dit in een kennisprofiel zou willen zetten, hoe zou je dat daarin zetten. Ik had het net over de match tussen de vraag en het profiel. Hoe zou je uw kennis dan in z'n profiel weergeven.

Geïnterviewde: Op basis van competenties. Wat ik net schetste van mij waren 3 competenties van de 8 basis competenties die wij toetsen. Wij zeggen altijd dat voor een bepaalde opdracht, is het prettig als iemand 3 van de 8 competenties beschikt, of goed in is voor een bepaalde rol. En sommige competenties zijn conflicterend. Bijvoorbeeld, iemand die heel erg creatief is, is vaak iets minder administratief onderlegd, iets minder nauwkeurig. Als je dat vertaalt naar een functie, dan is iets minder motiveren en stimuleren, hoort bij sales functie. Andere mensen enthousiast maken over een product of een proces, iets verkopen zeg maar. Zo'n sales profiel zijn over het algemeen iets minder goed in administratie, dus meer erg goed in het enthousiasmeren en het bedenken, maar minder goed in het structureren. Die structuur conflicteert met die creativiteit. Dus als iemand zegt hij moet en een goede salesmanager zijn en hij moet de administratie goed doen. Dan krijg je vaak een beetje een gespleten persoonlijkheid, letterlijk.

Wouter Heijs: En buiten die 8 competenties, hebben jullie nog iets anders in dat profiel? Zoals persoonlijke voorkeuren of dergelijke?

Geïnterviewde: Ja behoeftes, competenties brengen we in kaart. Dus wat vindt hij op dit moment belangrijk, qua structuur. Dat kan van alles zijn.

Wouter Heijs: Maar dit is niet volgens een vast format?

Geïnterviewde: Nou dit is volgens de vragenlijst. Dus als ik tegen jou zeg, ken jij jouw behoeftes, misschien weet je dat niet, misschien weet je dat wel. Dus dan zeggen we, hier heb je er 50 die wij alvast gedefinieerd hebben. Daar zit van alles bij, chaos, structuur, ambitie, vrijheid. Daar zit van alles bij. Dan zeg ik: kies er nou eens 10 uit, en als je er nog een mist, zet hem er maar bij. Zet ze dan eens in volgorde van belangrijkheid, dus de belangrijkste bovenaan. Geef aan wat de betekenis voor die behoefte van jou is. Dus vrijheid betekent voor mij dat ik mijn werk zelf kan indelen. Dan in welke mate die vervuld is, dus je kan zeggen, ik vind die heel belangrijk maar ik vind dit hier helemaal niet terug. Bijvoorbeeld, ik moet klokken en dat vind ik waardeloos. Dan of de hoogte van de vervullingsgraad afhankelijk is van jezelf of van het team, en dan je eigen voorstel tot verbetering. Als laatste vraag, vragen we je dit met werkaspecten in contact te brengen. Met de werkgevende, met je team, met de werktijden, etc. Daar komt vervolgens een matrix uit. Een aantal aspecten komen dan vaker terug dan andere aspecten. In die matrix zit ook een simpele kleurcodering. Rood heeft echt aandacht nodig, geel is let op en groen is helemaal goed.

Wouter Heijs: Dan weet je dus precies wat voor hem belangrijk is.

Geïnterviewde: En hoe vaak komt dat terug, en staat dat in relatie tot het werk, want het kunnen ook persoonlijke behoeftes zijn. Het is wel belangrijk voor jou, je moet kijken naar de werk-privé balans. Het mooiste is als je op je werk en thuis lekker in je vel zit.

Wouter Heijs: Ideaal.

Geïnterviewde: Als je op 1 van de 2 problemen hebt, gaat het ook nog wel goed. Maar als je op beide problemen hebt, dan zakt het in elkaar. Als dat te lang duurt, ga je een probleem krijgen.

Wouter Heijs: Oke, welke opleiding heeft u gevolgd?

Geïnterviewde: LTS, mavo, havo, HTS.

Wouter Heijs: En staat dat in verbinding met wat u nu doet? Gebruikt u die opgedane kennis nog dagelijks?

Geïnterviewde: Nou de techniek, omdat we bij technische bedrijven zitten weet ik wat een techneut doet, ik weet wat een engineer doet. Werkinhoudelijk kan ik het een beetje inschatten, maar eigenlijk niet meer dan dat.

