

**UTILIZING TEXT ANALYTICS IN PROCESSING
CUSTOMER FEEDBACK**



Master's thesis

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TIIVISTELMÄ

Tämän tutkimuksen tarkoituksena on kuvata, kuinka tekstianalytiikkaa käytetään tiedon tuottamiseen vapaamuotoisista asiakaspalautteista ja kuinka saatuja havaintoja voidaan hyödyntää liiketoiminnassa. Siinä kerrotaan tämän hetken tilanteesta eri liiketoiminta-alueilla olevien toimijoiden näkökulmasta.

Tutkimuksen teoriaosuudessa käydään läpi asiakaspalautteisiin, tekstin analysointiin ja tekstianalytiikkaan sisältyviä keskeisiä käsitteitä ja teorioita. Lisäksi siinä käydään läpi käytännön esimerkkejä siitä, kuinka saatuja tietoja on käytetty yritysten liiketoiminnan haasteiden ratkaisemiseen. Kyseessä on laadullinen tutkimus ja sen aineistonkeruumenetelmänä käytetään haastatteluja hankkimaan tietoa liiketoiminnan eri toimijoiden tämänhetkistä haasteista ja näkökulmista asiakaspalautteiden käsittelyyn liittyvän tekstianalytiikan toteuttamisesta.

Tehtyjen haastattelujen tuloksena saatiin käsitys, miten tekstianalytiikkaa tällä hetkellä hyödynnetään asiakaspalautteiden analysoinnissa ja minkälaisia haasteita, hyötyjä ja parhaita käytäntöjä tämä on tuottanut yrityksille. Haasteita on noussut esille sekä asiakaspalautteiden keräämisen hallinnoinnissa että niistä tehtävissä analysoinneissa. Hyötyjä on löydetty paljon ja useat haastatelluista mainitsevat potentiaalia olevan vielä enempään. Analyysien toteuttamista tapahtuu hyvin eri tasoisesti, mutta kokemuksena on jokaisesta kertynyt käytäntöjä tähän tutkimukseen. Tutkimus tuo esille parhaita käytäntöjä, joita on löydetty, kun asiakaspalautteita käsitellään tekstianalytiikan avulla.

Avainsanat Tekstianalytiikka, asiakaspalautteet, laadullinen tutkimus

Sivut 68 sivua, joista liitteitä 6 sivua

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ABSTRACT

The purpose of this research is to describe how business is using text analytics to generate information from free-form customer feedback and how the findings obtained can be utilized. It describes the current situation from the perspective of the actors in the different business areas.

Research's background theory describes the key concepts included into customer feedbacks, text analysis, and text analytics. The theory covers also real-life examples how information acquired have been used to solve business challenges. This is a qualitative research, and its collection of material uses interviews to obtain information about the current challenges and viewpoints of different industry players implementing text analytics for processing customer feedback.

The conducted interviews provided an insight into how text analytics is currently being used to analyse customer feedback and what challenges, benefits, and best practices this has brought to companies. Challenges emerged both in the management of the collection of feedback and in the analyses performed on it. Many benefits have been found and several of those interviewed mention that there is potential for even more. The implementation of the analysis takes place at very different levels, but experience has accumulated practices from each into this research. The research brings up the best practices found when customer feedback is processed with text analytics.

Keywords Text analytics, customer feedback, qualitative research

Pages 68 pages including appendices 6 pages

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1 INTRODUCTION

The use of text analytics is increasing in today's business world and it has also become an integral part of companies' business development. When the amount of data held by companies is increasing, most of it is known to be unformatted text data. By collecting large amounts of data, companies must also strive to find value in them. When particular patterns can be found in the text data, its collection is meaningful and the investigation of the cause by analytics is justified (Butler Analytics, 2014). The amount of information that can be found from unstructured text can for example produce a good support for companies' decision making in their different business challenges.

One example of using text analytics to find out from customers' feedback how satisfied they are with the company. Customer feedback is an important part of companies' customer relationship management allowing customers to share their opinions about the company's products and services. The feedback information can be structured, meaning it is desired to be collected in a certain format for processing it easier further. But also unstructured, i.e. free-form information is wanted because of the unforeseen information it provides. Unstructured information is collected as free-form text, and this creates the need to be able to interpret the content of the text using analysis.

There are several ways how text can be analysed, and the method applied depends on the intended use. Text analysis can comprise completely different levels of actions taken on the text. Simplified it means word spotting, which is commonly not understood to be an analytical method and can bring completely false conclusions about text's content. However, different levels of more sophisticated analytical methods can be applied to analyse the text for bringing out its true meaning and to solve the business challenges in question. The value of the company's resolved business challenge is often guiding the implemented analysis model which is chosen.

Other examples of utilizing text analytics are various. It can disclose the deficiencies in areas that would not come up in any other ways in large text amounts. Texts entered by customers can also be explored in a smaller scale. Example of that is examining what text is entered in companies' web site's search boxes. Those can reveal the often searched, but non-existing products or services companies should have. Text analytics has seen to provide benefits also in other business, like in health care. There, the health institutions have found remarkable information by searching through patients' epicrisis, how their treatments have worked within different patients. This has provided them information which of the

treatments give the best results and enables to develop patients' treatment programs to a better level.

1.1 Background of the thesis

This thesis objective is to clarify how text analytics can be used to process information from customer feedback and what benefits that has provided to companies. The challenge of being able to produce information from text, has increased when companies are digitizing their services nowadays. One of the main processes, that has been strongly moved into digital channels is the customer service and the possibility it offers to give feedback. While this process primarily serves the individual consumers and their needs, it also provides a vast amount of text data about customers' perceptions of the company. That text data can be used to produce a better understanding of customers' needs in more extensive way at that moment.

The author's personal interest for doing this thesis is to understand the text analytics challenges and benefits more broadly and deeply. This supports him as a specialist, in a company that provides text analytics solutions, to help better their customers to achieve benefits when implementing text analysis into their business. By getting to know the theories in this area, the author is able to better both understand customers' challenges and support to solve them. While this thesis is research oriented, it also highlights the need to understand how text analysis of customer feedback is implemented with success. Also, no work on the same topic was found in Theseus during the thesis process. So with this thesis, new information is created into the University of Applied Sciences community.

1.2 Research objectives

The objective of this research is to create a comprehensive document about how text analytics is used in today's business for providing information on customer feedback. At first, the research goes through the theory of these topics and later describes the business usage, experiences, and benefits of text analytics in customer feedback through a qualitative research. The theory part includes in high level what text analytics is, how it is executed for business and where the produced analysis can be used. Theory presents also real-life business cases where customer feedback has been used to increase customer insight and benefits achieved with that information. The practise part investigates what is the current status of using text analytics to gain understanding from customer feedback through interview research. The interview research is carried out with domestic business actors who use feedback analysis in their business processes or solution providers who have helped companies to implement these processes.

The research question to search for an answer is following.

- What kind of benefits companies can achieve by using text analytics to create analysis from customer feedback?

The sub-question related for the research question is below.

- What kind of best practices have been discovered in processing texts analytics from customer feedback?

1.3 Thesis structure

The thesis consists of five main sections, where the first is the *Introduction* describing the thesis background, research objectives, document structure and definitions with key concepts.

The second section *Customer Feedback and Text Analysis in Business* includes theory information about thesis different subjects. First, it concentrates to define how important customer feedback is in business perspective. Companies that want to be customer-oriented need to listen their customers and begin to understand customer feedback's importance as part of customer engagement process. Example of what information customer feedback can give to companies for helping them to keep their existing customers presents the real-life case model for this objective. Information about customer feedback's different impact on product and service-oriented businesses highlights issues that need to be considered by actors in these business areas. The section also includes information what objectives companies have to gather customer feedback.

This theory section also opens comprehensively topics related to text analysis. To begin with, the known principles and good practices of text data analyzation is presented. This goes through the characteristic of the unstructured data are and what organizations need to consider when making investments to take out information from it. Next, various methods for data analysis are described with the information about their practical application ways. This part illustrates how differently text analysing can be done from a simple manually processed single word searches into a complex computer-based analytical algorithm execution. This is also going through the different ways of implementing text analytics. Research explains the different implementation levels and what are the expected results when using each of them. As a practical example, how search for specific attributes/features are conducted and results are interpreted to indicate positive, negative, or neutral/mixed tone of the text. Or what automated content extraction is and when it is used to automatically match predefined criteria to be able to search important themes more easily from texts. The research theory covers text mining overall and its capability to uncover valuable patterns and themes. It describes also more deeply what some advanced methods are, like sentiment analysis, and how those are used to classify text documents.

Third section *Research Implementation Methodology* is concentrating to depict how thesis qualitative research is carried through. Objectives for the selected methodology are explained and how the thesis research questions are answered. This describes the different things that need to be considered when qualitative research is conducted including presented aspects, made evaluations and points to be concentrated. Here is also described the things related to interviews execution, such as how they are conducted, who is interviewed, and how results are analyzed. Also, the information asked is described in high level and the whole interview template can be found attached into thesis.

Fourth section *Results of Customer Feedback Text Analysis* presents the results of an interview research. It explains the current status where business has used the different types of text analytics and what are the advantages that have been reached in domestic market. This reveals different companies' maturity level of using text analytics and what empirical learnings have been found out. With the help of real-life use cases, thesis give empirical based information about disclosed results of the text analytics execution and how those have been used in business. It brings out also, what is the level of value and business benefit for companies doing this.

Section five is for presenting the *Conclusions* drawn by the author for the thesis. It describes the starting point of this research and in high level how the results were achieved. There is also mentioned the main development points for customer feedback analysis, which were discovered during the research and backgrounds why they are significant. Last part of this section presents the observations from the author's point of view for doing this research.

1.4 Definitions and key concepts

Key concepts

Analytical methods are more advanced forms of analysis in example presenting patterns of similarity, items of interest, levels of influence or predict changes (Struhl, 2015, pp. 25, 27).

Customer feedback is defined as complaints, compliments or thoughts about the organization's goods or services either voiced publicly to an organization or its employees. (Celuch, Robinson & Walsh, 2015, p. 281).

Qualitative research includes different trends, data acquisition and analysis methods and ways to interpret materials without a single correct way to do research (Saaranen-Kauppinen & Puusniekka, 2009, p. 4).

Sentiment Analysis means a way to measure the text contents tone whether it is positive, negative, or neutral (Struhl, 2015, p. 120).

Text Analytics comprises analytical methods used to understand sentiment and used linguistic styles of text data (Struhl, 2015, p. 234).

Unstructured data is not following any regular pattern, which makes it easily adaptable into a table (Struhl, 2015, p. 5).

Word spotting means the exact identification of characters and words in the processing of document text data (Varghese & Govilkar, 2015, p. 2628).

2 CUSTOMER FEEDBACK AND TEXT ANALYSIS IN BUSINESS

The theoretical framework of this thesis begins with the description of customer feedbacks. It brings up why feedbacks are collected and in what way they are important. This section presents also what impacts feedback can have to business and what kind of objectives companies have set to that.

Next section explains text analytics basics and describes its key concepts. First part of this goes through what principles and best practices have been found for text analytics. Next part includes what different methods can be found to analyse text data. This includes background information and where text analytics is generally used. The different approaches for processing text data are reviewed as well as the advantages and the disadvantages they provide. This includes also what processing steps need to be done for the text data in text analytics, so it can be analysed and what information each phase provides to the analysts. This section ends to a use case example from real-life where text analytics has been used to bring out valuable information from large amount of customer feedback.

2.1 Customer Feedback

Following chapters describe the feedback companies are collecting from their customers. First is clarified why feedback is important to companies, secondly companies want to achieve by doing that and lastly how they do they track feedback in high level. Also examples what impact the feedback has had on the actual business is described.

2.1.1 The Importance of the Customer Feedback

Companies that want to be customer-oriented listen to their customers. Research by companies on their customers' engagement, including customer feedback, has increased recently (Celuch, Robinson & Walsh, 2015, p. 280) and those are carried out to make observations to find out sufficiently effective change needs to be implemented. A customer engagement means all non-transactional customer behaviours that may affect to the company (Verhoef, Reinartz and Krafft, 2010, p. 247-252). By doing different kind of engagement activities like executing campaigns or arranging events company aims to create a strong relationship into their customers.

Recent perceptions have begun to understand customer feedback as part of customer engagement and have a broader meaning than just complaints. This includes feedback information, which can be negative, positive or neutral, and plays a key role in directing companies' activities to the market. (Celuch et al., 2015, p. 281) Especially research in the service

sector has for a long time focused on use of various customer feedback functions (Zeithaml and Bitner, 2000), as a result of the long-standing growing importance of personal services (Gronroos, 1990), which have shifted more and more into digital online channels over the last decade.

On average, businesses lost 10 to 30 percent of their customers annually without knowing who those are, when the lost happened and most importantly why they were lost. Companies do not also often have exact cost information what the lost means for their revenue and profit. An estimation can be done by summing all the new customer selling costs (promotions, lead generations, calls and visits) and comparing that with the number of sales required to be done for covering them to make breakeven (considering company's products or services gross margin), like in figure 1 below (Hill & Alexander, 2006, p. 5, 9–10)

Cost of new customers (hypothetical example)	
Cost per appointment (promotion, lead generation, telesales)	£2 500
Cost per sales call	£1 000
Visits per sale	9
Selling cost per new customer	£9 000
Total cost per new customer	£11 500
Breakeven sales per new customer @ 40% GP	£28 750

Figure 1. The cost of new customers (Hill & Alexander, p. 9–10).

Companies have tend to concentrate more to acquire new customer than decreasing the customer loss and find out the reasons for that. The reason for customers to leave is some kind of gap between their expectations and perceived experience. There are various reasons for this gap, but when it leads to dissatisfaction the relationship tends to end. (Hill & Alexander, 2006, p. 6)

Hill and Alexander mention five common gaps that can cause dissatisfaction for customers in their writing *The Handbook of Customer Satisfaction and Loyalty Management*. One of them is the promotional gap, which is marketing caused by setting expectations to customers that are hard to fulfil. Another gap is related to understanding, where companies has no correct idea what the customers' interests and priorities are. This gap has been also seen as a problem of gathering the information with surveys and feedback to clarify these needs. When requirements are understood, the procedural gaps concern often perceived service and are results of dissatisfaction due to failed operational procedures. When needs are understood and appropriate procedures are in place, the behavioural gaps might occur. It means, that the personnel is not aligned with the designed procedures and this causes dissatisfaction in their behaviour. Thus all of the above gaps are filled the perception gap might come along.

That is caused by the former experience, which still affect to customers' opinion about the company. Customers' minds label companies, their perceptions are behind the times and are slow to change. (Hill & Alexander, 2006, p. 6–9)

2.1.2 Customer Feedback's Impact on Business

In product business, new products approach to the market can fail because their quality is undefined for customers (Yao, Fang, Dineen & Yao, 2009, p. 1281). Lack of information leads to the situation where the consumer feedback has become an important information source for product's reputation (Standifird, 2001). Consumer feedback creates the new products reputation and how customers evaluate them, which is based on the assessment of other customers who already bought the product. The reputation is not restricted only to product, but also into sellers. In selling platforms like eBay, the sellers with more positive feedback sell more than those without that according to Standifird's examinations. Feedback include two main measures, level which is related to the customer experience's positivity and consistency which describes the stability of feedback. Products feedback usually have very mixed combinations in their level and consistency, but what comes to the negative feedback, the extremely negative ones have stronger impact than moderately negative. (Yao et al., 2009, p. 1281)

Buyers have certain process, what comes into their decision-making. The figure 2 below describes the five stages and their relations. (Yao et al., 2009, p. 1282) It is particular noteworthy, that feedback from other buyers is influencing to later buying decisions.

