Monitoring the Repeated Calls at IKEA

Bachelor Thesis Assignment

Emma A. Vlaswinkel

University of Twente
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M. Iacob
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Author:
E.A. Vlaswinkel (Emma)

University of Twente
Drienerlolaan 5
7522 NB Enschede

CSC IKEA
Sontweg 9
9723 AT Groningen

Supervisors University of Twente
prof. dr. M.E. Iacob (Maria)
dr. A.I. Aldea (Adina)

Supervisor CSC IKEA
R. IJsbrandy (Richard)

Management summary

This research has been conducted for the Customer Support Center of IKEA. This Customer Support Center handles the questions and requests of all of the customers of IKEA via social media, chat, mail and phone. Currently, they are dealing with a very high number of calls. After looking into the reasons customers might have to reach out, the repeated calls have been established as one of these. The main focus of this research is to provide the Customer Support Center with a tool that provides them with insight into this topic.

Repeated calls have been identified as calls by the same phone number within either 3 hours, a day, a week, or a month. The customer will call again when he thinks that he is not helped properly. This can have three underlying reasons. Either the agent who helped him did not have the required knowledge, the agent did not have the right conversational skills, or the process which was started simply required the customer to call again. Since IKEA currently does not have any idea which part of the calls is repeated, nor which underlying reason is actually the biggest cause, they cannot reduce this number. Once they have more insight into this topic, they can improve the situation.

Since the Support Center already works with PowerBI to provide dashboards to the employees which translate the data to helpful information, a dashboard in this program has been chosen as the correct product. To determine which Key Performance Indicators should be included using which visualizations, two literature researches were performed.

Afterwards, focus group sessions were held to determine which Key Performance Indicators from the different possible ones are actually wished for by the employees. Since two separate departments will be using this dashboard intensively, their wishes were discussed separately. The development department will mainly use the pages focusing on the performances of the teams or individual agents, whereas the operations department will mainly use the pages showing the influence of different topics and processes on the repeated calls.

Simultaneously with determining the wishes for the dashboard, the possibilities were considered. In order to visualize the requested information, the correct datasets to include had to be selected. The Interaction Flow Report, containing the details of the calls themselves, and the Reason For Contact report, containing the information regarding the topic of the call, will be used. Using the Interaction Resource Fact report these two can be matched. Unfortunately, this overlap is not complete, and only a part of the calls can be assigned a reason for contact.

Using all this input, the dashboard was created. During this process, more focus group sessions were held to keep improving the product. Using row-level security, the right functions have access to the right pages. Multiple pages for both of the departments are included, as well as a page to make the step to Speechminer. In this program, the individual calls which are represented in the dashboard can be listened to. To determine whether this step can actually be performed properly, a case study has been performed. Focusing on one team and one day, the repeated calls have been analyzed, and the recurring aspects highlighted. The remarkable features have been communicated to the employees responsible for these topics, after which directly steps were taken to improve the situation.

To determine whether the dashboard actually fulfils the wishes indicated, an evaluation form has been sent out and filled in by different departments and involved employees. The results were very positive, and the given tips were directly implemented when possible.

To conclude, a dashboard in PowerBI has been created which will help the Customer Support Center of IKEA with gaining insight into the topic of repeated calls. Finding out what are the main causes enables the company to improve these, and thus the situation of such high demand.

Preface

This research is performed as a final assignment before finishing the Bachelor of Industrial Engineering and Management at the University of Twente. The research has been conducted with the Customer Support Center of IKEA from February to June 2021.

In this preface, I would like to thank everyone who helped me to complete this research. Firstly, I would like to thank both my supervisors for the University of Twente, Maria Iacob and Adina Aldea. Maria Iacob has been my first supervisor, guiding me through the entire process. She helped me find direction in the academic part of the thesis and gave feedback during multiple meetings. Adina Aldea was my second supervisor, providing feedback from a second perspective.

Secondly, I would like to thank everyone at IKEA. Richard IJsbrandy, my supervisor, has been very supportive of the research and helped me reach out to the correct people. My colleagues in the Business Analysts team have taught me very much about PowerBI and other programs and reports used. Together with my colleagues in the Customer Knowledge and Insights team, we made the valuable step from data analysis to action. Additionally to helping me complete my research, they also helped tremendously at keeping working from home fun, improving my online drawing skills week by week.

Lastly, I want to thank my friends and family for their personal support during this period. Talking about our experiences with fellow students helped a lot with finding direction with the research.

Enjoy reading this thesis!

Emma Vlaswinkel
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Acronyms

AHT Average Handling Time.

CK&I Customer Knowledge and Insights.

CSC Customer Support Centre.

IFR Interaction Flow Report.

IRF Interaction Resource Fact.

KPI Key Performance Indicator.

KPIs Key Performance Indicators.

NVAC Non Value Adding Contact.

NVACs Non Value Adding Contacts.

RC Repeated Call.

RCs Repeated Calls.

RFC Reason For Contact.