Wouter Heijs: Dat expert finding system dat ik heb omschreven, zie je daar het nut van in? Ook voor extern gebruik.

Geïnterviewde: Ja absoluut, dan moet je nog iets verder gaan.

Wouter Heijs: Hoe bedoel je dat?

Geïnterviewde: Je zal moeten matchen in domeinen.

Wouter Heijs: Alle techneuten bij elkaar bijvoorbeeld?

Geïnterviewde: Nou alle techneuten van Thales is 1 domein bijvoorbeeld. De interne medewerkers. Je zal ook zeggen Thales gaat samenwerken met een x-tal andere bedrijven, maar je kan ook zeggen met een 3-tal op gebied van engineering, met 2-tal op het gebied inkopen, daar doen ze een project mee. Dan kun je zeggen, we matchen eerst alleen maar intern, dus is de expertise intern aanwezig, dat is 1 domein. Dan zou het 2^{e} domein kunnen kijken naar bedrijven waar we mee samenwerken op een bepaald vlak. Zo krijg je interne en externe kandidaten. Je zou ook kunnen zeggen dat je dat wil uitbreiden, dus industrieterrein, branche, holding, whatever, dan wordt het interessant.

Wouter Heijs: Dus steeds een stapje verder?

Geïnterviewde: Ja, en dat gaan wij doen.

Wouter Heijs: Dat gaan jullie doen? Eh, wat denk je dat niet in dat profiel zou moeten staan, wat zou jij als privacy schendend ervaren?

Geïnterviewde: Wat mij betreft kan alles erin, het moet wel relevant zijn. Geef eens voorbeeld dan.

Wouter Heijs: Telefoonnummer, foto, naam, moet je de keus maken op basis van pure expertise, stel dat het een open systeem is, waarbij alle bedrijven meedoen. Zou je dan willen dat jouw naam en telefoonnummer erbij staat? Of dat je gewoon via dat systeem elkaar bereikt.

Geïnterviewde: Nou, je zou het op verschillende niveaus moeten doen. Als iedereen erin kan, dan moet het gebeuren op basis van competenties.

Wouter Heijs: En dan dus de naam weglaten.

Geïnterviewde: Ja, en ook geen contactgegevens. Dan mag het niet te herleiden zijn tot een persoon. Dat is eigenlijk wat de AVG zegt, de GDPR. Dus dan zou je kunnen zeggen: er is iemand binnen dat bedrijf die over die expertise bezit, maar dat bedrijf maakt het ook alweer lastig. Maar goed, je wilt uiteindelijk wel een bepaalde kant op. Je wilt wel een bepaalde persoon kunnen vinden. Dan zou je kunnen zeggen, ik weet dat hij bij bedrijf A zit, laat ik de contactpersoon bij dat bedrijf A inderdaad beschikbaar is, want je hebt het ook nog over tijdstip.

Wouter Heijs: Hij moet tijd hebben, of kunnen maken.

Geïnterviewde: Ja, want dat jij nu dit onderzoek doet, dat is hartstikke mooi, maar jij had vorige jaar niet kunnen, en volgend jaar doe je het ook niet. Dus dat is ook nog een belangrijke factor. Dat soort zaken spelen allemaal mee. Matching op domeinen, matching op verschillende niveaus, en in eerste instantie zou ik alleen maar met gecertificeerde mensen matchen. Mensen waar je toegang tot hebt en daar ook iets over moeten kunnen zeggen. Dus misschien een personeelsfunctionaris, of een..

Wouter Heijs: Dus niet direct de persoon aanspreken, maar gebruik maken van een tussenpersoon.

Geïnterviewde: Nou, je zou het aan de persoon zelf kunnen geven, die mag zich daarin aanmelden en daar komt waarschijnlijk een betere match uit. Dus jij gaat beter op de positie passen die je nu hebt. Het kan ook zijn dat jij dat wilt. Nou werk je bij VDL of Siemens, en dan zit je daar niet meer helemaal lekker in je vel, je bent je aan het oriënteren, je bent latent op zoek, zoals dat zo mooi heet. Dat kan allerlei oorzaken hebben. Dan is het zaak dat je daar zelf wat aan doet, dus je gaat op zoek naar een andere functie, soms kan dat intern niet, dan doe je dat extern. Dus wat zou er nou mooier zijn, dan dat jij je aan kan melden, bij dat systeem en dat zoekt de meest ideale baan voor jou op dat moment. Of opdracht, want baan is eigenlijk achterhaald.