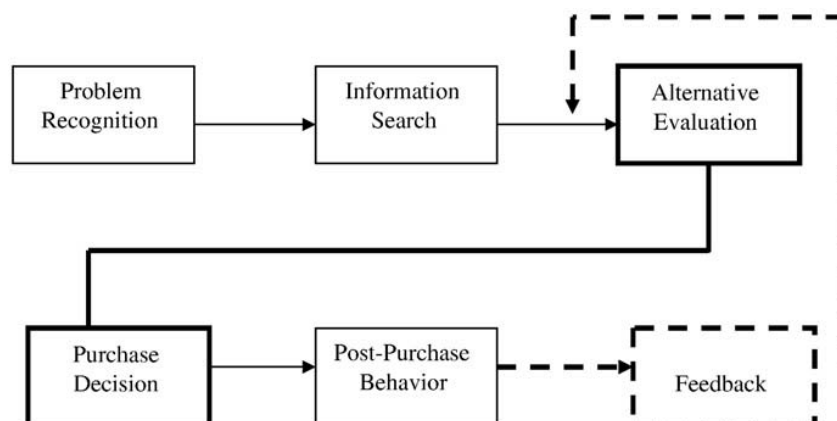


Figure 2. Consumer decision-making in the click-and-mortar context (Yao et al., p. 1282).

The decision making starts with the problem recognition stage, which is consequence of noted difference between actual and desired state. Customer feedback is important in information search stage providing reliable information that reduces uncertainty and helps making decisions. Other customers experiences can provide significant information about

the products' credibility and quality. Considerable part of the feedback is given by word-of-mouth, which has been seen to affect more on buyers than presented formal marketing promotions (Bone, 1995). The word-of-mouth communication has moved mainly into internet and it has become an affective information source for potential buyers (Yao et al., p. 1282).

Studies have shown that online feedback about sellers' reputations has significant effect on their future sales opportunities. Generally, in online commerce previous feedback and its attribution are impacting key factors for buying customers' decisions. (Yao et al., p. 1282)

Several studies have proved the idea, that when company's products quality are unknown the markets form their approval based on reliability and perceived risk (Melnick & Alm, 2002). Information from others is perceived as helpful and favourable feedback reduces buying risks (Yao et al., p. 1283). Third-parties' positive opinions has been also seen as signals for quality products (Podolny, 1993, p. 831).

Higher feedback levels give products better market seal of approval and consistency in feedback reduces expected risks. When the level of rating is high most of the previous customers are supposed to be satisfied with the products. Ratings high consistency indicates that most of the previous customer agree with products' assessments and this has also seen to strengthen the high-level feedback of products. As opposite, high inconsistency weakens the product preferences. (Yao et al., p. 1283) When conditions of level and consistency are equal, it has been notified that negative opinions affect more by highlighting threats, than positive ones which emphasize benefits (Standifird, 2001) and the same applies also in situations where the extreme opinions from both ends has been found (Yao et al., p. 1283). This confirms the theory of negative asymmetry meaning negative feedback is always stronger than the positive one (Standifird, 2001).

Yao et al. investigated the feedback levels and consistency relation into the purchase decision in their article Effects of customer feedback level and (in)consistency on new product acceptance in the click-an-mortar context. The results can be seen in the figure 3 below, which illustrates their study findings. It can be seen how high inconsistency of feedback is weakening the purchase decisions compared to the low inconsistency. Another observation is seen in low inconsistency feedback as the positive feedback level increases, the purchase decision is clearly strengthened more than in high inconsistency feedback.

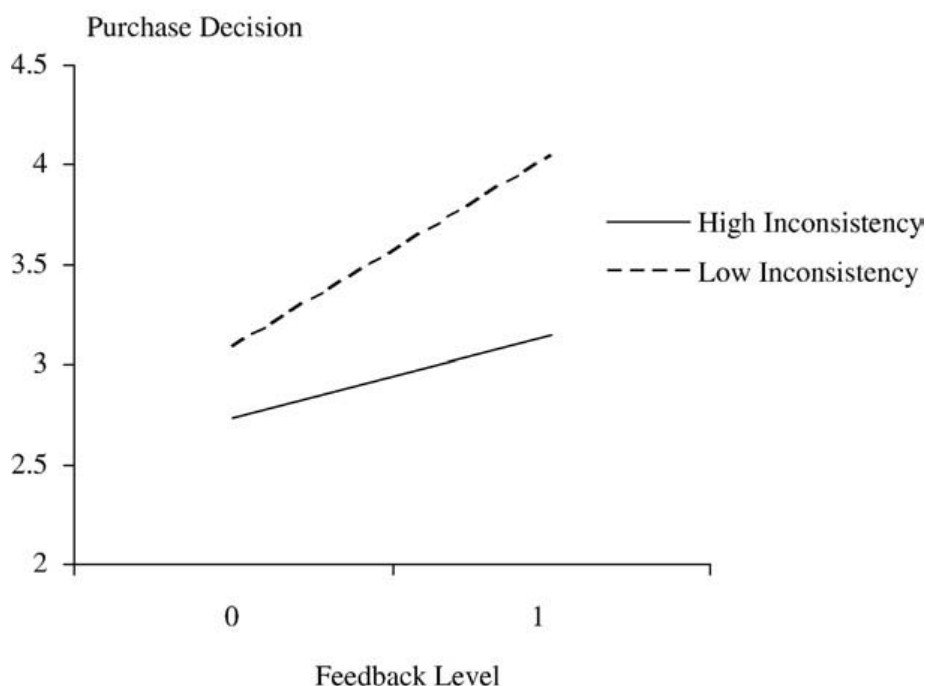


Figure 3. Interaction between feedback level and inconsistency (Study 1) (Yao et al., p. 1283).

As seen how strongly customers rely on the opinions of other users in decision making, the companies can take the advantage of that to manage their seller reputation and design their online marketing activities (Yao et al., p. 1286). The similar applies also to service business, wherein example the hotel business can improve their performance by managing their online reputation. In example of Chinese hotels, they have seen this as a cost-effective way to improve their reputation instead of doing investments into facilities. (Schuckert, Liang, Law & Sun, 2019, p. 528)

When traveling to China increased strongly in last decade the local hotels there invented that they could not compete with the international hotel chains (Schuckert et al., 2019, p. 528). This was mainly result of their inability to compete with services, high level properties (Schuckert et al., 2019, p. 528) and the fact that guests were not concerned about the difference in offered prices (Mattila, 1999). All information was out to be compared in the online hotel review sites, which brought up all available hotel options and consumers picked up the international hotel chains (Schuckert et al., 2019, p. 529), because they tend to make rational decisions in previously unknown matters based on others' evaluations (Ye, Law and Gu, 2009. p. 181–182). This led to the strategy change of local hotels moving to offer hospitality services in budget travellers' sector. (Schuckert et al., 2019, p. 529)

The study what Schuckert et al. made brought up interesting points about the feedback behaviour of local hotel guests. The local consumers who are not familiar to online reviews, might have only restricted experiences to both international hotels and learning about them in online. Study showed that more frequently the local hotels responded to their consumers

reviews the more satisfied they were. Similar reaction was not found in the international hotels' responses, which was concluded due to customers' expectations to be already in a higher level to get more detailed responses. Responses to negative reviews was seen more effective in local than international hotels. Business travellers tend to post lower ratings than leisure travellers and local consumers posted lower ratings than internationals, which was seen as an evaluation habit of the local consumers. (Schuckert et al., 2019, p. 534–535)

Several key findings were found to be developed in the local hotels' managements' response strategy. The overall attitude to review responses should be more positive, as it is among the international hotel chains. Attention should be paid more to experienced hotel visitors as they bring out better unsatisfactory points. Detailed content is an effective method for response frequency and strategy improvement. (Schuckert et al., 2019, p. 536)

2.1.3 Objectives for Collecting Customer Feedback

Customer feedback is used to guide the companies to adjust their business towards customers' needs. Feedback gives insight about which companies' peoples' actions and business processes are done right and which wrong (Robinson, 2011). In addition, feedback can give much more information about companies like how well they satisfy their customers' needs (Soderlund, 1998; Voss, Roth, Rosenzweig, Blackmon & Chase, 2004), what perceptions customers have about the company's business (Sampson, 1998), what requirements customers have for them (Voss et al., 2004) and what knowledge customers have about the company (Kumar & Bhagwat, 2010). In addition to simply gathering information, the companies must also respond to feedback and with personally formulated messages, so customers understand that they have been taken seriously. (Martíšková & Švec, 2017, p. 82)

Value of the feedback to the company can be classified as N. Robinson has defined. Customers who are satisfied and return to do more business with the company are in "good" level, while the ones who also defend and promote the company's brand are in "better" level. The "best" level customers give the company such a feedback, that it leads into improvements or produces value in the future for making the company more competitive. (Robinson, 2011). Valuable feedback is also used for inspiration to find out the really meaningful improvements for customers. (Martíšková & Švec, 2017, p. 82).

Martíšková & Švec examined the feedback of Czech e-shop customers with interesting findings. They discovered that the two main reasons for giving feedback were to give information for the e-shop to learn from customers and remedy the appeared shortcomings for the benefit of other customers. Also reasons like getting a good feeling, testing if they get an

answer to their feedback and reluctance to disappoint the e-shop came up. The most frequent issue for giving feedback was assortment of available goods, followed by delivery speed and communicating with support. Responses to the feedback from the e-shop was also tracked. Almost half (47%) of respondents got reply within one day and additional 38% got it in a week. If the response time exceeded one week the respondents could not remember receiving them. (Martíšková & Švec, 2017, p. 76–77, 79)

The type of feedback that comes up often is complaints. As an opposite mindset to the form of making improvement suggestions are complaints, which indicates customers' dissatisfaction (Celuch, Robinson and Walsh 2015). Complaints can be defined as negative feedback, where valuations are considered to be positive and suggestions are seen as neutral feedback (Martíšková & švec, 2017, p. 73). Customers tend to give feedback only when they are either very satisfied or disappointed (Martíšková & švec, 2017, p. 81). Reasons for complaining are various and mainly their purposes are to get compensation, to express anger, to help improve service and selfless course of action (Lovelock, Wirtz and Bansal, 2008). Complaint behaviour has focused on three options: publicly, privately or to a third party (Singh, 1990). Complaints various factors, such as age, and consumer activity have been found to be positively related to customers' public complaint behaviour, while the same is not observed in their privately made complaints. (Fox, 2008)

There are also general objectives for handling feedback. The need to process customer feedback systematically through a system is obvious, as customers expect to receive a response to their feedback and, in particular, they expect that complaints are processed quickly (Martíšková & švec, 2017, p. 73). Companies should examine the impact of information from their customer feedback on the organizations' learning to understand changing customer needs and the use of such information to meet customers' requirements (Caemmerer & Wilson, 2009). By researching consistently customer behaviour companies prove themselves as market-oriented (Brady and Cronin, 2001). Especially in the service business, the companies' key implications are that every member of an organization is some way customer accountable, and data needs to be used for creating an understanding of customers' changing needs to allow customer service to be continuously developed. (Sitkin et al., 1994). Traditionally companies' performance has been measured with quantitative metrics, but it has been also brought up that qualitative information like customer surveys must also be considered, among other information (Reynolds and Walters, 2008).

2.2 Text Analysis

2.2.1 Principles and Good Practices for Analyzing Text Data

Text in its many varieties is the fastest growing data source on the internet. Text can be found in example from scientific and news articles, blogs and postings, product descriptions and reviews, tweets and postings, scholarly papers, and research – and so on. What to do with all this unstructured data is the essential question. (Struhl, 2015, p. 3)

Commonly, there is a lot of data in all digital devices and solutions which does not have a meaning. That data is formed just from the operations and even a mistranslated text is seen just as data. But when the data is processed so, that we can find some unexpected insights or meanings from it, it turns into information. The number and significance of information is not dependent on the amount of data, thus its often in the other way around. The more data one must process, the harder it is to make meaningful findings. This is because meaningful findings are hidden under irrelevant data and bringing them up is more challenging. Therefore, processing unstructured data requires knowledge where to look from and how to analyse it to create information. (Struhl, 2015, p. 4)

The characteristic of the unstructured data is, that it is not following any regular pattern. Usually the unstructured data is understood as text data. Thus, text includes sentences with separation characters and chapters it is not comparable to the data tables with columns and records. When the unstructured data is analysed, the first steps include removing unnecessary content and modifying the rest so that it can be processed. The workload what needs to be done to get valued analysis from the text might surprise. It might lead to more costs than expected and therefore its justified to evaluate the benefits of the results before starting to do the analysis. Using the right text source for the analysis and carrying out the implementation according to analytical principles is helping to achieve better results. (Struhl, 2015, p. 5-6)

Organizations who want to have the information from text as free learn that it always needs investments. Software costs for doing text analysis are everything from free to five numbers and more. Choosing a free software can be tempting, but it comes with the requirement of skills that needs to be learned and whether specialists can be used or not, it is time consuming. Free programs might also be cumbersome to operate and require special skills to deal with more complex issues. They can also have shorthanded support, which means that when someone is stuck with something, the overcome can demolish the need in time wise. It is also good to note that company needs to invest to the infrastructure when greater volume of text data is handled. This includes data storage, hardware, and software for operating and maybe someone to deal with the whole system. (Struhl, 2015, p. 7-8)

Good reasons and the right way to implement text analysis justifies the investment. The business need for making better decisions based on the implemented analysis is the requirement for doing it. The analysis has no value if there is not an involvement from business who would act based on its results. Text analytics is like other analytical process and it must follow certain principles to be successful. Sometimes leaving few minor rules out generates reasonable results, but the odds come down if the known principles are not followed. (Struhl, 2015, p. 8)

One known principle is that the analysed problem is well-defined. Well-defined problem means that it is objective oriented and there is a plan how to use the intended results. Also, knowing what is looked from the data provides the insight better than a misleading thought, that innovative processing produces information by itself. The same phenomenon has been experienced already in the time when data-mining took its first steps in early 1990's. There are urban legends from that time, where data miners could show from the retailer's data some products correlation at certain time point in sales. Then they located those products closely in store and sold them at discount for making big profits. When investigated further, it was exposed that this story was based on fictional origin and was an example of untrue claim about unplanned information discovery. (Struhl, 2015, p. 9)

Another good principle is that analysis time consumption has been identified. Processing unstructured data comes always with surprises. Problems with unstructured data and the inconsistencies it contains increases the processing time. Some of these challenges can be handled with advanced software, but rule of thumb is that preparing the data takes most of the project's time and analysing only a small part. (Struhl, 2015, p. 9)

It is important to identify what in the data is important and what not. Analytics has two concepts for helping with this, data samples and statistical significance. Data sample means that instead of processing the whole data; one can take some amount of it as a sample and review the results from processing test analysis with that. It is important to take care, that the used data sample frames represent the whole available data, so they do not lead into incorrect conclusions. By starting just to process the data without noticing where the samples are taken can steer in the wrong direction. Statistical significance means that analysis claim is not false and analysis implementer is very confident about that. To be confident, the samples need to be big or when using smaller samples, there must be lot of comparisons within them to achieve statistical significance testing. Statisticians see that they are not making false claims when their significance is 95 % certain. This certainty level is a convention, which has been established very solidly. (Struhl, 2015, p. 9-11)

Too much data can distort the traditional significance testing, and everything may start to look significant. Traditional significance testing can exceed its limits by carrying out thousands of comparisons for trying to find out, what has significant effect. Other methods can perform the testing with a new data for validating how well the text analysis model works. (Struhl, 2015, p. 11) As an example, Bayesian networks is approaching this problem by trying to find the value of information by estimating the probabilities of the variables and their conditional dependencies (Pollino & Henderson, 2010, p. 6). By using a proper significant testing, one can find what should not end up into an analytical text analysing model (Struhl, 2015, p. 11).

The simplest text analysis models should be used to present the results. Sometimes making complex processes and showing their results can be impressive, but what makes the real impression is the way of explaining in the simplest way what is happening. A good practice is to use the model that is working as simplest to present the results. Complex graphics with fancy features can create admirations, but they do not often make the point as clearly as more simpler versions do. Finding the way your target audience understands the results is one of the needed skills in producing analyses. This supports the goal for producing simpler business decisions and decrease their risks. (Struhl, 2015, p. 13)

2.3 Methods for Analyzing Text Data

Several levels of techniques exist for analysing text data. These range from doing word spotting in Excel to creating millions of data points including neural networks. These techniques can be used to identify recurrent themes, trends, and issues from text data like customer feedback. As result, the business is provided by information that helps them to implement better their strategy and enhance customer experience. (Medelyan, 2018)

2.3.1 Word Spotting

PhD Alyona Medelyan (2018) mentions word spotting as the first approach level of text analysis methods. Academic world does not recognize word spotting as text analytics approach, thus its associated more generally into handwriting recognition. Despite this method is not recognized to be any type of text analytics technique, it is used commonly within do-it-yourself analysts and skilful Excel users. Therefore, it is good to understand what this approach enables. Word spotting means that the text data is processed through and certain words are spotted from it. This kind of function can be implemented by Excel or coding in 10 minutes, which makes it look like an attractive approach method. But this method does not perform too well for text analysis. Spotting means that all words has to be hardcoded in the search queries, which makes it an effort demanding

method. Since the meaning of the text consists of sentences and not just individual words, this method is not used as a real alternative for processing and analysing textual data. An example of a one-word content definition in Excel is shown in the figure 4 below. It illustrates how the search with one word can be misleading what the what the text originally intended to mean. By trying to set up all the rules with different words and their combinations is not worth the effort as there are better methods available for doing this according to Medelyan.

	A	B	C	D
1	NPS Category	Comment	Category	Notes
2	3	Always cost	PRICE	
3	1	Because I find my gas bills are crazy, even in summer.	BILLING	Should be "Price"
4	10	Very easy to understand web site	EASE OF USE	Missed the Website aspect
5	8	easy to pay and different payment options	EASE OF USE	Missed the Ease of Payment aspect
6	10	Everything was easy to do and I had no problems!	EASE OF USE	
7	8	it was easy	EASE OF USE	
8	9	It's easy and fast	EASE OF USE	Missed "Fast"

Figure 4. Example of Word Spotting in Excel and a challenge that occurs when meaning is sought only with a single word (Medelyan 2018).

Where the word spotting has been seen working is when there is very limited amount of data and effort to tweak the rules for effective search gives acceptable results. Any data over few hundred rows increases the required effort too much to have accurate outcome. This method can only be utilized in situations where processing is done only few times for a limited amount of data. (Medelyan 2018)

2.3.2 Manual Rules

The method one level up from word spotting is to create the manual rules. Both of these methods share the same concept, where the aim is to create the pattern that matches text with expressions. The created patterns might become complex and therefore the solution providers in this area aim to provide a solution that makes it as easy as possible to create and maintain rules. The good side in this method is, that it is easy to understand and adjust. The downside is, that creating and maintaining accurate and well-functioning rules requires a lot of effort. Solutions using this method include sometimes pre-build categorizations for certain business areas including hundreds of phrases and words to help the matching process. The benefit for using manual rules is that when setup properly, it can process millions of feedbacks and give an overview of what they mainly contain. (Medelyan 2018)

There are many challenges for using manual rules method for processing text. One is, that words are often polysemy, meaning they have several intentions. It is hard to create purpose-built rules which can bring out the various intentions of same word used in different context. As an example

of this in customer feedback, the word friendly can mean that either service personnel were friendly or used solution was user friendly. Significant is revealed in the context used and requires searching the other words in sentence. Another challenge is that core topic is sometimes not the most obvious thing in a sentence. Feedback “after losing my credit card, the seller waited patiently when I was looking for cash to pay”, is telling about the seller’s behaviour, neither about cash nor credit card. Manual rules are also bad to find the sentiment. The following three examples include words “not” and “great” with different sentiment. First sentence “coffee was not that great” can be interpreted to be neutral expression. Second sentence “I did not think coffee was great” indicates a negative attitude. Third sentence “I did not expect my coffee to be this great” talks about the positive surprise the customer had. It is often not understood how varied and diverse the use of language is and therefore it is impossible to interpret the sentiment of the content correctly with pre-set rules. (Medelyan 2018)

The described challenges in manual rules method can be insuperable. There are industries like computer software, where the feedbacks describe very individual level topics and pre-described rules do not exist for them. If a well-working rule has been defined, it is hard to keep it well functioning during the time. Keeping the feedback accurately categorized requires linguistic specialized resources and continuous monitoring of feedback to identify new expressions. Thus, this method is widely used, it is an endless development process that requires heavy investments and becomes easily expensive. (Medelyan 2018)

2.3.3 Text Categorization

Text categorization is a real analytical method that uses algorithms and automatization. Its idea is to use machine learning algorithms and supervised approach. First the machine learning algorithms are used in training data to sort out text categorization rules, which is called supervised learning. Then the created analytical model including the sorting rules is used for analysing the desired text. Example of this process is described in the figure 5 below.

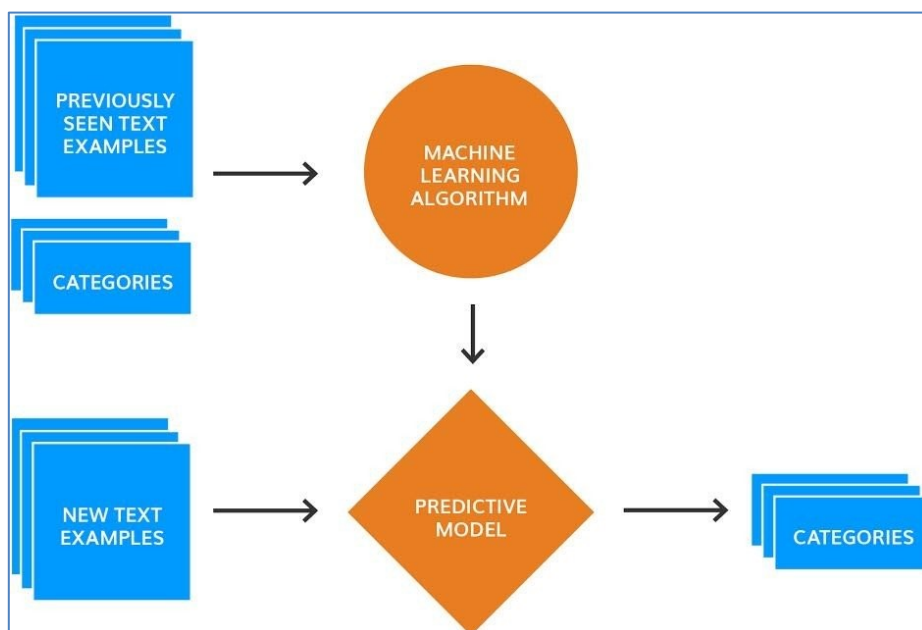


Figure 5. Model of supervised Machine Learning approach to create text categorization (Medelyan 2018).

Benefit of this method is that algorithms create the patterns and rules instead of manual contribution. This differs it from the two earlier methods and it is able at some level to describe the meaning of words in the text. By taking the earlier example where customer entered feedback “after losing my credit card, the seller waited patiently when I was looking for cash to pay”, it was all about the behaviour of the personnel. Therefore, the words “waited” and “patiently” are important in terms of the content while the words “credit card” or “cash” not. With a proper training the capture of correct categorization can be achieved. It only requires finding similar examples in the training data. (Medelyan 2018)

Text categorization’s ability to achieve accurate results in processing customer feedback is depending on the training data. Although the modern deep learning algorithms are more powerful than the old ones, it is the amount of the training data and its quality, that has the greatest significance. The amount of required data is dependent on the used algorithm for categorization model and the number of categories to be created. Having several categories whose content are close to each other require more data, so that the algorithm can find the differences between them. (Medelyan 2018)

Several challenges have been found with text categorization. Main challenge is how much time can be used to train the model to provide accurate results. Customer feedback is continuous flow of text data with lot of content variation and the objective is to understand its meaning as early as possible. Things that affect to the ability to train the categorization model are the tools used and human resources capacity in this area. Tools are expected to ease the process, while human resources expectations are to have the competence and enough allocated time. Other challenges are

related to the maintenance of algorithms. While your categorization is well trained for certain purpose, it might not notice the new phenomenon. The same challenge applies also to the other methods mentioned earlier, the incoming feedback needs to be under continuous monitoring to both discover the new themes and items categorized incorrectly. Another challenge comes when algorithm reaches high-level in capability of distinguishing categories. The complexity makes it difficult to understand how algorithm works and it also affects to the ability to adjust its operation. This lack of transparency makes it hard to find out why some categories start suddenly work poorly. After understanding the inaccuracy, the next challenge comes with finding enough training to correct it. (Medelyan 2018)

Training algorithms and getting the right kind of training data is hard. One reason which results in lower-than-expected performance of the algorithm is companies' estimate about the amount of training data they have. Refining one category requires that whole training data is re-labelled starting from the beginning. As an example, when company has created a working categorization model for customer support department and wants to use it for customer survey purpose it needs to be re-trained because the content is different. The training might take months to get the algorithm create accurate categories and sometimes time drives past the need. (Medelyan 2018)

2.3.4 Topic Modelling

This approach is unsupervised Machine Learning method, which means that it can learn from the text. There have been different perceptions of what algorithm “topic modelling” means although some use this term from any algorithm. For data scientists it means only Latent Dirichlet Allocation abbreviated LDA, which means mathematical modelling of language to find out both the topics and how they have spread throughout the text. Example of Topic Modelling is in figure 6 below. It has three different illustrative parts:

- 1.) First part shows the text source, which is in this case is different reviews for beers.
- 2.) Second part describes an example of a topic which is a similar words collection.
- 3.) Third part shows the assigned topics within one review. In this case the example product review has four assigned topics. (Medelyan 2018)

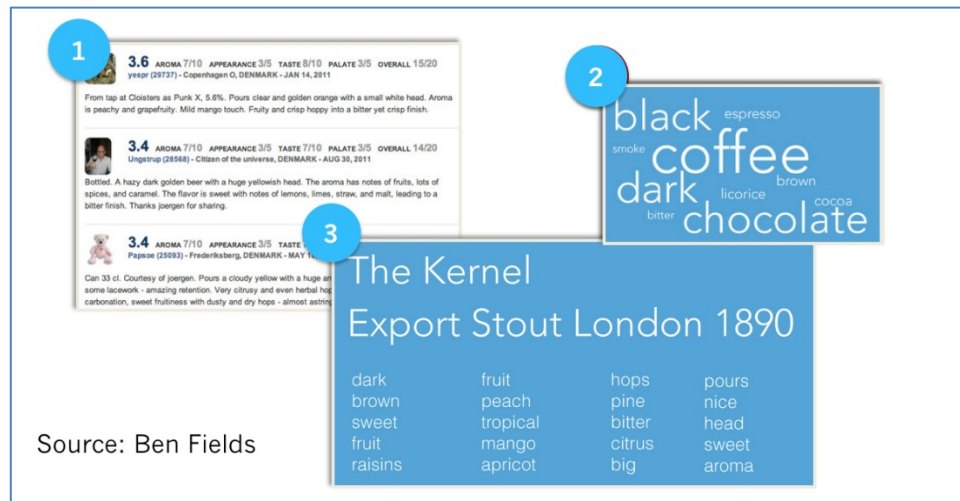


Figure 6. Example of topic modelling in action (Medelyan 2018).

Topics created in the example, can also be weighted to put more purpose into them. This could be presented in the figure above, that example product reviews have 40% of topic 1 (dark, brown, sweet, fruit and raisins), 15% of topic 2 (fruit, peach, tropical, mango and apricot) and so on. (Medelyan 2018)

The benefit in topic modelling is that it requires nothing more than direct raw text from customer feedback. As an unsupervised method, the algorithm learns by examining which words are close to each other in different reviews. It has been widely used, for example, to analyse feedback or to find product recommendations in e-commerce sites. Topic modelling has also disadvantages and major one of them is that the significance of the topics is really difficult to interpret. When it models the text, it is happening by a non-transparent algorithm and it is not how people understand language. In the example figure 7 below, we have found the four topics where two of them cannot be described in one word. (Medelyan 2018)

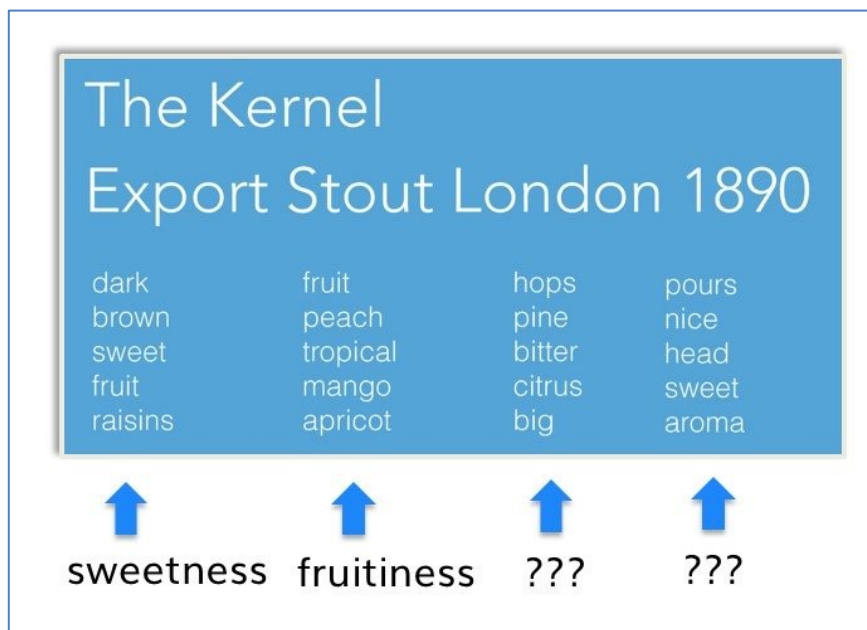


Figure 7. Product review description of topics in words (Medelyan 2018).

The challenge described above can be solved by data scientists using public libraries that give meaning to the unclear topics. However, making business decisions based on such topics is challenging and monitoring changes in topics to measure the impact of taken actions is even more difficult. Overall, topic modelling is considered an algorithm that is able to find language properties quite well and tasks requiring natural language understanding. For analysing feedback, this method is not always recommended because its lack of transparency and its difficultness to be interpreted.

2.3.5 Mixing the Methods

All the before presented methods have some shortcomings. Getting results after months' work, which does not discover new observations does not meet the desired goals. Late responses or missing significant feedback topics have often substantial business impact. It may lead to lost customers and stagnant growth.

There are key things that matter most in analysing customer feedback. The analysis to be made should be accurate, relevant to the topic and feasible. Rising topics should be found without any specific action taken. To be able to exploit the domain and general knowledge the made actions must be transparent. According to Medelyan, the best approach needs to have human intervention, that all the required things can come true.

Mixing the methods is a bottom-up analysis approach. It first extracts the phrases from the customer feedback and then tries to find the potentially insightful ones. The most important phase in this approach is to bring together similar phrases under a theme and organize these themes to be easily viewed and edited.