Wouter Heijs: Zoals wij het nu voor ons zien, is het andersom. Het systeem zoekt de andere kant op; er is een baan en er wordt gezocht wie daar het best bij past.

Geïnterviewde: Ja, maar je zou het ook om kunnen draaien.

Wouter Heijs: Maar dat is jullie business.

Geïnterviewde: Niet zo zeer, onze invalshoek is vanuit 2 posities. Jij kan bij mij komen op zoek naar een nieuwe baan. Dat is vanuit het individu opzoek naar een nieuwe baan. Maar aan de andere komt Thales ook heel vaak op zoek naar een engineer, dus je zou bi directioneel moeten kunnen matchen.

Wouter Heijs: Omdat de tijd vaak niet klopt?

Geïnterviewde: Ja, en soms kun je het ook creëren, want heel vaak nemen de managers niet de moeite om het te melden in het systeem. Dat is lastig, hebben ze geen in, en dergelijke. Dus wat nou als je

gewoon die medewerker die rol laat spelen. Die kan zichzelf aanmelden, ik ben opzoek naar wat anders omdat mijn behoeftes niet meer worden voldaan. Wat zijn die behoeftes dan, kunnen we daar wat aan doen? Soms zijn het hele kleine dingen, je zou bijvoorbeeld kunnen zeggen: ik heb een hekel aan klokken, kunnen we jouw werk anders definiëren? Dus je hoeft niet van 8 tot 5 te werken, maar je moet het werk dat er is oplossen. En als jij dat van 7 tot 4 doet, is dat helemaal goed. Als het op een bepaalde deadline maar geregeld is. Dan kom je de drie belangrijkste drijfveren tegen in het algemeen. En zeker bij Thales op hoger niveau. Aan de onderkant van de markt is het zo: je staat aan de machine, die spuugt er elke dag 100 uit, en ik kom als baas bij jou en zeg: joh, als jij er 110 kan doen morgen, krijg je een bonus. Dan ga je harder lopen, als je op dit niveau acteert, middelbaar en hoger, dan ga je op andere zaken acteren. Dan denk je die 110, daar word ik niet anders van, een klein bonusje is niet meer je motivatie, dan gaat het meer om dat je jezelf wilt ontwikkelen: craftmanship. Dat je de vrijheid hebt om dat te doen wanneer jou dat uitkomt: zelfbeschikking, en als er een hoger doel achter zit. Dat kan zijn in de zorg, verdediging van het land.

Wouter Heijs: Het idee dat je een betere wereld maakt?

Geïnterviewde: Wat jouw idee van een hoger doel maar is, maar die 3. Als jij die drie terugvindt in een baan, ga je er harder voor lopen. Bij Thales als ze daar bonussen geven, zijn dat geen motivatoren, dat zeggen ze wel, maar dat is een beetje uit hebzucht zeg maar. Dat is geen feitelijke prikkel om harder te gaan lopen of extra bijdrage te leveren.

Wouter Heijs: Is dat bewezen?

Geïnterviewde: Ja, dat is wetenschappelijk aangetoond.

Wouter Heijs: Dat is wel bizar, dat het op laag niveau wel werkt, en op hoog niet.

Geïnterviewde: Ja eh, waar dat kantelpunt zit weet ik ook zo niet. Het heeft ook te maken met het feit dat je je wel moeten kunnen redden. Je hebt een basisinkomen nodig waarmee je je hypotheek kan betalen, je kinderen naar school kunnen.

Wouter Heijs: Als je dat niet hebt, wordt het geld heel belangrijk.

Geïnterviewde: Ja als je de eindjes aan elkaar moet knopen, dan wil je wel wat harder lopen voor die paar euro. Maar als jij rond kunt komen en de ene maand 100 euro meer hebt, dan in de andere maand, dat is wel leuk, maar word je eigenlijk niet echt anders van. Je merkt geen significant verschil, en als je dan elke dag een stapje harder moet lopen denk je op een gegeven moment, ja die 100 euro kan me gestolen worden. Dus dan krijg je andere behoeftes die belangrijk gaan zijn. Dus de basisbehoeftes zijn ingevuld, zeg maar de Maslow-piramide, en je gaat naar zelfontwikkeling toe, dan zijn die zaken veel belangrijker. Die 3 dingen, en dat zou in het systeem ook terug moeten komen.

Wouter Heijs: En nu nog even het laatste onderwerp. Wij willen dat die profielen automatisch gegenereerd worden, de bestaande systemen gebruiken inderdaad vragenlijsten en dergelijke, dus dat het door de persoon zelf wordt ingevuld. Wij willen kijken of het mogelijk is om op basis van verschillende bronnen binnen het bedrijf, dus een CV of dergelijke, dat het automatisch wordt gegenereerd dat profiel, en dan nog wel een final check eroverheen om te kijken of het klopt.

Geïnterviewde: Wat is je budget dan?

Wouter Heijs: Eh, dit is nu nog helemaal in een beginnende fase.

Geïnterviewde: Als je het echt automatisch wil, dan doe je CV parsing. Dus moet andere woorden, het CV wordt automatisch in het systeem opgenomen en gerubriceerd. Dus het email adres komt op de plek waar het email adres moet komen te staan, opleidingen bij elkaar. Dat is nog een complex proces, want wat is een opleiding als het op papier staat en wat is ervaring.

Wouter Heijs: Dat is lastig te onderscheiden inderdaad.

Geïnterviewde: Maar dat is er al, dat is niet zo moeilijk. Ten 2e zou je kunnen zeggen, ik ga ook zijn social media profiel in kaart brengen, en vaar dat ik zeg: wat is je budget. Want daar kun je heel veel voorkeuren, drijfveren en interesses in kaart brengen. Automatisch gegenereerd, want jij bent daar al mee bezig: je twittert wat, je doet er wat mee. Dus die 2 zaken kun je automatiseren. Samen met nog wat andere zaken, al zijnde: heeft hij een diploma, tot en met background checks. Heeft hij lening, dus ben je gevoelig voor bepaalde financiële prikkels? Kan je dan wel meedoen aan bepaald project bij Thales, want als ik een schuld heb en ik moet bepaald geclassificeerd project draaien bij Thales, dan ben ik dus gevoelig voor omkoop en invloed. Wil je dit ook meenemen, dat kan bij Thales een belangrijk aspect zijn. Dit kan je ook automatiseren. Een bewijs van goed gedrag, kan je automatiseren. Dat zegt ook iets over de persoon en kun je allemaal automatiseren in mijn optiek.

Wouter Heijs: Wij hebben ook al een klein lijstje gemaakt van welke bronnen dan beschikbaar zouden zijn, daar heb jij er net al een heel aantal van opgenoemd. Wat voor bronnen hebben jullie binnen Company 2 die je specifiek voor dit doeleinde zou kunnen gebruiken?

Geïnterviewde: Dan krijg je weer: wat is je budget, daarnaast is het privacy aspect nog niet meegenomen.

Wouter Heijs: Dat is inderdaad de vervolgvraag: zijn deze bronnen dan privaat of publiekelijk?

Geïnterviewde: Nou ja, als ik vraag: mag ik alles van je weten en jij zegt ja, dan is het goed. En wat is de impact van je toestemming, wat doe je er mee. Heel simpel voorbeeld, Cambridge Analytics is in staat om verkiezingen te beïnvloeden op basis van een social media profiel. Die doen dat vanuit een negatief aspect. Tot nu toe is het zo dat Google en Facebook jouw data analyseren en daar doen ze goede dingen mee. Jij krijgt advertenties te zien de je waarschijnlijk wel interessant zou vinden, omdat ze in jouw kennisbubbel zitten.

Wouter Heijs: Ik vind dat soms wel te ver gaan.

Geïnterviewde: Jij krijgt advertenties te zien die interessant voor jou zijn. Het kan zijn dat jouw vriendin achter de laptop zit en die heeft op Zalando naar schoenen gekeken, daarna zit jij op de laptop en kijkt op de Formule 1 website en daar zie je die irritante Zalando reclame aan de zijkant. Dat heeft niks met jou te maken, maar goed; dat weet Google niet. Je bent ingelogd met 1 profiel. Maar wat als Facebook dit ook gaat gebruiken om verkiezingen te beïnvloeden?