2.4 Text Analysis Implementation Process

Text Analytics is an exciting research area that tries to solve problem for produce information from unstructured data by using techniques from data mining, machine learning, natural language processing (NLP), IR and knowledge management. Text analytics involves the pre-processing of document collections (text categorization, information extraction, term extraction), the storage of the intermediate representations, the techniques to analyse these intermediate representations (distribution analysis, clustering, trend analysis, association rules etc.) and visualization of the results. (Feldman, 2004)

2.4.1 Preparing Text for Analysis

One key concept in text analytics is the theory for how to prepare it for analysis. Tearing apart unstructured text documents into their component parts is the first step in pretty much every NLP feature, including named entity recognition, theme extraction, and sentiment analysis. (Redmore, 2018)

There are 7 basic steps involved in preparing an unstructured text document for deeper analysis:

1. *Language Identification*: the first step in text analytics is identifying what language the text is written in.
2. *Tokenization*: When we know what language, the text is in; we can break it up into pieces. Tokenization is the process of breaking a piece of text apart into pieces that a machine can understand.
3. *Sentence Breaking*: After identifying the tokens, one can describe where the sentences end. Point is, before you can run deeper text analytics functions, you must be able to show where the boundaries are on a sentence.
4. *Part of Speech Tagging*: Once we have identified the language of a text document, tokenized it, and broken down the sentences, it is time to tag it. Part of Speech tagging is the process of determining the part of speech of every token in a document.
5. *Chunking*: Let us move on to the text analytics function known as Chunking. It refers to a range of sentence-braking systems that splinter a sentence into its component phrases (noun phrases, verb phrases, and so on).
6. *Syntax Parsing*: The syntax parsing sub-function is a way to determine the structure of a sentence. In truth, syntax parsing is just fancy talk for sentence diagraming. But it is a critical preparatory step in sentiment analysis and other natural language processing features.
7. *Sentence Chaining*: The final step in preparing unstructured text for deeper analysis is sentence chaining, sometimes known as *sentence relation*. (Redmore, 2018)

The following sections are describing more deeply what are the first actions to be done for the text to make it ready for used in analyses. In all analytics, data preparation is a critical phase, which leads to more consistent and accurate results when done carefully. Many of the steps included into preparation have little to no to do with analytics, but they are necessary part of the whole process. (Struhl, 2015, p. 24)

The notion of document means in text analytics everything from one-line sentence of text to a whole book. For the process, the notion means the set of text we want to process as an entity. First thing what is done for the document is creating the word vectors. This means first taking out all the unnecessary items that are not needed in the analysis, which is what the commercial programs do also as a first step. Stop words are first taken out from the text and it includes a, the, and, of, to, and so on. These words do not have any meaning and therefore they fade those words that have real meaning in analysis. (Struhl, 2015, p. 24 - 25, 29)

Following step is stemming, where the words are produced in their basic form. This process includes transforming plurals into singulars and correct the spelling errors using a dictionary. It contains also very challenging operations like changing tenses into uniform for avoiding including of the same word on several occasions in slightly different forms. Other complex operation is the conversion of idiomatic expressions into a basic form. Idiomatic means that group of words have different meaning than they would have when each word treated separately (Cambridge University Press, 2020). A special type of stemming is lemmatization, where the words are changed to the basic form depending on how they are used in the text. In example the word "moped" is changed to a stem differently based on the whether it is a noun or a verb. (Struhl, 2015, p. 29)

Stemming includes also other text cleaning operations. Based on the text source all nonsensical or useless comments are removed. In practice, this would comprise words like "no comment" or words that cannot be recognized to have meaning like "fjffj...". This kind of expressions are often found from the online text sources. Word pairs are something, that needs to be resolved as their meaning can be opposite than the separate words present. As an example of that the "not bad" has a positive meaning although each word separately refers to a negative term. Also, words that do not appear in the text that is under process can be deleted because their meaning in the whole document is minimal. Especially software programs processing text analytics has settings that can be tweaked to ignore certain part of text as irrelevant based on frequency, which affects the effectiveness of the analytical processing made later. (Struhl, 2015, p. 29-30)

The process for taking the words from the text is called tokenization. The words are called tokens and process named entity extraction aims to resolve the blanks between the tokens. Expressions like women's, men's

and professions titles with names or company names constitute also as a single purpose, like “Mr. Smith” or “Hill Corporation”, thus they have two tokens. A separate dictionary is required for this process to recognize the phrases as single items and not all text analytics software programs in market are capable for doing this phase. (Struhl, 2015, p. 30)

2.4.2 Ways of Finding Meaningful Content

After doing the preparing steps described above the text should contain mainly cleaned words. When the number of documents is large there is still too many words to be analyzed and the amount should be reduced. For efficient predictive model, the variables number is not more than 80 and in descriptive the hundred is the limit for workable models. Three commonly known methods for removing the not used words are usage of sliding windows, automated coding processes and factor analysis. (Struhl, 2015, p. 31)

Sliding window can be thought of a frame that moves along the text and counts how many times same words appear close together in the text. This means that the wider the window, more words are noted to be included into it together. The window’s length is usually from 6 to 11 words and it moves one word at a time until it is in the end of the text block. During the process it saves the counts how many times the different words fall together. The benefit of this method is, that it brings up the strongest themes that can be found from the text. It forms a similarity matrix that shows how often the words appeared together. Words are spread into X and Y axis and the number at their intersection shows the prevalence, like in figure 8 below. Sliding windows derived similarity matrix table is used as a base for different types of presentation models in text analytics. (Struhl, 2015, p. 31-32)

	able	also	benefit	best	busi	can	career	colleague	connect	contact
able		1	2	0	4	0	3	0	0	1
also			0	0	1	0	1	0	1	0
benefit				0	5	1	6	0	5	2
best					1	3	1	0	1	3
busi						1	4	2	4	4
can							1	2	3	1
career								1	5	5
colleague									2	2
connect										5
contact										

Figure 8. Similarities matrix showing how often words occur together (Struhl, p. 33).

For a long time, the self-made coding was the best option to understand the themes of the text. Note, that coding in this context means marking the most common words or word combinations with a code which can be referred later. That was done by creating a sub level that examined the certain theme and then the main level calculated the amount occurrences. Similar structure was done with different themes, like in example when clarifying the negativity of the text. There the negative comments in sublevel are gathered differently from hardware and software and then those are accumulated into overall negative comments. Thinking about that we are processing a text with only few hundred replies from survey the number of options that need to be coded makes the work time-consuming and expensive. Looking from this point of view there has been always a requirement to automate this process. Nowadays the advanced text analytics programs can process thousands of comments and provide hundreds of main- and sub-codes from them. These different levels of codes mean that in main level there is one word to describe the topic and in lower level few of them describes it, like in the figure 9 below. (Struhl, 2015, p. 33-34)

5 people
_random people
_people to use
_liberties of some people
_anonymous people
_people from different areas
_check people
_times people
_people to enter
5.5 people to connect
_people to connect connecting with people
_service to connect people
_opportunity to connect with people
_connecting to people in field
_connect to other like-minded people
_help people connect

Figure 9. Some automatically generated codes (Struhl, p. 36).

Encoding the word groups bring several benefits. It can be used to find out what kind of word combinations the text contains and in what different ways things are presented in it. This gives the analyst a base, where the key ideas can be presented as codes, which can be further used in analysis. (Struhl, 2015, p. 34)

Factor analysis is an analytical method for reducing the number of words in a document to a manageable level and bring insight into their content. It has been used in example to disclose how similar different answers can be in intelligent tests and this has also been utilized to refining psychological scales. The strength of this method is its capability to bring out the underlying topics and meanings of presented questions based on the received responses. (Struhl, 2015, p. 36)

The idea of factor analysis method is to group the presented question items into factors, which explains what they have in common. As an example, if we have a survey of 20-30 questions, we can define that we want to know what the six most common factors in our response document are. The analysis goes through the document and bases on the content create the six identified themes. Then it evaluates how closely each question items are related to the themes. This evaluation is called loading and it has the scale from zero to one. If the question item is more than 0.5 it is considered to be strong. When the loading is less than 0.5 it is small and those are usually removed to make results clearer to understand. By taking the small loadings with, we would have more complex chart as all the question items have always some loadings to the other factors they primarily belong to. The small loadings aka off-loadings are removed in the example figure 10 below. (Struhl, 2015, p. 36-37)

	Factor and loadings			
	1	2	3	4
Factor 1: care, concern and trust				
This product is a way companies show how much they value employees	.792			
Is a company that employers can trust	.665			
Is a socially responsible company	.659			
Offers online solutions for managing benefits	.640			
Is compassionate and respectful when working with employee	.549			
Is forward thinking	.513			
Factor 2: market leadership				
A market leader in supplemental coverages		.767		
Offers a broad range of employee benefits products		.762		
A market leader the employee benefit industry		.716		
Is financially strong		.703		
Offers innovative employee benefit products/solutions		.655		
Has a positive corporate reputation		.548		
Can be trusted to do the right thing		.542		
Factor 3: employer service focused (easy to do business with)				
Delivers superior customer service to benefits administrators			.746	
Is easy to do business with			.745	
Is timely and fair in evaluating claims			.729	
Offers products and services that are worth the price			.577	
Factor 4: employee-focused				
Offers face-to-face benefits counselling for your employees				.825
Is a leader in helping employees understand their benefits				.622
Is a leader in providing financial protection benefits				.602
Delivers superior customer service to your employees				.546

Figure 10. A factor solution with names for the factors and factor loadings (Struhl, p. 37).

Defining the number of factors affects to the success of the analysis. A thing that can determine the right number of factors is called eigenvalue. This value describes how well the factor explains responses' patterns. The larger eigenvalue means a stronger factor. In statistical solutions the default eigenvalue is set to one, thus it has no statistical base. There is no mathematical best answer for correct factor number, but some experience-based wisdom exists. Too few factors mean there are many questions gathered behind same factors without having actual relation into them. In addition to denoted off-loading, too few factors can also cause the same questions to be found behind several factors. Too many factors tend to have only few questions behind factors, which impairs the factors' ability to differentiate. (Struhl, 2015, p. 38-39)

There are few ways to define the correct number of factors. One is to define a name for the factor that explains the common theme for grouped questions. If all the grouped questions can be linked to the different factor themes' names the number can be right. Another method for determine the number is to run the KMO test, where an analysis is run to the separate words to define if they can be a factor. Another more mechanical based option to define number of factors is the scree plot. This visual illustration shows the different factors eigenvalues and from the plot in figure 11 below can be seen how the value changes within them. When the value plot gets flatten it means there are no big differences between the factors' eigenvalues in the Y-axis. As in this example, based on picture plot it can be defined that somewhere below seventh factor the significance of eigenvalue drops, and the factor number defined to be that. (Struhl, 2015, p. 39-40)

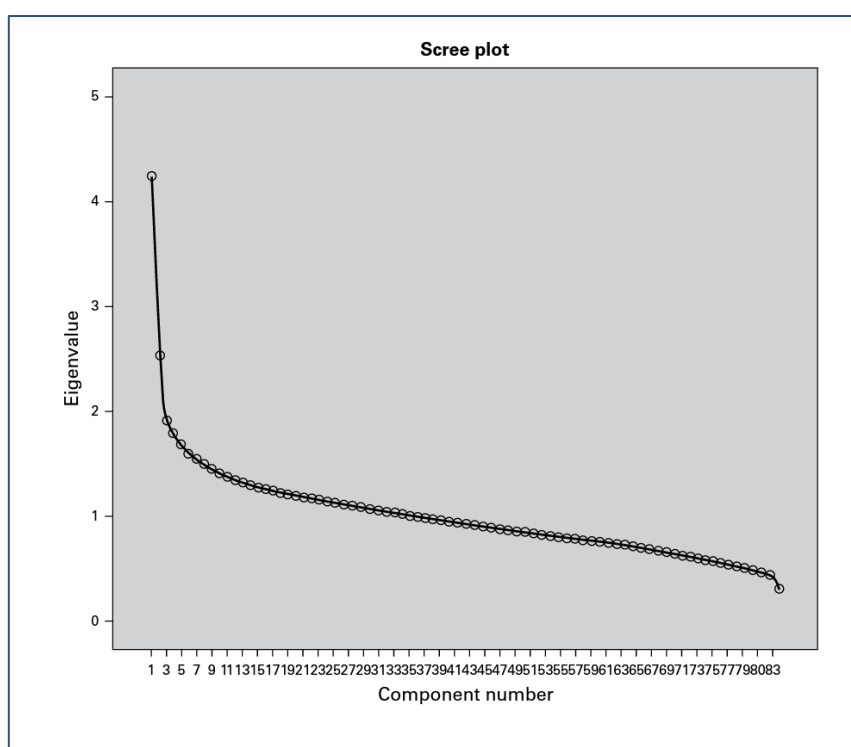


Figure 11. Diagnostic measures that may help find a factor solution (Struhl, p. 42).

Next chapter includes more about the analytical methods than can be used to make more deep analysis with the cleaned and stemmed text, where the meaningful themes and keywords belonging to them have been identified. Also, in that chapter the difference of descriptive and prescriptive text analytics is described in theory and practical examples.

2.4.3 Analyzing Text with Analytical Methods

Third conceptual theory is the explanation how the prepared text can be analyzed with different analytical methods. This section describes both the methods and what is the purpose of using each of them.

Different methods what can be done with the prepared text.

- Factor analysis as an important practical use to find common underlying ideas or themes in a set of text content.
- Getting words into figure for visualizing the disclosure results.
- Clustering words for finding patterns or similarities among words in text.
- Clustering and classifying documents first investigate the contents to cluster similar documents and classification puts them in to similar groups.
- Sentiment and word counting where former finds the tone of the text and latter gives preliminary insight about main areas of interest in text.
- Different predictive models with Regressions, Classification Trees and Bayes Nets gives some guidance about what influences and explains some results from the text. (Struhl, 2015)

Difference between Descriptive and Prescriptive text analytics is following. Descriptive comprises big part of the whole text analytics and it shows the extensive patterns, computes number of words and indicates which one of them are close to each other. Descriptive analytics and what its capable of has caused confusion. In the end it is, like the name says, description with details and it cannot present what a change in one element affects. Prescriptive analytics instead can describe what effects to the outcome and how much. Predictive methods take forward the analysis by describing if specific comments have any level of influence for example people's preferences or liking for some subjects. (Struhl, 2015, p. 27)

2.5 Applying Text Analytics to Business

2.5.1 Use Case Example – Assessment of Consumer Financial Complaints

This use case presents how “Applying Text Analytics and Machine Learning to Assess Consumer Financial Complaints” can bring out observations that could not be noticed without the use of text analytics into large unstructured data. This case is based on the public data that United States Consumer Financial Protection Bureau has collected from tens of thousands of complaints that have been made against companies every year. Objective for this kind of analysis is to quantitatively assess how an organization can identify various trends such as consumers' biggest concerns. (Sabo, 2017, p. 76)

This case shows how text analytics techniques can be used to explore the sentiment and machine learning methods to model the natural language from the free from text from the complaints. Focus on this case is to investigate the relation of complaints to the paid money by the companies.

An important point that is also treated is the visualization of the results for business. (Sabo, 2017, p. 76)

The US CFCB was founded after the financial crisis in 2011 to help overseeing that corporations and financial institutions consumers have fairly treatment. The company has handled over one million complaints and as the amount is increasing there has become a need for automate the textual data processing. The challenges that have been identified are following. First, there is a big difference how two different handlers tag the text in manual analysis. Also, within one handler the ten first manually analyzed cases in a day can be totally differently treated as the ten last cases. And finally, when a trend has been recognized from the text data it is expansion to cover over last year's data is not manually feasible. In this use case the idea is to tag every record based on the action the organization took against the complaint. By having the complaints' results tagged we can investigate more the trends that lead into particular outcome. (Sabo, 2017, p. 76)

This use case shows how analysts can quantitatively assess the different trends by using sentiment modeling and machine learning. First step is acquisition of the data and its preparation. The data used in the analysis was about half a year amount including 37 619 complaints. It includes two important information; one is a text field that describes the consumers' narratives as freeform text and the other is information from the companies' responses used as a category target. When the solution-based analyzation starts the same attributes are set in the SAS software for getting contextual analysis. What the solution does, is that it goes through the different companies' responses and searches the phrases, terms and their combinations associated to each given response. In example, the response "Closed with Monetary Relief" gets certain associations from the customers' narratives, but the response "Closed with Explanation" typically does not include the same associations. This helps greatly analysts to characterize the monetary relief complaints with solution building automated rules. Same can be done by manual work to create the categories, then run the analysis against them and finally present the sorted results. But that option has a challenge as the analysts don't know of all patterns that can be found in the text data, thus they need to explore them. In that way the process would be much more time consuming than with a solution, which produces the results in minutes. Also, the benefit of the solution approach is its capability to create the taxonomy that fits best to the text data in use. Analysts' time can be used much more productively by letting them tweak the process in the solution based on their knowledge, instead of building the whole process. (Sabo, 2017, p. 77-78)

In the figure 12 below, we can see what contextual analysis did in this case. In the figure the results are shown from the response "Closed with Monetary Relief" and what combinations of terms or phrases can be combined into the same categories. The achieved benefit is, that the

identified terms and phrases can be used to auto-classify new text complaints, especially the ones for resulting to similarly monetary reliefs. In this way, the complaints prioritization can be done automatically, and analysts can explore the terminology that characterizes financial compensation in these categories. (Sabo, 2017, p. 79)



Figure 12. Rules Generated by SAS Contextual Analysis Related to Monetary Relief.