Wouter Heijs: Je legde net de nadruk al op tot nu toe. Denk je dat ze dit negatief gaan gebruiken?

Geïnterviewde: Doen ze toch al, bijvoorbeeld Cambridge Analytics, die zijn echt niet de enige. Er zijn heel veel onschuldige beïnvloeders. Laatst kwam uit een onderzoek naar voren dat bepaalde gebieden, politiek gevoelige gebieden zoals Israël, waren mensen die beïnvloedde hier bepaalde profielen. Dat

waren mensen die creëerde dus nepnieuws om te zorgen dat bezoekers naar hun website kwamen, en advertentie-inkomsten konden opstrijken. Dat is eigenlijk ook al negatief, maar dan is het een beetje een boefjesstreek. Jij ziet een of andere kreet staan en denkt: he wat is dat? Je gaat erna toe en denkt: ah, valt wel mee. Of je ziet nepnieuws, maar je ziet ook die advertentie staan, en dan hebben zij hun geld verdiend. Dat is al over de streep, dan is het voor eigen gewin. Als adverteerder heb je daar last van, want die betaald clicks waar die niks aan heeft. Dus het is een glijdende schaal, je krijgt die reclame te zien, maar dat is nog aan goede kant, maar het glijdt al wel. Er is een glijdende schaal.

Wouter Heijs: En dan richting verkiezingen beïnvloeden, dat is weer een paar stappen verder. Dan heb ik nog maar 1 vraag, zijn de bronnen binnen dit bedrijf waar we het over hebben gehad, up-to-date? Je maakt in het begin een keer z'n profiel en vragenlijst, stel deze persoon komt terug, doe je dat dan weer opnieuw.

Geïnterviewde: Dan doen we dat opnieuw inderdaad.

Wouter Heijs: Dus het wordt wel geüpdatet.

Geïnterviewde: Ja, maar niet automatisch, vroeger kon dat wel. Dan kon je bijvoorbeeld zeggen ik link jouw LinkedIn profiel eraan. En als jij andere functie kreeg, meeste mensen zetten dat op hun LinkedIn profiel, dan zou dat automatisch geüpdatet worden. LinkedIn vindt dat niet meer goed, om 2 redenen zeg maar. 1 heeft te maken met een stukje harvesting, dus informatie omtrekken uit LinkedIn. Zou je dat automatisch doen, dan heb je LinkedIn eigenlijk niet nodig, en zij willen eigenlijk dat mensen bij hun komen. Het 2^{e} heeft te maken met privacy, jij verandert zaken op LinkedIn, maar als ik 1 keer ben gekoppeld in het verleden, en je vergeet dat, dan zou ik in principe dat elke keer doen. Dan blijft het systeem altijd up-to-date, dus dat is de 2^{e} reden dat ze dat niet goed vinden.

Wouter Heijs: En dat is dus niet meer mogelijk met de nieuwe privacywetgeving?

Geïnterviewde: Jawel, maar met een omweg. Die privacywetgeving is zo lek als een mandje, niemand die kan tegen mij zeggen je bent GDPR proof. Er is geen instantie waarvan ik zeg geef mij eens een stempel. Je kan wel een stempel krijgen die zegt dat je de N-norm volgt, maar niet of jij AVG bent, want dat is allemaal nog interpretatie.

Wouter Heijs: Het is dus nog niet specifiek genoeg.

Geïnterviewde: Er zijn ook hele simpele voorbeelden. Mag ik een foto van jou opslaan, ja zou je zeggen, maar aan een foto zie je al heel veel dingen. Ik zie dat je blank bent, ik zie dat je waarschijnlijk geen godsdienst aanhangt, want ik zie geen kettinkje of keppeltje. Ik zie dat je geen tattoo hebt, etc. Dus sommige dingen zijn heel banaal, want je moet een foto hebben, dan weet ik wie het is. Als ik hem dan tegenkom dat is makkelijk, plus het haalt allemaal herinneringen naar boven bij mij. Die foto heeft dus heel veel waarde in een matching systeem voor de eindgebruiker. Aan de andere kant leg je daarmee dingen vast, die AVG-technisch gevoelig kunnen zijn. Dat vind ik een beetje overtrokken. Dus als je zegt: in onze database mag je geen foto meer opslaan, dan vind ik dat overdreven, want jij kunt ook een kruisje omhebben omdat je dat mooi vindt, en niet omdat je Rooms-Katholiek bent. Het heeft ook te maken met voor welke reden, sla je welke data op. Als je gaat solliciteren, mag ik jouw CV opslaan. Dat hoort bij het proces, ik heb dat nodig, daar geef je toestemming voor. Daar geef je echter onbewust toestemming voor, officieel hoort dat bij het sollicitatie proces en dan mag ik dat als PNO-er dat CV bewaren zolang het sollicitatieproces duurt. Of ik moet er toestemming voor hebben, op voorhand of

erna. Bijvoorbeeld: je bent helaas nummer 2 geworden, maar we vinden jou heel erg waardevol, en je wil waarschijnlijk in de toekomst een andere functie, mogen we jouw gegevens dan bewaren? 9 van de 10 mensen vinden dat goed.

Wouter Heijs: Als je in eerste instantie het vertrouwen al hebt gegeven aan dat bedrijf, ga je er ook niet vanuit dat ze opeens iets geks gaan doen met je gegevens.

Geïnterviewde: Dat denk je dan inderdaad, maar er is dus geen organisatie die mij een stempel kan geven die zegt dat ik op de juiste manier met de privacy om.

Wouter Heijs: Maar wie checkt het dan?

Geïnterviewde: Het kan gecheckt worden, er is in Nederland een instantie, maar daar werkt geloof ik een mannetje of 35.

Wouter Heijs: En die moeten alle bedrijven checken?

Geïnterviewde: Ja, wat gebeurt er dan? Dan ga je de grote jongens controleren. Stel bij Thales is een data-lek, dat is interessanter om te controleren als instantie dan als er bij Company 2 een data-lek is. Wij zijn maar klein, bij Thales Hengelo werkt meteen 1600 man, en het is defensie gerelateerd dus gelijk een mooi voorbeeld. Dan sturen ze daar wat mannetjes op af en hebben ze geen tijd om mij te controleren. Dat is gunstig voor mij. Ze doen waarschijnlijk een paar grote en een paar kleintjes.

Wouter Heijs: Ze kunnen natuurlijk ook niet hebben dat er naar buiten komt dat ze alleen de grote doen, dan gaan de kleintjes allemaal denken: lang leve de lol.

Geïnterviewde: Precies, dus daar doen ze gewoon wat steekproeven.

Wouter Heijs: Oke, dan ben ik door mijn vragen heen, heeft u nog vragen?

Geïnterviewde: Wanneer gaan ze het aanschaffen?

Wouter Heijs: Ze gaan het zelf ontwikkelen, maar dat is een grote maar.

Geïnterviewde: Geef ze dan maar een tip mee, ze kunnen beter een bestaand platform verder door ontwikkelen, dan iets heel nieuws. Dat duurt veel te lang en is veel te duur.

Wouter Heijs: Ik zal het doorgeven.

Geïnterviewde: Ze hebben namelijk niet de expertise in huis die ze nodig hebben. Daarnaast worden de teams vaak te groot. Je kan beter een team hebben 3 à 4 man, die alle disciplines in zich hebben. Die bijvoorbeeld een front en backoffice kunnen programmeren, die verstand hebben van de business etc. anders wordt het geen succes. Ik vraag me of er bij Thales de juiste mensen op dat project worden gezet. Er worden wel allerlei stakeholders bij betrokken: een afdelingsmanager, en een engineer en een PNO-er, maar wie is er met de dagelijkse gang van zaken om die match te maken. Die moet je er bij hebben en die moet je dat systeem neer laten zetten. En dan krijg je, dat veel te veel mensen er zich mee gaan bemoeien, zeker bij Thales in Nederland, een compromis database en dat is niet wat je wilt.

Wij hebben onze software ontwikkelt voor onze nichemarkt. Er zijn in Nederland al ruim 40 matching systemen, van veredeld Excel lijstje tot vak volwassenproduct. Ik denk dat er in Nederland 3 of 4 concurrenten zijn, en als iemand voor de andere kies dan hebben ze er geen verstand van of tillen ze er

niet zo zwaar aan. Maar volwassen matching systemen zijn er niet zoveel, dus dan kan je beter zeggen ik ga van daaruit verder, of ik maak daar een kopie van en zet in de software, want er zijn heel veel dingen die mensen zich in de praktijk niet realiseren. Dus waar je match je op, waarom is die foto nou belangrijk, dat soort dingen.