The figure above shows in the first column the text phrases that are joined with “&” sign marking combining the words and the “~” sign meaning not. In example, the sixth line with “card & ~debt & interest”, means that text includes words “card” and “interest”, but not “debt”. Also, other than stemmed forms of these words like “cards” and “interesting” are good enough, yet no versions for “debt” are allowed. This indicates to the business, that in monetary relief category this rule applies to cards and their interests without referencing to debts. The colored components of the bars in the figure illustrate how well the phrases match to the category “closed with monetary relief”. The blue parts indicate the cases when the category matches correctly to the response type. Green part shows cases where the category rules apply also to another response type. In this response type, the red parts describe the cases where the solution is not capable to define a rule to differentiate their association between this and other response types. (Sabo, 2017, p. 80)

Text analytics can reveal defects in company’s business. If financial institution would examine the results presented in figure 12, they can oversee for example that they have given incorrect information about the interest rates associated with their cards based on the identified category in complaints. In a larger scale, text analytics can reveal general practices in business areas which lead to the wrong operating model and should therefore be corrected by supervised authority. (Sabo, 2017, p. 80)

3 RESEARCH IMPLEMENTATION METHODOLOGY

3.1 Qualitative Research Methodology

This section describes the used methodology in the research and how it is used. It also describes what the criteria are for using this method to produce research with successful results.

3.1.1 Thesis Objectives by the Selected Methodology

This thesis is a qualitative research based on the research questions and answers. Qualitative research is a general term for a research working method, in which researchers form their interpretations of the subject of their studies and present those interpretations in order to increase knowledge of the research subject (Wright, 2008, p. 157). The target group for the research is chosen as people with different job roles who are involved in activities related to this theme. The thesis includes gathered information from the target group and observation material which helps to explain and understand goals of the thesis and its research questions. Qualitative research is said to reflect the place, time, traditions, and current status of the researched subject (Wright, 2008, p. 157) and thus this research produces up-to-date information what is the current status of using text analytics in several Finnish companies.

3.1.2 Making Use of Qualitative Research Methodology

Several reasons can be found for using qualitative research method in this thesis. As an example, the potential problems in different areas of implementing a text analytics ecosystem in different companies (Hammarberg, Kirkman, De Lacey, 2016) can be revealed by getting information from the people who implement such systems. With this method the answers to the research questions of this topic are searched.

The main goal in qualitative research method is to provide guidelines that are based on experiences. They are based on smaller samples comparing to quantitative research and the research must verify that its conclusions are objective and not based only researchers own opinions. Other method, quantitative research, has been kept as a method to generalize and sometimes obscures the meaning results in the aggregated data. It is important to understand when to use what method and specially how to use them, if combined in some way. (Hammarberg, Kirkman et De Lacey, 2016)

Qualitative method brings out the standpoint of the research participants. It aims to enlighten what are the concepts that have been discovered based on experience and what perceptions and opinions have been formed as a result of these. (Hammarberg, Kirkman et De Lacey, 2016)

Richness of qualitative studies is also the information it provides about the thoughts, feelings, and behaviour of respondents (Wright, 2008, p. 158). Qualitative research sets up its information to techniques like interviews and small-group discussions with key informants. These methods are used to gather both background information and institutional point of view. This experience-based information leads sometimes to totally new learnings that were not expected to be discovered. (Hammarberg, Kirkman et De Lacey, 2016)

Qualitative research are evaluated by their trustworthy, credibility, applicability, and consistency (Leininger, 1994). This method, as any other, should explicitly and transparently provide it is trustworthy with the end conclusions, how they were derived, how research was conducted and what was the purpose of the research (Hammarberg, Kirkman et De Lacey, 2016). If small samples are used in qualitative studies, it may be difficult to justify the reliability of the studies performed, but by extrapolating the study and its results, the reliability can be justified (Wright, 2008, p. 162). It means that qualitative research's credibility is proved when its results are shared and recognized with the other people working in the same context. If the interpretations turn out to be defective the credibility is questioned. Applicability means how easily the research results can be transferred to another functional environment to make external validation. When research findings apply into same context outside the research environment, they are considered applicable. Consistency of the research refers to its repeatability by other researchers. This means that if the same information would be given to other researcher, the similar patterns would be found. (Hammarberg, Kirkman et De Lacey, 2016)

The research's practice part concentrates to narrate about the conditions of intended use, discovered experiences and observations on them. Part of the knowledge is based on publicly available information and part based on interviewed peoples' replies in different roles in companies that are using or producing text analytics for customer feedback. The practice part of the research includes the interview to gather some undiscovered information about the current status of using text analytics in today's business. The purpose of the interview is to bring out information like, how the text analytics process was conducted overall, what business decisions were made before the implementation start and during the implementation. Also, information about the gained benefits, how they were measured and how they were used to develop better business decisions.

3.2 Research Information Collection and Analysis

This section goes through the plan and the execution of the interview research. It describes also how information from the interviews is collected and analysed. The latter part of this section includes the responses to the study and what conclusions can be drawn from them.

3.2.1 Conducting Interviews

The interview is about the usage of text analytics in today's domestic business and the plan how the interviews are executed is explained first. The interviews are done through remote meetings with the interviewees as it is secure during the pandemic time. The interview time is agreed based on the respondents' schedules to make it easy for them to participate and be as easy as possible. Time reservation for the interviews is estimated based on the test interview, which is done before the actual interviews. All the interviews are conducted in Finnish and the used questionnaire's English version can be found from appendix 1 *Utilizing Text Analytics in Processing Customer Feedback – Interview Questions*.

All participants are emailed with information about the interview in any case, which includes an attachment of the personal agreement to consent to the use of the information from interview for this research work. As the consent agreement is in English, the e-mail contains its main points in Finnish. To confirm the approval of the agreement, a reply to that e-mail with a confirmation text and in his or her own name is sufficient. Agreement is made to have permission to use the interview materials and that is described in appendix 2 *Rights Transfer Agreement for Thesis Interview Materials*.

Interview starts with explanation of its purpose, by explaining the participant's rights and data protection, and describing the main parts of where the questions are asked. During the interview, the questions are shown one by one from the shared view to the interviewee first time during the interview. This is applied for getting answers, which are their direct reactions to questions without any preparation in advance. Interviews are recorded, so that they proceed smoothly, and time is used efficiently, without need to stop for write down notes. The content of the collected materials is transcribed later for creating analysis and making conclusions.

Reason for doing these interviews is their produced broader understanding about the subject. Interviews are used to obtain research material, and the material is to be analyzed and interpreted to solve the scientific research task (Hirsjärvi & Hurme, 2001, p. 34, 42.). The interviews are mainly unstructured, where the ways of presenting questions vary and no ready-made response options are provided (Hirsjärvi & Hurme, 2001, p. 43-44). Part of the interview is conducted in a structured way, including pre-formulated systematic questions and response options (Saaranen-Kauppinen & Puusniekka, 2009, p. 53). The use of a structured model aims to find similarities and differences in responses that may not be clearly detectable in open text responses. By just doing observations of this subject from different sources can lead to biased results. The media information about carried out text analytics implementations usually bring up more the positive sides as they are produced by the implementer and

their client company also including a marketing purpose in their stories. The challenges and estimations about the realized business benefits receive less attention and are not always brought up neutrally.

Remote interviews are not expected to have major impact on the success of the interviews. As the interviewer's behavior, gestures, and expressions, as well as other characteristics, play important role in the formation of the interaction situation (Saaranen-Kauppinen & Puusniekka, 2009, pp. 53–54), remote connection solutions' cameras are on during interview. This creates more human atmosphere to the interview session and enhance trust building through transparency. For the interviewer it is important to remember look directly to the camera often to emphasize presence. Also, a reminder to the interviewee, that recorded materials are deleted after certain time, facilitates the creation of open communication. An ideal interview includes certain things. The interviewees feel that interviews are designed, things proceed as planned, interviewees are motivated to respond and understand the role of the interviewer together with trust to the confidentiality of their information (Hirsjärvi ja Hurme 2001, p. 43). With the above listed ideals in mind during sessions is helping to conduct successful interviews remotely.

3.2.2 Research Interviews Participants

The target group of people interviewed consists of seven people in different industries and background profiles. Represented are both businesspeople who make decisions based on the produced information from the customer feedback analysis and the persons who are implementing analysis into gathered feedback text. Implementing persons to be interviewed are from within the companies and as well consultants, who have broader experience working with several companies in this subject. The interviewees are the business acquaintance of the author, which he has become familiar in recent decades.

Organizations included into the research are in two categories, solution providers supplying text analyzing capabilities and companies that make use of customer feedback analysis in their business. Business companies are chosen from different industries to bringing insight into the differences between them. Information on the differences between different industries is also sought from the answers of the supplying companies. All participants' information is treated anonymously, meaning no personalizing information about the interviewees is published in this study. However, some general classification factors are presented about each interviewee's company in order to bring up differences in analyzes, for example between different industries or company sizes.

For getting a comprehensive result by having seven people to be interviewed, it is clear that such a sample does not allow precise conclusions to be drawn regarding the objectives of the study. Despite the

small size of the interviewee group, it represents the people who have been implementing text analytics or been a part of organization that takes the advantage of obtained result. The experiences of the business organizations and the solution providers or consultant companies who operate in this area is used in this research.

However, during the interviews, the author noticed that the same themes were repeated in the answers of several interviewees, meaning that even a sample of this size can be used to make estimates of what is the status of using text analytics for analysing customer feedback at the moment and to identify common phenomena about it. All of the interviewees have certain background experience in implementing the text analysis for customer feedback in some role. People with consulting background or having that from the past have naturally experiences from different clients. The consultants' work backgrounds and experiences vary widely, so it was noted that they emphasize, for example, working with certain types of tools and operating methods in their responses. Based on these, the answers to the research questions can be expected to be very true with this sample, especially when similarities with the theories previously described in this research were found from the answers. Observations with a clear connection to the theoretical part of this thesis can be found in the section *4 Results of Customer Feedback Analysis Research*.

The research interviewees backgrounds are described only in high level. The confidentiality policy for the interview was, that no Personal Identification Information is published or used in this research, and the same considers also any information related directly to companies' names, operations, or business monetary values. From figure 13 below can be seen that the industry is distribution varieties well with emphasizing slightly to providers of services or solutions in this field. The other part of this figure illustrates interviewees current job roles related to this topic, where more than one option could be chosen.

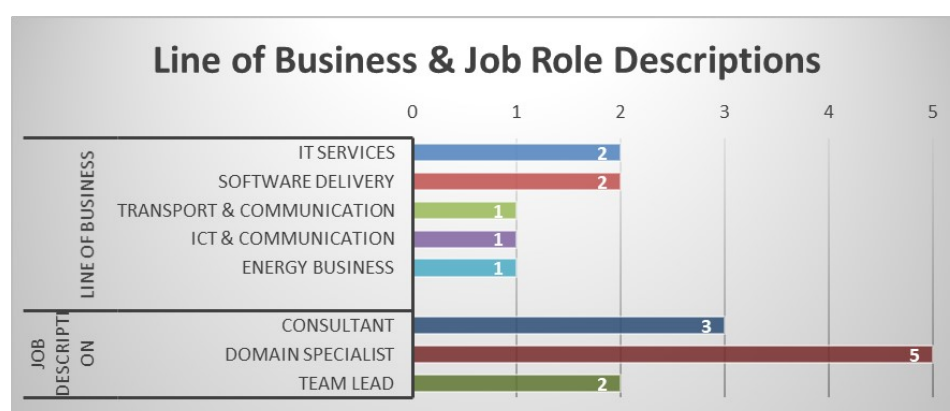


Figure 13. Research interviewees' line of business and job role descriptions.

Other interesting factor among the interviewees was their role in relation to text analytics. Interviewees were allowed to choose multiple roles in

their responses and put them in the order where the strongest role is mentioned first. The figure 14 below points out, that the role of the Data Scientist is emphasized in the responses. This is due to the several persons' background company, which is solution or service provider in text analytics and that some people responded more than one role, wherein this role is only part of their job.

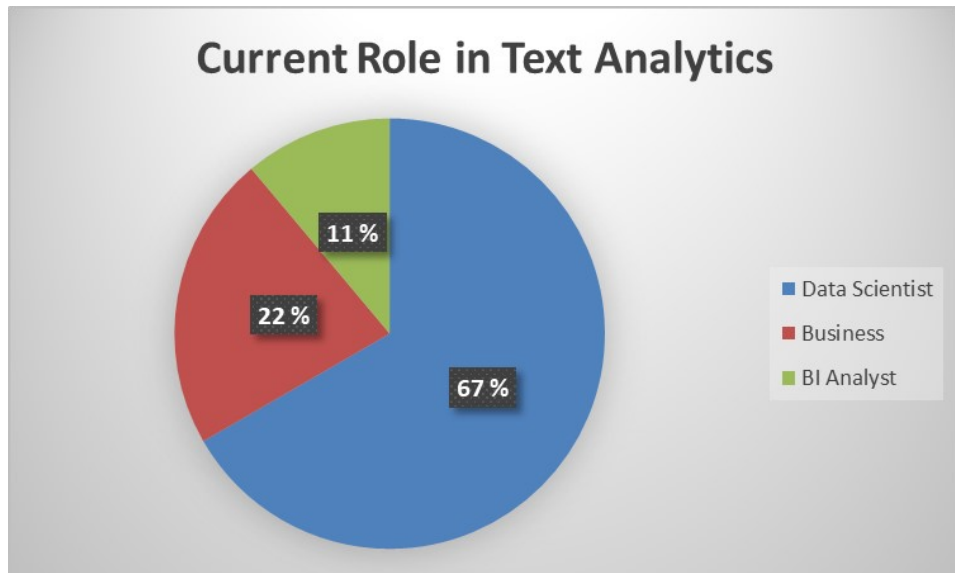


Figure 14. Research interviewees' current role in relation to text analytics.

The figure 15 shows the interviewees' experience and level of expertise in text analytics with Box Plot diagrams. The first diagram shows the interviewees' experience in text analytics in years. The blue box in the figure contains half of the observations received from the respondents and the median of the values is marked with a line in the middle of the box. The segments outside the box describe the lowest and highest values of the distribution between which the answers fall. Additionally, an anomalous value is shown as a separate point in the diagram. The second figure shows how the interviewees answered a question where they were allowed to assess their own skills in text analytics. The answer options ranged from 5 to 0, where five means extensive and deep experience on the topic as well as its good application skills and zero means no experience at all on the topic. The chart of responses shows that the majority of responses are set to ratings three and four, with one exception of rating five.

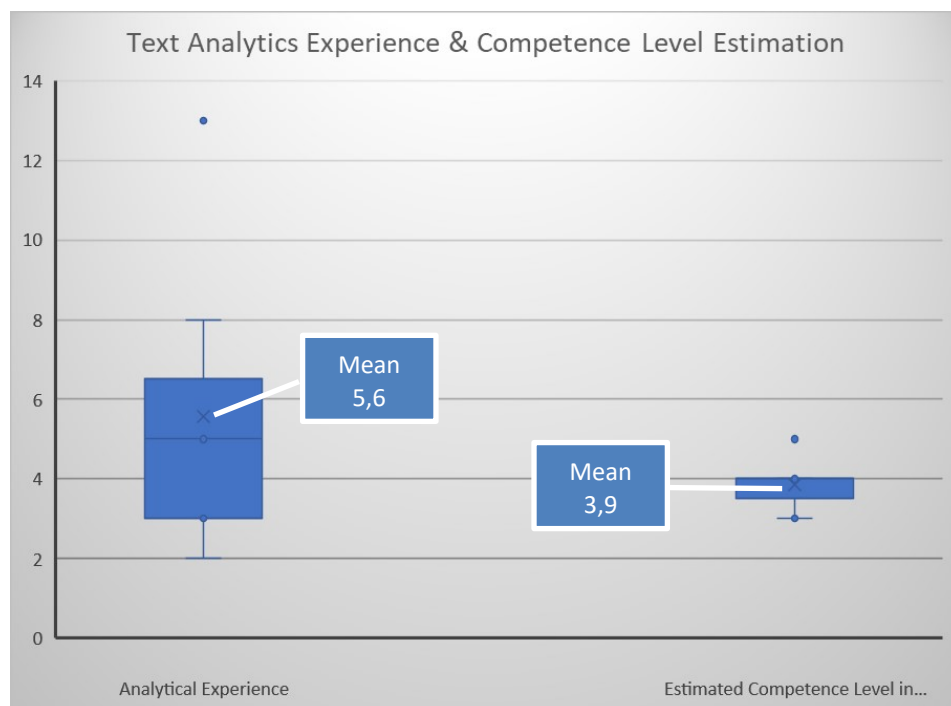


Figure 15. Research interviewees' text analytics experience and competition level estimation.

3.2.3 Research Questionnaire

The purpose of the questions is to find information for the research questions. The interviews' contents mainly consist of the questions about the background information about interviewees, the objectives of the customer feedback analyzes, the observations have been made during the implementation about the change needs in the business processes, the challenges have arisen in the technical implementation, the best practices have been followed or found during the implementation, how well the analyzes have been put into production, how analyzes performance are monitored and what lessons have been learned from the subject entirety. In unstructured questionnaire the order of the questions can be changed and explanations about them can be given (Wright, 2008, p. 166). The questions of the interview are described in the attachment 1.

Some of the questions are done in a semi-structured format to provide clear classifications. In this research it clarifies the definition of respondents' backgrounds, while topic related questions are desired to provide more openly produced answers. In this way, the comparison of the respondents is made clear, but the answers related to the subject better reflect the respondents' own views. In semi-structured interviews, respondents are asked to make selections in checkboxes for their assessments or classifications of companies, products, and services, depending on whether they think of them positively or negatively. Space must also be given to comments, which also gives insight of their awareness and feelings about the research's subject (Wright, 2008, p. 165). Questionnaires that are semi-structured give the interviewer the

ability to manage their staging for confirming that all of them are covered or giving comments to something already asked. The interviewer can also mix standard questions with closed questions or quick rating questions to get the interviewee opinions. (Wright, 2008, p. 167)

The analysis of the interviews' responses are carried out in several phases and the process includes different perspectives. As it is a qualitative interpretation from the gathered material, analysis always include do-it-yourself type of experiment and search for results. In the context of empirical research, analysis means reading the material carefully, organizing the text material, specifying the content and structures, structuring the material's content, and analysing the content. The analysis can also be the classification of content material on the basis of, for example, different topics and themes. The answers are searched for different layers of meaning and benchmarks, such as how many times a particular keywords or phrases were used and what those reflect about their speaker (Wright, 2008, p. 158). The purpose is to understand the interviews' content and review the occurrences and manifests of matters which are central to the research problem (Saaranen-Kauppinen & Puusniekka, 2009, pp. 73–74). The goal is to find perspectives, what can be found from the material that is related to the research problem (Saaranen-Kauppinen & Puusniekka, 2009, p. 75).

3.2.4 Research Analysis

In qualitative research, the results are related to the research process, as they are not absolute truths or declarations of state of affairs. Because absolute solutions cannot be achieved, only standpoints are offered as results. Sufficiently narrow, clearly, and carefully defined research questions serve as guidelines in the analysis. (Saaranen-Kauppinen & Puusniekka, 2009, pp. 74–75)

To begin with, the gathered interview material is easier to manage, when it is first converted into text format (Saaranen-Kauppinen & Puusniekka, 2009, p. 78) and this process is called transcription. The transcription of the interviews is done at the top level, as the purpose of this work is to seek answers to research questions and not to examine the interview situations themselves in more depth. According to Aku Kallio (n.d.) transcription is decomposing speech and activity into written form, which is a key part of the process of capturing qualitative material and analyzing it. It enables the researcher to become acquainted with the material, to make observations and interpretations of it. The key point in transcription is how accurately the speech is broken down and that is influenced by what kind of questions are being answered. In example, whether you are interested purely in the content, the content of different terms or even the course of the conversation's interaction. (Kallio, n.d.)

Converting interviews from speech to text format was a demanding operation. After the interviews, the recordings were transferred from the Microsoft Team's folder to the author's own media storages. By playing through the recording, the responses of the interviewees were registered into the text document, either directly by typing or by first spoken through Google Docs. The Google Docs application includes a speech-to-text feature that works reasonably well with the Finnish language. However, practice taught that it is worth to dictate speech only a few words at a time and immediately check if their content had been interpreted correctly. When author dictated longer snippets and then moved them into text document, there was often a need to go back to the recording and find out what was actually said in the point where there was completely wrong content. In author's opinion, the use of speech recognition as an aid clearly speeded up the transcription of the text, if there was no need to re-examine the content.

In semi-structured interviews, which focus precisely on certain issues, only the points relevant to the research are selected from the interviews' material. Use of such a procedure should always be justified in the research report. (Saaranen-Kauppinen & Puusniekka, 2009, p. 79) Marking text sections that talk about the same or similar things with codes helps to structure the material and facilitate analysis. For example, by using the word processing solution's functions the research tasks and questions' relevant matters can be labelled in the text material. Coding the text in this way enables to map the pertinent parts of the text material to find out what is related to the research topic. (Saaranen-Kauppinen & Puusniekka, 2009, pp. 80-81)

Coding text in subject areas requires the use of clear classification. Once the answers were in text form, there was a need to search for thematic topics. Careful transcription was emphasized at this point, as otherwise the classification into topics was not that clear. The topics of the classification used are taken from the research questions and their related topics. Tagging topics in the text was fast in itself, although along the way it often became apparent that a section of the text was related to more than one topic. This challenge was solved by marking the same text with several tags, indicating that the different classifications applied on it. When reading the response texts and tagging them is, it was noticed that it is the same as doing text analysis using similar methods what interviewees present in their responses and also is described in the theory section of this research. The manual text classification is done here.

Text thematic approach may be based on the themes of the questions, for a particular reference frame or theory. The coding method described above, can be used in the formation of themes as well as quantification, which seeks to quantify the frequencies of phenomena. The sections of the interviews that talk about specific theme are grouped under that theme. The research report presents points borrowed from the interviews' text

material in order to provide illustrative examples and to show the reader proof of the material used by the researcher. (Saaranen-Kauppinen & Puusniekka, 2009, pp. 105–106)

Classification into types refers to the compilation of manifesting cases, i.e. the compilation of text material into the classification types describing it. In the classification types that characterize the material, interest can be focused on issues that are thought to be special, individual, strange, and out-of-average. The type descriptions combine the common and typical elements present in different answers. Comparing the type descriptions shows what types can be constructed from the text material and how the different types differ from each other. Quantification supports classifying types, as calculations or tables can be used to check whether all typical elements are included in the report. (Saaranen-Kauppinen & Puusniekka, 2009, pp. 108–109)

The analyzes is based on gathering information from several sources and by summarizing them. In example, triangulation in qualitative research means referring to multiple methods combinations according to Len Wright (2008), like combining information from interviews and observations when studying the same subject. A simplified version used is to take three interviewers from different backgrounds and ask them on the same topic to determine how similar answers are obtained. The use of triangulation in qualitative research requires both balancing multiple perspectives in research design and the realities of research data which reduce the risks of biases. (Wright, 2008, p. 163) The results of this study are reviewed using the analysis of responses described above, where the backgrounds of the respondents are compared to the consistency of their responses.

Conclusions of the research replies to the research questions and opens the interpretations that have been made of the interviewed research material. The interpretations should be transparent enabling the reader to follow the solutions and thinking made by the author according to Günther and Hasanen (n.d.). While the qualitative research is subjective, it is important to describe and justify the used research process, so that the reader can assess whether the used approach was appropriate for the objectives (Günther & Hasanen, n.d.). Based on the need for transparency in the research work, attention is paid to the rationale for the reached conclusions. The conduct of the research is also described at a very precise level, in order to create the right image for the readers' evaluation of the research.

After classification, the text was processed with the subject as a whole. When the classified texts were joined together, it was easy to see which answers are repeated in the questions on the same topic. Although qualitative research does not involve comparing quantities statistically, it can be used to derive how common the issues raised are in this sample.

Differences in responses are also showing up in the compiled texts when individuals from distinct text analysis roles responded with their own goals and utilization in mind.

This brings versatility to the answers received in the interview. It tells more broadly what has been sought and achieved by analysing the text from customer feedback. The results presented in the following sections are based on information obtained from interviews and analysis performed by the author.

Summary of the conducted analysis steps described above. The following steps were executed, conversion of speech into text, its classification into thematic areas according to the thesis, and then the combination of text according to the classification topics used. The thematic approach was not used to search for separate themes, nor was the classification into types where a description of the text content would have been sought. The aim was only to search the text for answers to the research questions and to draw conclusions based on it.

3.3 Research Validity and Reliability

The presentation of research results in qualitative research raises questions about its validity and credibility. According to Saarinen-Kauppinen and Puusniekka (2009, p. 26) factors affecting the validity of the study are whether it has been thoroughly conducted and whether the obtained results and the conclusions reached are “correct”. By clearly presenting the results and the methods by which they are reached, the author gives the opportunity for readers to assess the correctness of the results. However, the validity of a qualitative research is not assumed to describe reality in a straightforward way, but can be understood more as credibility and persuasiveness, i.e., how well the constructs is produced to be understood by others (Saarinen-Kauppinen & Puusniekka, 2009, p. 26).

Despite the assessment of the method used in this research is problematic (Saarinen-Kauppinen & Puusniekka, 2009, p. 26), there are different ways it can be measured. Diachronic reliability refers to the persistence of measurements or observations when a study is conducted at different times, but studies rarely deal with objects that do not change over time (Saarinen-Kauppinen & Puusniekka, 2009, p. 26). When researching customer feedback processing and text analytics at different times, no similar results is produced, as methods and technologies in these areas are constantly evolving. While synchronic reliability means results obtained simultaneously by different instruments, the overall challenge is how the diverse results obtained by qualitative methods from the same phenomenon can be true (Saarinen-Kauppinen & Puusniekka, 2009, p. 26). By doing this research as quantitatively research, the author believes essentially the same issues arise. However, the number and diversity of exceptions it raises would probably be smaller.

The reliability of this study is verified in accordance with the good practices by strive for reasoned and openly described categorization and content coding. Also, the conducted interviews' reliability is confirmed by pre-testing and practicing in beforehand. (Saarinen-Kauppinen & Puusniekka, 2009, p. 26) The author also pays close attention to the style and content of the used language in the interviews, as the concepts used by the researcher may not work uniformly in all situations, i.e. careful use of language and speech patterns are relevant (Saarinen-Kauppinen & Puusniekka, 2009, p. 26). As reliability is affected by how much the nature of the research and its research topic impacts on the responses of the interviewees (Saarinen-Kauppinen & Puusniekka, 2009, p. 27), the author of the research emphasizes its neutral goal in the search for objective information in the interviews.

4 RESULTS OF CUSTOMER FEEDBACK ANALYSIS RESEARCH

4.1 Results of the Research

This chapter explains what the results of the research are by using the materials collected in the interviews. It describes first the current usage status and purpose of feedback to the interviewed companies. Then it goes through their implementation challenges, used methods and solutions. Finally is presented, what business benefits they have achieved and what best practices have been found.

4.2 Current Status of Analysing Customer Feedback

Customer feedback is now being collected more and easily through digital channels. There are several channels through the development of technology such as on-line websites, cell phone app programs, emails, and social media channels, as well as traditional personal appointment or feedback via phone. Feedback through speech can be converted into text if necessary, making feedback easy to transcribe and analyse it through.

The threshold for giving feedback has also eased as a result of social media. Five respondents out of seven estimated that the amount of customer feedback continues to increase, and their exploitation is also increasing. This phenomenon continues what was mentioned to happen already six years ago by Celuch, Robinson & Walsh (2015). Feedbacks are also collected more comprehensively than before, for example with different services. Traditional Net Promoter Score (NPS) surveys are expected to be replaced with more rapid feedback acquisition on a certain topic, as in the case of sales situations. One respondent cited a decrease in direct feedback volumes, which is sought to compensate by actively sending surveys to more customers, to maintain the required level of feedback and, through it, an understanding of the situation in the market. One of the interviewees mentioned, that their current method of collecting customer feedback is old-fashioned.

The importance of feedback in companies is mainly on the rise. For their own company, customer feedback is a very important channel for at least four of those interviewed, and the company has in several cases already made good progress in their exploitation. Taking advantage of feedback is also perceived as an important issue to be raised in the company's strategy. However, in one of those interviewed, feedback was not considered to be very important topic and but even in that case its potential has been noted.

Responding to customer feedback varies. In general, companies do not put effort to respond to customer feedback if it is not specifically requested. Some of the feedback has such a content, like customers' opinions or

thanks, that customers do not expect responses either. In those cases, customers answer directly whether they like or not something and what is the reason for that. But it is good to respond to complaints or other customers' pains, because customers most often give feedback only when something is wrong. Martíšková & Švec (2017) found the same phenomenon, i.e. feedback tends to be given only when customers are very satisfied or disappointed.

As noted in the hotel use case in the theory section by responding to feedback, you can greatly improve customer satisfaction. However, information message is sent about received feedback, which is improving the customer experience when they know that their feedback has been received. Some customers, however, want a response for their feedback, which differentiates feedbacks from posting a corresponding comment on social media. As a good practice into this, customers are given a selection, by which they can indicate their desire to get a response.

The primary purpose of collecting feedback is managing customer relationship. It means, seeking a deeper understanding of customers and through it, improvement of the customer experience. Due to technical development, the usability of customer feedback has improved. According to interviewees' opinions, some of the companies know, how to take advantage of customer feedbacks and others not so much. In all respondents' attempts, the exact purpose of collecting feedback has not been established but it is still being collected and sought out how to benefit from it. In one case, the whole concept of service is built around the fact that the service has only one feedback channel and it is used to keep a close track of the client's situation.

NPS, in particular, is perceived to support things related to customer relationship. In order to support traditional selection field responses, text feedback is used to seek information, why customers have been answered in a specific way and what topics the provided feedback is directed at. Also, in NPS monitoring, if the target values of the answers in a certain topic do not exceed the desired limit, the issue is raised and addressed. Analysis of the feedback has often opened discussions about the issues that came up and how they could be done in another way. As a development example, combining texts from traditional channels' feedback with feedback from social media channels has come out. Generally, when a phenomenon is found in the feedback which applies to several customers, it is noticed and addressed. For example, this is aimed at identifying errors in customer related processes and correcting them to develop a better customer experience. This is what Robinson (2011) describes in order to gain insight of a company's successful and unsuccessful actions and processes.

4.2.1 Challenges in Customer Feedback Analysis

There are different challenges in analysing texts from feedback. Because texts from feedbacks are in free form their content may be very variable. Examples of the content of challenging texts include English words mixed in Finnish feedbacks, the use of sarcasm in texts, the brevity of feedback, and the inclusion of personal information in feedback that should not be shown up to feedback handlers. As Medelyan (2018) expresses this, it is not understood how varied and diverse the use of language can be. The distribution of the content of feedback into more things is also perceived as a challenge and, in particular, how to divide such feedback into more categories. In particular, more support from systems is needed to deal with such a thing.

Other noted challenges are the old feedback collection system, which has not been renewed in the context of the analysis utilization, the assumption that the feedback collection is executed centrally, when it is not, or that a challenging channel was selected for feedback collection and when this is noticed, new plan is started how this should be done. So, the architecture of feedback channels has to be in order, as more companies have noticed, that there is a lot of feedback coming in at day level. And in some companies, the need for real-time analysing has been raised, which brings its own kind of requirements.

Different types of challenges arise in the implementation of the analysis. In long feedback, feedback has been often given to several things and finding this in the text can be difficult. Identifying the tone of feedback, whether it is positive or negative, is sometimes challenging. There can be a lot of variation in naming of the subjects in the text, which are challenging to understand as same. As an example, in some cases the name of the city has sometimes come in feedbacks with dozens of different versions. In the topics' classification, it has been discovered that, when analysts cannot find rational categories for topics, then the "others" category has become remarkably big. In some cases the challenge is that classifications are living over time and this requires maintenance to retain the quality of the analysis. And in general, teaching a model is often perceived as laborious task.

In the challenges associated with the systems the operation and maintenance matters most. For example, when heavier analysing processes are executed, the whole operational systems might jam. This can be avoided by investing enough in infrastructure when handling larger amounts of data as Struhl (2015) mentions. Either the models do not produce good results without constant monitoring and maintenance. Maintenance of models is seen as continuous development and finding resources to do that is problematic. The necessary resources must also be linguistic specialized and continuous monitoring is sought to identify new topics Medelyan (2018) states. Visualizations from models have been

found in some cases challenging to implement. The complex text analytics cases lead usually to an underestimation of the time required and their results are difficult to evaluate.