Wouter Heijs: Er schiet me nog 1 vraag te binnen. Die vragenlijst die jullie ergens op slaan, wat voor format heeft dat, is dat een Excel-lijstje, Word-bestand, wat is dat precies?

Geïnterviewde: Ehh, nee dat wordt gewoon in een database format opgeslagen en is gewoon doorzoekbaar, de taal weet ik zo niet uit mijn hoofd, dat hebben de programmeurs gemaakt. Wij hebben een stukje opensource software, er zit wat python in, PHP, Go; Google language, daarmee kunnen we direct op de core programmeren, dat gaat sneller. En data ophalen, want dat krijg je ook nog, want wij hebben 25 000 man in de database zitten, maar je wil wel snel resultaten. Hoe snel haal je die data op, hoe rubriceer je die data, en dat zijn dingen waar ze bij Thales nog niet over hebben nagedacht.

Wouter Heijs: Daarom is dit onderzoek verkennend, is het überhaupt iets wat de moeite waard is om te maken, en de conclusie kan maar zo zijn, nee dit is te duur.

Geïnterviewde: Nou om het zelf te ontwikkelen zou ik zeggen hmmm, of ze moeten echt zeggen dit is high-tech, classified en dergelijke. Daar mag geen andere partij bij betrokken zijn, maar je krijgt een beetje de make or buy decision. Dat heb ik ook in de opleiding gedaan. Heb je kennis, tijd en financiën om zelf te doen, dan moet je het zelf doen. Als jij zelf een huis kan bouwen, je hebt het geld, tijd en expertise, dan moet je het zelf doen. Goedkoper kan niet, dat zie jij bij heel veel boerderijen in de omgeving. Heb je niet die 3 factoren, dan moet je het aanschaffen.

Einde opname

A.7 UTAUT-questionnaire

Questionnaire expert finding systems and expert profile

This questionnaire serves to evaluate the usage behavior of potential expert finding system users. The questionnaire is derived from the UTAUT framework. The Likert scale is displayed under each statement, which ranges from strongly disagree up to strongly agree. Please circle the response that corresponds with your opinion on the statement. The demographic information is used to explain excesses (if any) in the results.

Demographic information

Age: up to 40 / 40+

Were you already familiar with expert finding systems? Yes / No

Function at Thales:

Performance expectancy

PE1: Using the expert profile would enable me to accomplish tasks more quickly

Strongly disagree Disagree Neutral Agree Strongly agree

PE2: Using the expert profile would improve my performance.

Strongly disagree Disagree Neutral Agree Strongly agree

PE3: Using the expert profile would increase my productivity.

Strongly disagree Disagree Neutral Agree Strongly agree

PE4: Using the expert profile would make it easier to do my work.

Strongly disagree Disagree Neutral Agree Strongly agree

Effort expectancy

EE1: Learning to use the expert profile is easy for me.

Strongly disagree Disagree Neutral Agree Strongly agree

EE2: I find the expert profile easy to use.

Strongly disagree Disagree Neutral Agree Strongly agree

EE3: Using the expert profile takes too much time from my normal duties.

Strongly disagree Disagree Neutral Agree Strongly agree

Social influence

SI1: People who influence my behavior think that I should use the expert finding system.

Strongly disagree Disagree Neutral Agree Strongly agree

SI2: People who are important to me think I should use the expert finding system.

Strongly disagree Disagree Neutral Agree Strongly agree

SI3: Having the expert finding system is a status symbol at my company.

Strongly disagree Disagree Neutral Agree Strongly agree

Facilitating conditions

FC1: I have the resources necessary to use the expert profile.

Strongly disagree Disagree Neutral Agree Strongly agree

FC2: I have the knowledge necessary to use the expert profile.

Strongly disagree Disagree Neutral Agree Strongly agree

FC3: The expert profile is not compatible with other computer systems I use.

Strongly disagree Disagree Neutral Agree Strongly agree

Behavioral intention

BI1: Whenever possible, I intend to use the expert finding system.