The challenges of analysing can be linked into the business. The process of achieving cultural change is sometimes unfinished, meaning that the analysis is received through the organization, continuously used, and accepted as a new tool. Especially changing people's daily routines is the challenge here. A strategic decision to execute the analysis implementation internally or to purchase it as delivered by external consultants, may cause a challenge when the basics and operating models of both alternatives are unascertained. Internal implementations increase in personal dependency and internal resources may be also misused. External partners can deliver ease of use analysis and know how linked to the business, which in internal implementations may be missing. Partners can also have special skills, such as an example experience in speech recognition.

4.2.2 The Purpose and Utilization of Feedback Analysis

Certain generalities have been found from the implementation of the analysis. Customer feedback are generally consistent for text data and the selection fields that classify them. This has seen to reflected, that usually the most valuable customers also turn out to be the most satisfied. It has been noted that feedbacks need to be analysed in a specific context in order to best benefit from them. Some experiments have been made to translate verbal feedback into text by means of speech recognition.

The impact of customer feedback on the business is very variable. It has generally been noticed that people bring up a lot of things in feedbacks and when those are analysed, these things are noticed and reacted to. For example, in open channels, sustainability and responsible business topics are raised all the time. Also, the analytics department status in the company matters and, if appreciation is found, business listens carefully found observations. Analysis of customer feedback has created new positions in companies, where for example, people are focused on made analysis to track the quality of services. However, interview brought up, that one cannot be always sure if the information about the thing that changes the business comes from feedback or from somewhere else.

The starting points for analysing texts variate from experimentation to achieving a finished process. A number of companies set out to try how text analytics can be exploited and handling customer feedback is one of dozens of use cases. In those cases, text analytics is not started to be implemented only for customer feedbacks. Sometimes only descriptive analyses are sought, which provide statistics, but the essential thing is to set the purpose of how one wants to exploit results. Analytics may be

perceived as a hard-class science, which it does not need to be to achieve benefits.

The ultimate goal of analysis is to get the most out of customer feedback what is available and automate such a process. As motivation for the development of analysis, companies attempt to identify the topic areas of feedback, categorize them into specified categories, and identify positive or negative sentiments of feedback. These are used, for example, to seek new topics for business, more understanding of customer feedback, identification of process errors and customer problems, in example, support for quality monitoring. A lot of textual customer feedback also comes with Net Promoter Score queries and the impact of found topics on scoring is desired to understand. On a bigger scale, the aim is to understand trends in customer feedback and prioritize the problems that were found in them. In this, the topics' volumes are weighted and that indicates what need to be developed first.

A major issue for implementation is the breakdown into a one-time trial and the implementation of a permanent process. Levels of implementation vary from very manual doing to more systematic solutions. In some cases, company only wants to examine what topics are raised at the moment without predetermined categorization. The interviewees' answers raise clearly how business expectations differ from reality. Analysis is expected to solve all sorts of problems and everything is assumed to happen automatically. As a practical example, new topics have been assumed to be easily found, although in the text used in the modelling there are no more than a few subjects referring to them. Like Struhl (2015) notes this, it is a misleading thought, that innovative processing produces information by itself.

4.2.3 Methods Used in Feedback Analysis

Purpose and business problem dictate what types of implementation methods are used. Depending on whether you want to identify, for example, terms or sentiment, which method is used. First is necessary to try to understand what topic the feedback relates to at a more general level. However, the use of the method is not an end in itself, but rather how the results obtained can be exploited in business. As Struhl (2015) states this, analysis has no value if business is not involved, and act based on the results.

There was also a different idea that business should be determining the categories by which feedback is wanted to be examined. So, categories should not be the topics found by first exploring the text. In this case, the analysis results reflect the given categories relation to the analysed text and with that, their meaning for the business comes up. As said, there is no exploration in this approach, where one first examines the content

using analytics before the actual execution of classification. The discovery of new topics remains low in this modus operandi.

Big differences have been discovered in the implementation of the analysis at various companies. When designing analysis, a company may have an overly positive idea of how to deliver it in-house or with the help of a partner. In the early stages of the companies' text analytics development, the objective where the results are exploited is not defined very precisely. This is contrary to Struhl's (2015) known principle that the problem to be analysed must be well-defined. The distribution of the results achieved around the organization must also be considered in the analysis planning process, since, for example, the executing side of the analyses is often not made aware of how the results have been actually exploited.

Some of those interviewed mention companies doing only one-time experiments, while some are already seeking automated production systems. The potential opportunity to take advantage of feedback is mentioned in almost every interviewee's response and real-time is contemplated in at least one company. The question about the maturity level of the company in utilizing text analytics gave responses to all reply options. That means companies are not exploiting analysis for systematic implementation in their various business challenges. As an attention here that some respondents responded with their view on the maturity of their customer bases, which expands the number of companies which the answer includes. The options of those responding directly for their own company were, that text analysis is utilized from somewhat until to the implementation of widely systematic and different methods using solutions.

Implementing text analytics includes, in practice, a lot of data integration for creating a structure in unstructured data. Generally, text data is well obtained from feedback systems in one-time implementations, but implementing a continuous process is more challenging. Often different technical matters become challenges to processes. The analysis has to undergo pre-processing, using, for example, start and stop lists to take out the most common words used or not used in analysis. This is also mentioned by Struhl (2015), that stop words are taken out as the first step when processing text data. Anonymization of data must also be done if they contain personal information. Analysis of the text is also challenging due to the reasons mentioned earlier, like there is a lot of writing in the style of the colloquial language, special characters are used, and also whatever content, such as ugly words. Whereas, in some topic areas, feedback can be so specific that it is easily to be connected into some product, for example. In speech recognition experiments companies have also been able to test how much words they translate into text correctly.

Text modelling can take advantage of the finished information to which use case it relates. NPS data is often used as background information in

text classification and businesspeople are required for implementing the classification. The estimates of the required workload are often in too low level and in particular, the methods of supervised learning take time. Sometimes, when companies have detected the workload ahead, the implementations have taken steps back and started to do it by one thing at a time.

Differences in classifications made by a person have been seen to be dependent on the time point when they are performed. This is good to note, while systems always do the classification in the same way. The results of the analyses are sometimes evaluated very overly, i.e. they are simply estimated to be satisfied or dissatisfied without further examination of the reasons leading into this.

4.2.4 Solutions Supporting Text Analysis

The methods and tools used depend on the need for analysis. There are a lot of methods to be found, especially in open-source environments, and a comparison between them is necessary to achieve a qualitatively accurate text analysis model. Ready-made applications make it easier to get a first view using the topic modelling features included into them. In some cases, the categories found by the machines have been found to differ from business classifications in such a way that they cannot be exploited though. While the best methods are able to find and identify similarities even in large quantities of text, as learning methods, they are not suitable for use if too little educational data is available. Some implementors are found to be able to experiment with different methods cross to create new experiments, while others do only in an accustomed way.

Naturally, local language support is required in text analysis solutions. Solutions supporting the Finnish language have been found to work well. In addition to language, special vocabularies need to be taught to solutions, since in many of them do not include specific vocabularies for different industries. In general, commercial solutions are mentioned to work well and even the default settings can provide benefits. Also, significant is that solutions provide the possibility for discussion between analysts and business. The situation is well described by an interviewee comment who has a consultant experience in implementing for clients as, "making neural networks with python and looking at what comes out from that, doesn't open up easily to a business developer". The user interface and usability of the solution should be in a level, that even a business expert can use it. This is what Struhl (2015) also mentions, that the simplest text analysis models should be used to present the results. The main advantage of solutions is perceived as their ability to scale to different text volumes. The clearest disadvantage what was found in some solutions, is the absence of an immediate possibility to make modifications in the process of categorizing or tone correction.

4.2.5 Achieved Business Benefits by Analysing Customer Feedbacks

Importance of the processing and analysing customer feedbacks is that there are always things to be found that can improve the company's operations and services. What usually happens is that new things are noticed what company wants to accomplish or observed deviations lead to changes in business processes. This is what Robinson (2011) mentions the best customer feedback produces, it leads into Improvements or produces other value in the future. There are always a few points that surprises companies. Although it is thought that perhaps this topic is just coming, the fact that it is already found so much is a surprise. This is where Struhl's (2015) statement comes true, by processing the text data so, that unexpected insights or meanings are found, it produces new information. The analysis has also provided an understanding of how the customer feedback received at the beginning of the customer relationship compares with the feedback at the end or middle of the customer relationship.

Feedback analysis have accelerated customer understanding and helped to focus on the right things. Analyses made from feedback can be used for other customer analyses as well, such as using in marketing for evaluating customer churn. Also, the value of customer segments can be assessed and cross-tabulated with customer satisfaction through customer feedback. Sometimes it is even possible to directly determine how much, for example, an improvement in call centre affects to NPS values.

Feedback is mostly related to the operation of a service or product and similar areas of development are the most emerging. Analyses have been used to notably speed up the feedback processing and to follow up the volume of feedback what comes into different areas like invoicing or products. In example, when company discovers, that tens of feedbacks are related to a certain issue, it indicates strongly there is a problem. New processes have been created around the customer feedback analysis and based on that new job roles are needed in the organization. That has changed the way the company is managed.

At the beginning, the execution is more of an adjustment after the first experiments, and by processing the text data, companies can already find benefits with the basic functions. Utilizing text analysis can mean utilizing existing materials without the need to upgrade the other systems. The benefits of feedback analysis have been found as an excellent way to enrich company's market knowledge and feedback information is seen as an important data source for doing that.

Mainly, the answers to the formal questions can also be found in the free-form comments through analysis. Based on interviewees' experience, text analysis methods are seen to work amazingly well, and the subject areas of the text can be found accurately using the methods with basic settings. Identifying the categories related to own business in some level has been

an achievement to companies. What has been also surprising is that these have been able to experiment with really small budgets. Maybe therefore, business is sometimes disappointed when finding that analysis is a smaller process than imagined and they can be dissatisfied for the provided solution also.

4.2.6 Discovered Best Practices of Feedback Analysis Utilization

Analysing customer feedback can be utilized much more than what companies do today. It enables customers to give feedback on topics, on which they have not been able to response in formal questions. But if the questions asked are too close to each other customers feel frustrated and do not reply to all of them. This causes also that respondent starts to give same reply into different questions. Therefore, it is important to design what company wants to ask from their customers and define how they react to different responses. Text analytics can be used in here to suggest the suitable reply options in formal questions.

There are plenty of examples where the feedback analysis are applied in business. Where the results has seen to be used, in example, is for finding the factors that affects to the NPS scores. Another case is where the identified customer value segments are analysed in matrix with their customer satisfaction scores. Feedback analysis are often used for other customer analysis as data sources and in there they can be used for example as information for customer churn estimates.

Provided feedback information can also be utilized for marketing needs, to change the image of services or products with issues. In this kind of example, a categorization is produced to find out what the feedback is about and whether its sentiment is positive or negative. Then the improvements are implemented based on results obtained from feedbacks and marketing can promote changes made. Like in this example case, it is good to find those business cases where something can be done with the results. Moreover comparing the obtained feedback results with analysing texts from external sources, like social media, can give new perspective to the topic's general situation.

Companies have different ways to start getting acquainted with text analysis. The breakdown of feedback analysis to one-time experiments and to part of productional system sets completely different starting points for implementation. For example, when it is not a one-time experiment, the question about how it connects to existing architecture becomes appropriate. And even one-time experiments must aim for reproducibility so that as much of what exists can be reused when a similar need arises. If nothing else is invented, one starting point can be to explore what the text data reveals, when company does not know what they want to search from it.

One of the main learnings is how to process the data correctly. Automating the data processes as early as possible helps to concentrate more to the analysis execution. Usually the analysis is not required in real-time but analysing data from several days back can be too late to react to occurred issues. The company who has identified the phases of their text analysing process, have gained better understanding how they can start to develop the process and its different entities.

Data scientist work includes, that different comparisons between methods are made, assessments which tools works best, and what is the appropriate method for the challenge in question. A practical example can be to compare two open-source libraries and assess the results in order to find what is the better option in the use case.

Using the machine-learning models to directly produce categorization classes need to be thought carefully as usually they are clearly seen in the supporting role. This was also mentioned by Medelyan (2018), that when the algorithms way of operation becomes too complex, they lose the transparency, and it becomes hard to find the cause why models suddenly work poorly. She mentions however, that with training data including the correct examples and proper training, the capture of correct categorization is achievable.

Creating the categorizations manually results into classes, which are easier to understand and support well business requirements. This is because humans have a deeper ability to understand the context of business than artificial intelligence. However, it should be noted how difficult it is for people to classify materials in the same way. This can lead to a situation, where machine learning education materials can become inconsistent and therefore synchronization between classifiers is required intermittently.

The cases where the text analytics works well are those where there is plenty of feedback material available. Analytical models work well, when they can be taught well, and it is disadvantage if there is not enough material. In small amount of materials analysis, like group of feedbacks less than 500, the analysis are usually worth to be done manually. In reality, the total amount of customer feedback in companies is much larger than this. Companies keep information about quantities as confidential information.

Text classification is the most commonly used form of analysis. Classification can found topics well based on the rule, wherein the more different the categorization classes are the better the topics are found. Also, if there only few messages for a class in the categorization text, it is hard to create functional categories based on that data. Categorization requires support from business to divide the texts into correct categories. This underlines what Struhl (2015) states, that the analysis has no value without involvement from business who would act based on its results.

And it is also good to understand whether the classification directs some operational activity, in which case the changes in the classification must also be extended into operations.

The classification information should be used during the analysis execution for comparing what text analytics suggests and how well that matches to the created classifications. One way to test the used method is to evaluate how well it matches with the manually created classification. And overall, it is important if text analysis can be combined somehow with other data, so that its functionality can be evaluated. The comparison can be also made with real life situations, in example, whether there has been a shortage of skilled customer service during the time frame of received bad feedback. And the volume of the topic in feedback disguises the scale of the issue. In other words, business should not rely directly on text analysis, but try to confirm the finding through other means.

If classifications are seen to change over time, it requires maintenance to retain the text analysis quality. This highlights issues such as, how often classification models need to be updated and does the company have resources for doing that.

In the design phase of the analysis, the careful go through is required for analysis objectives, intended use and where the outcome of the analysis is used. The company's strategy can decide the method of implementation. In example, if personal dependence is to be avoided, external partners are often chosen to execute the implementation. Partners' capabilities to lead the results into business can also support the partner's choice. Whether or not the partners are used, the business users should be involved in the text analysis design right from the start till the end to be taught how to use the analysis. Based on the experience, the thing that goes most often wrong is the estimate of the company's internal workload, which easily leads to misuse of the organization's resources. One of Struhl's (2015) principle is, that analysis time consumption has to be identified, because processing unstructured text data comes always with surprises. And in order to get analysis solutions for production use, it has been found, that internal sales work and systematic management are needed. In accordance with Struhl's (2015) principles, the target audience need to understand the results and make business decisions accordingly.

4.2.7 Observed Best Practices in Analysis Solutions

When choosing an application, company needs to know what features they want to emphasize. Whether the goal is to have ease of use, more complex and more in-depth methods, particular methods for very specific use case or certain delivery model of analysis. Despite the above, the requirement for used language is always absolute.

Visualisations are significant advantage to in the beginning to create explorations from the texts, without the need to start to know coding. Essential is also to know the purpose and that the required method, like classification feature, is included in the solution. Different phases of the analysis process can be also carried out with one or several solutions. If speech recognition is executed, the quality of the voice in the feedback is a major thing. Commercial solutions' benefits are that well known providers' products have a stronger confidence in technological performance than open-source systems.

5 CONCLUSIONS

Starting point for this research was to create a comprehensive information related to the collection of customer feedback and the analysis of the text obtained from it. This section describes how it was achieved and the compilation of various development ideas related to the analysis of customer feedback is summarized in the next section.

The purpose of the first part of this study was to present the background information collected from different sources related to the topic, which provides a deeper understanding of what kind of issues are related to the topic of the study. It first focuses on how customer feedback is utilized and what issues are involved in handling it in different business areas. Real-life examples of observations and exploitation illustrate well the issues that customer feedback handlers deal with.

Another topic whose theory is widely discussed is the utilization of text analytics. It goes through different levels of methods for gaining an understanding of free-form text data. The section also describes what measures are needed for analysis using text analysis in order to process the text material so that its purpose is found in its content.

In the practical part of the study, the current situation in the use of text analytics in the utilization of information obtained from customer feedback was investigated with the help of an interview study. Interviews were conducted with Finnish businesspeople who use to analyse their feedback on their business processes and solution makers who have helped companies implement these processes.

In response to the question of what benefits companies achieve by using text analytics to analyse customer feedback, several examples were obtained. The interview highlighted both the benefits to the business and the benefits associated with analysing the textual data itself. As an example of the above, topics related to monitoring the company's operating processes, improving them, and developing new functions were found. Regarding the latter, how well can the analyses identify the issues described above and link the information obtained to other activities of the company.

To the question of best practices, a number of tried and tested operating models were found that can be used by feedback analysts. Several responses highlighted how text analysis is used to identify the root causes of NPS responses and what issues should be considered when making a classification of textual material whose results can be validated. Other examples were also found of the different applications where the analyses have been utilized, the good practices related to the analysis itself, and how different applications support the performance.

5.1 Customer Feedback Analysis Development Subjects

Based on the interviews in this study, a wide range of good practices were found that companies utilize in analysing the textual data of their customer feedback. This section brings together suggestions which of those practices should be used and why.

There is always something that can be used to improve the company's operations and services. Finding new perspectives and guiding analyses is made easier when company tries to find things for which they can also do something. Customer feedback also provides a lot of new areas for development in the company's operations that would not otherwise be noticed. The potential for customer feedback has been widely recognized in companies.

When companies start to explore the analysis of texts, such as customer feedback, first through experiments, they should also define some primary goals for that, which controls what is being done. In addition to the primary goal, it is good to keep in mind that the information collected, and the findings made from it can also be used in other customer related activities the company has.

The results sought from the implementations must be linked to business objectives. Implementations between one-time experiments and automated processes differ greatly in terms of needed workload. The former can be implemented with considerable investment, supported by an external partner, and the latter can require a company to significantly change its business processes and organizational operation models. Struhl (2015) states, that in order to obtain information from text data, it is necessary to make investments. He mentions the three main things, which are choosing the software to be used, building the needed skills and obtain the required infrastructure. And when real-time needs come up, those demands go even further including e.g. data flows management and necessary computing capacity acquisition.

When analysing customer feedback, validation of the results obtained has a great importance. For example, a comparison with other data or activities helps to confirm the validity of the results. Over time, the used model must be taken care of to ensure that it continues to produce good enough results. Products, services, and their related processes are constantly changing, which reflects also into the received feedback.

The classification in text analysis is directed by business needs. The commonly used classification is based on the choices made by the business. If there is no certainty about the classification categories, text analytics can also be used to suggest the categories. Anyway, it is always good to compare how a classification made by a business matches to the options produced by using text analytics.

One of the most significant factors in conducting successful analysis is the company's own human resources. Their involvement, from the design stage to the end use of the production, helps to keep the idea of utilizing the results into something during the system construction. By involving individuals whose work tasks are related to the topics of analysis, the results can be compared to their own experiences. Making a cultural change in an organization can come up when a new analysis system is introduced and accepted as a tool. Implementing new operational models into the organization and utilizing them requires change management. Nor can it be underestimated, that resources are also needed to maintain the new tools as time passes.

Sharing and communicating the results in the company is important. The implementations in the analysis of companies in the same industry are clearly different from each other, and something new is learned in each implementation. Sharing information about the lessons learned and the ability to exploit the results opens up opportunities both to expand the process done and to create similar ones when the need is seen.

5.2 Observations of Doing Research

At the beginning of doing this research, the author had only slight knowledge of part of its theory. He knew some of the text analytics terms but could neither put them in to a big picture nor understand what their purpose and relation to each other is. In the customer feedback subject, the main thoughts were that it is connected to NPS or can be given directly.

In conducting this thesis, getting acquainted with various practical cases of how customer feedback can be used to control a company's processes or search for new ideas to improve their operations opened up a whole new perspective on the utilization of customer feedback. Similarly, the terms of text analytics gained a new content as the understanding of their purpose increased and also what is the difference in their use. By interviewing the different actors, it was found what kind of challenges are solved with these things and what practical lessons have been learned, so that they can be used successfully.

A great lesson was also how this kind of research is done and what steps are involved in its execution. Prior to the practical phase, the author had no experience in planning the conduct of interviews, requesting permission to use interview materials, defining interview questions to find what to look for this thesis, converting interview materials to text, classifying text materials into research topics, and writing the research based on classified texts. All of the steps described above were carried out and when making the classifications, it was noticed that actually text analytics is being performed here manually, i.e. the same thing that many of the interviewees described doing in their answers.

The idea of text analytics raised many questions in the author's mind. What kind of topics the analytics would have found in the interview answers and how well would it have been able to classify the answers into research topics? And what would be the benefit of that, meaning how much would these have accelerated the progress of the thesis work? Getting answers into these questions through practical experiments is what the author sees as a natural continuation of this study.

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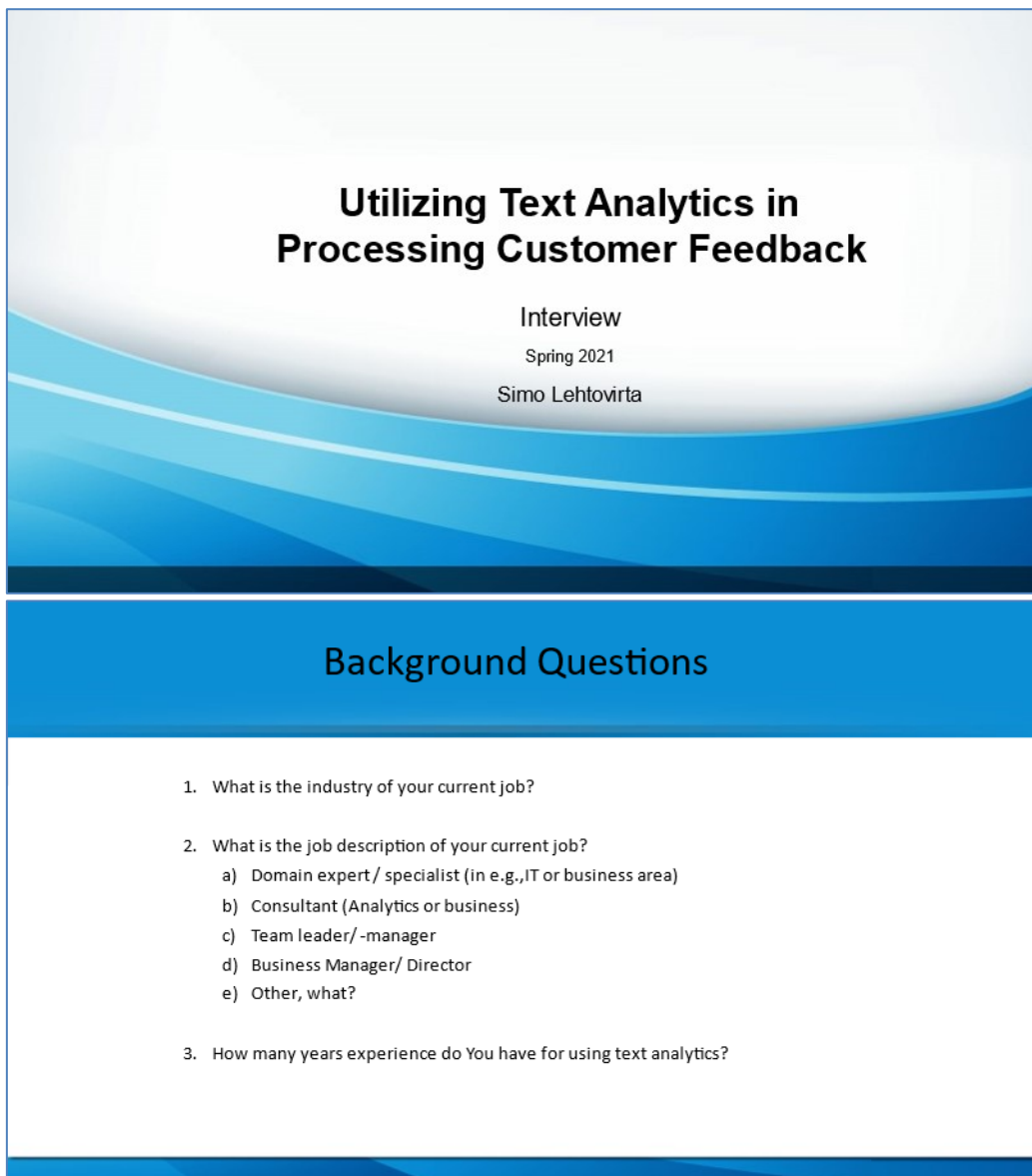
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Appendix 1: Utilizing Text Analytics in Processing Customer Feedback – Interview Questions



**Utilizing Text Analytics in
Processing Customer Feedback**

Interview
Spring 2021
Simo Lehtovirta

Background Questions

1. What is the industry of your current job?
2. What is the job description of your current job?
 - a) Domain expert/ specialist (in e.g.,IT or business area)
 - b) Consultant (Analytics or business)
 - c) Team leader/ -manager
 - d) Business Manager/ Director
 - e) Other, what?
3. How many years experience do You have for using text analytics?

Background Questions

4. Current job role in relation to text analytics?
 - a. Business User (presents requirements and utilizes results)
 - b. BI Analyst (understands business domain, data and key indicators)
 - c. Data Manager (manages data environments and data processes)
 - d. Data Scientist (understand analytical techniques, modeling of text data, analytics modeling application)
5. What roles have Your earlier jobs included in relation to text analytics ?
 - a. Business User (presents requirements and utilizes results)
 - b. BI Analyst (understands business domain, data and key indicators)
 - c. Data Manager (manages data environments and data processes)
 - d. Data Scientist (understand analytical techniques, modeling of text data, analytics modeling application)

Background Questions

6. What is Your current level of competence in text analytics (own estimation)?
 - 5 = High – extensive and deep experience and excellent utilization skills
 - 4 = Moderate – lot of experience and good utilization skills
 - 3 = Average – some experience and basic knowledge of application
 - 2 = Low – little experience and top-level knowledge of application
 - 1 = No experience or knowledge of application

Designing of the Text Analysis Application in Customer Feedback

7. How important the processing and analyzing of customer feedback is in Your company and what it aims to?
8. What is the current trend in customer feedbacks (decreases/ stays the same/ increases) in Your company and what amount of feedback requires a response?
9. How accurately the analyzed customer feedback's purpose is defined in the design phase of their implementation?
 - o In example, as being a part of service implementation or product selling objectives.

Designing of the Text Analysis Application in Customer Feedback

10. Has there been plans to carry out other related systems' implementations along customer feedback analysis? In example, new feedback system or new feedback channel.
11. Has there been plans to use classification information (ready-made response options) in customer feedbacks with the open text responses?
12. What are the key learnings in designing customer feedback analysis?

Methods for Implementing Customer Feedback Analysis

13. What are the selection criteria for the analysis method used in the text analysis and how is the suitability of the choice ensured?
14. What kind of comparisons are made between text analytics programs or methods before the system chosen for implementation is decided?
15. What kind of challenges have been discovered for getting text data from feedback systems or in their analyzation processes?
16. What things are important to consider when choosing the method used in analysing customer feedback?

Experiences in Implementing the Analysis

17. What level of implementations have been executed for analyzing customer feedbacks?
 - a) One-time implementation experiments,
 - b) Implementation of completed processes that can be used when needed or
 - c) automated, continuously working analyzation processes?
18. What benefits or disadvantages have been discovered in text analyzation solutions?
19. How well the classification information have been found and identified from the customer feedbacks? In example, found new subject area or recognized certain response segments.
20. Has the information analyzed from customer feedback been utilized in forming the broader customer insight?
21. What surprises have been discovered in customer feedback analysis execution?

Benefits of the Analysis and Achievement of the Set Objectives

22. How well have the implementation requirements been achieved with the implemented solutions?
23. Has the investment estimate made for the analysis of the text data corresponded to the investment required for its implementation?
24. Have the deviant observations found by analyzing the text of customer feedback led to changes in the business?
25. How well has the analysis of customer feedback produced future development targets for the company? In example, identified sustainable development and responsible operations change needs.

Benefits of the Analysis and Achievement of the Set Objectives

26. What maturity level do you think Your company is currently utilizing text analytics in processing customer feedback?
 - a. Not utilized.
 - b. Looking for some answers, for example, what topics are most commonly found in customer feedbacks.
 - c. Seeking clearly answers to some business questions, such as monitoring the quality of a particular service.
 - d. Seeking systematically answers to several business challenges and also performing analysis using various text analytics methods.

Appendix 2: Rights Transfer Agreement for Thesis Interview Materials

RIGHTS TRANSFER AGREEMENT FOR THESIS INTERVIEW MATERIALS

1. Purpose of the agreement

With this document, the interviewee (mentioned in point 4) transfers the rights to the interview materials gathered by the interviewer (mentioned in point 3) to be further used for a thesis work by the thesis author (mentioned in point 2). This further use can occur only in connection with the research activities related to the thesis (mentioned in point 2). No other use or publication is allowed on the gathered materials without written permission from interviewee (mentioned in point 4). By giving her/his acceptance to this Agreement, the interviewee (mentioned in point 4) accepts also to the *Terms related to the conducted interview and the gathered interview materials* described in point 6.

2. The subject of the gathered research materials

Name of Thesis:	Utilizing Text Analytics in Processing Customer Feedback
Author of the Thesis:	Simo Lehtovirta

3. Interviewer information

Name	Simo Lehtovirta
Address	
Telephone number	
Email (non-HAMK email)	

4. Interviewee information

Name	
Name of current Employer	
Address	
Telephone number	
Email	

5. Confidentiality

All information in this agreement is confidential and shall not be disclosed without written permission from both interviewer (mentioned in point 3) and interviewee (mentioned in point 4).

The author of the thesis (mentioned in point 2) agrees to maintain the confidentiality of any possible confidential or sensitive data that is related to the research materials.

6. Terms related to the conducted interview and the gathered interview materials.

The information is gathered during a remotely conducted interview through Microsoft Teams web meeting solution. The interview will be conducted in either English or Finnish.

The meeting is recorded and stored in the interviewer's personal data storage in HAMK (Hämeenlinna University of Applied Sciences), which is not publicly accessible through internet. Interview information transcript will be done
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within 5 days from interview and materials removed from HAMK storage. After that the thesis author stores and processes the gathered interview information only in his personal data storages with no continuous connection to any system or network.

The purpose for the interview is to collect information about the interviewee's experiences and views about design of the text analytics application in business, its implementation methods, lessons learned, measured benefits and their meeting of given expectations. In terms of thesis, the purpose is to present summarized conclusions and views based on information obtained from several interviews. It is not intended to highlight separate points from individual interviews, except occasionally, however, considering data protection, i.e. it is not possible to identify and disclose the respondent in any way. If a quotation from the interview is mentioned, it is noted to the interviewee.

Interview includes the following classification information about the interviewee:

- Industry of current job,
- Position level (in e.g. specialist, consultant, team manager, etc.)
- experience in year level for text analytics usage and
- current role in text analytics (implementer, user of results or both roles)

These information are used only as background information for the analysis of the interview and can be used on the basis of constructing summaries.

During the interview, the interviewee can mention if something he or she has said is classified information, in which case it can be used as background information, but not mentioned in any way in thesis.

After the thesis accomplishment, the materials will be stored for 5 years.

Signatures:

7. The Thesis Author and Interviewer. With this signature, I approve that I will comply with all my obligations under this Agreement to the received information from the Interviewee.

Date and place	
Signature and print name	Simo Lehtovirta

8. The Interviewee. With this signature, I approve the transfer of rights of the information given in the conducted interview to the Author of the thesis mentioned in this Agreement.

Date and place	
Signature and print name	*)

*) The interviewee can express his/her consent to accept this Agreement by sending an e-mail in response to a message containing this Agreement stating, "I agree" and his/her name. The consent response e-mail is stored as an attachment to this agreement.

This agreement will be stored permanently in the Author's secured data storage.