Strongly disagree Disagree Neutral Agree Strongly agree

BI2: I perceive using the expert finding system as involuntary.

Strongly disagree Disagree Neutral Agree Strongly agree

BI3: To the extent possible, I would use expert finding systems frequently.

Strongly disagree Disagree Neutral Agree Strongly agree

A.8 Survey Expert Finding Systems

First section: Introduction

This research is done in collaboration with Thales Nederland and the University of Twente. It aims to identify whether the size of a company has a relation to having a expertise management policy. Subsequently, sources that contain useful information for expert profiles will be researched. This survey will take about 10 minutes and contributes towards the scientific body of knowledge.

Expert finding systems (EFS) are systems that connect a person that enters a query into the system with a person that has expertise on this subject.

Does the company you work for have a expertise management policy? If yes, what does this entail?

Second section: Classifying

This section serves to classify each participant into the categories that are researched.

Which profession do you practice on a daily basis?

Which company do you work for?

How many employees work at this company? (approximately)

How long have you been doing this type of work?

What would you call your area of expertise?

What do you think others would call your area of expertise?

What education did you follow?

What would you say are the main elements of your profession?

Third section: EFS

An EFS serves two main purposes:

1. It increases efficiency within companies, as employees might be able to tackle difficult problems faster with the right guidance.

2. It allows employees to connect with people they would not encounter in their daily activities. It opens a door to a larger network.

Can you see the usefulness of an expert finding system?

To what extend do you think it can be used?

The EFS provides options to the person entering the query. Three expert profiles will be displayed to this person, and a choice for which one to reach out to will be made, based on these profiles. What do you think should be included in this profile?

What do you think should not be included in this profile?

Do you think anonimty should be maintained in this profile, and why?

If a profile would be made for you, what information would you consider violating?

Fourth section: Sources

The profiles will be generated automatically through software. Text mining will be used to go through the sources and display the information in the profile. The following questions will be about these sources.

Which sources do you think contain information that could be used to set up your expert profile?

Table 18: List of sources as shown in EFS survey

Social media	**Work documents**	**Human resources documents**	**Personal documents**
LinkedIn	Designs	Certificate of conducts	Curriculum vitae
Facebook	Reports	Location of work	Degrees
Google cookies	Schedules/ planning	Duration of work	Education
Delve			Transcript of records (education)
			Courses
			Licenses
			Certificates

Which soures do you think contain the most useful information?

Can you think of any sources that are not included in this list but should be?

Can you name or desribe the sources you have thought of?

What format does/do this/these sources have? For example, excel spreadsheet, word document, etc.

Are these sources private or public (accessible for anyone)?

Are these sources up to date?

Fifth section: The end

I would like to thank you for filling out this survey. For any questions related to this survey, you can contact me at w.b.heijs@student.utwente.nl.

A.9 Explanation employee expertise sources

Table 19: Explanation employee expertise sources

Employee expertise source	Explanation
CV	Curriculum vitae
Office documents	Projects such as Word documents
Certificate of conduct (COC)	A certificate of conduct is a document by which the Dutch State Secretary for Justice and Security declares that the applicant did not commit any criminal offences that are relevant to the performance of his or her duties.
EasyFlex	Human resources system
Intake questionnaire	Questionnaire used by companies during the application procedure
SAP Fieldglass	Human resources system
ERP SAP	ERP system
Career plan	Document that contains planned future steps in a person's career
Evaluations	Documents that review a person's performance
Email	Email exchanges between colleagues containing work-related information
SharePoint	Document management and storage system
Personnel files	Documents containing information about personnel
Enneagrams	Model that describes personality traits
Mendix quality software	Software platform
Afas Insite	Human resources system
Afas profit	Human resources system
Solidworks PDM	Computer aided modelling and design program
Jira	Agile project management system
Workplace by Facebook	Communication platform
Microsoft Who chatbot	Communication platform
OneNote	Free form information gathering program
Slack	Communication platform
Microsoft Teams	Communication and collaboration platform
OneDrive	File hosting service
Atlas.ti	Qualitive research and quantitative data analysis program
Azure	Software creation program
Cobra	Human resources program
Imply	Operational analytics program
Jabber	Communication program
Orcale	Database software
Connexx	Software enhancement program