1 Introduction

1.1 Company introduction

IKEA is a very well-known worldwide company. Founded in Småland in Sweden by Ingvar Kamprad in 1943 at the age of 17, the company has now grown to be a worldwide leader in furniture retail. The vision of the company is "to create a better everyday life for the many people". The corresponding business idea is "to offer a wide range of well-designed, functional home furnishing products at prices so low that as many people as possible will be able to afford them". In the year 2020, IKEA had 445 stores worldwide (IKEA 2021).

Such a gigantic company comes with many processes and a lot of documentation. The company has therefore chosen a franchise system, which allows for their international expansion. One of these 12 franchises of the Inter IKEA Systems B.V., which is the owner of the IKEA concept and worldwide IKEA franchisor, is Ingka Holding B.V. Ingka is then again separated into three businesses, of which IKEA Retail is the core business. They are responsible for operating the IKEA stores in 30 countries (INGKA 2021).

With operating the stores comes the responsibility of offering the desired customer support. Therefore, there are many customer support centers all over the world to answer the questions customers might have. In the Netherlands, there is a Customer Support Centre (CSC) in Groningen. They take care of requests, complaints, and suggestions via telephone, mail, chat, and social media.

1.2 Problem identification

1.2.1 Action problem

In the current COVID-19 situation, many difficulties arise for the customers as well as for the CSC. The customer will be served differently than he is used to. The delivery services are dealing with delays, the customer cannot go to the store to try out the products he is interested in, he cannot go to the store to ask questions to the employees, and he will probably have questions regarding the replacing lockdown-related services. On the other hand, the CSC will have to improvise to get these new services, such as Click & Collect or shopping on appointment, going, without previous experience on how to properly arrange this. They can hardly predict what the situation will be like in the short term future, making it difficult to plan and schedule.

To sum up, the customer will have a lot of questions, which he cannot ask in ways he could before, regarding topics which were never an issue before. On the other hand, the CSC is in a more uncertain situation than before. Their problem is that they are receiving incredibly many questions. Up to 80.000 initiated calls are received per week, of which only a part can be handled. Not everyone can join a waiting queue due to the blocking of the support channel to keep the numbers under control. The exact number of calls that are blocked is unknown. If a call is 'accepted', they get to a selection menu, which is a part of the Interactive Voice Response. After having specified the reason for contact, they will be placed in a matching specific waiting queue. Even after entering, about 20% of the calls leave their waiting queue before speaking to an employee. This can have different causes, such as a change in the need for an answer, but a likely reason is an irritation over the long waiting times.

1.2.2 Problem cluster and core problem

The direct problem is therefore clear, the CSC of IKEA is unable to handle all the calls they are receiving. Since this channel is the main one used, chat and socials will not be included in the research. The problem of not being able to keep up has three big underlying causes. This structure is also visualized in figure 9 Color deficiency interpretation. The first one is that the time it takes to help the customer, the Average Handling Time (AHT) is too long. The second cause is a possible shortage of employees. The third cause concerns the fact that they are receiving many calls. The employee shortage is a problem that can only be solved in the long term, which is why it is not considered now. This leaves two research-able causes. The company requested further

research into the high number of calls because they do not have insight into this yet, which is why this will be the focus. When looking into the underlying causes of this, three divisions can be made.

The first reason which could cause a customer to reach out to the CSC is when they have a complaint regarding a product or a service. A second reason is when a question or a request of the customer cannot be fulfilled via online services. This could mean that something went wrong when ordering online, they have a question regarding putting together their orders, or they have a question regarding the service of IKEA. This situation can have two clear causes, namely limitations to the online system, they might not be able to alter their order information themselves, or they want information that they cannot find online. The online system can not be altered considerably on short notice, which is why this cause is not considered further. A third reason to reach out to IKEA is when a previous contact moment did not solve the issue. This is called a Repeated Call (RC). After having looked into the possible research topics of complaints, the online information and the Repeated Calls (RCs), in consultation with the company, a focus on the RCs was chosen.

The main reason for RCs is a first contact moment which did not answer the question properly. Even when someone calls again within a short time frame for a new question, this might have been avoided by asking whether there are any further issues at the end of the original call. This can be summarized as *customers are not being helped properly.* The three aspects which have the most influence on this are the knowledge of the employee, the process answered and the conversational skills of the employee. If the employee does not give the right answer, the customer will call again when he finds out that the answer did not help him. Another cause is when the answer which is given requires a process in which multiple contacts are unavoidable, such as calling again when a certain situation occurs, for example receiving a specific confirmation email. Lastly, the conversational skills of the employee might not be sufficient. For example, an insecure tone of voice will make the customer doubt the validity of the answer, which might encourage him to call again.

Currently, it is not known which aspects of a call and which aspects of the knowledge of the employees are missing in cases of repeated calling. They were not yet able to find out which employee causes many RCs, nor which topics are often the subject of a RC. Combining this information, finding out which employee causes many RCs regarding which topic leads to valuable information which can be used to reduce this number. Therefore, the core problem is that there is currently an absence of insight into the topics and skills concerning these RCs.

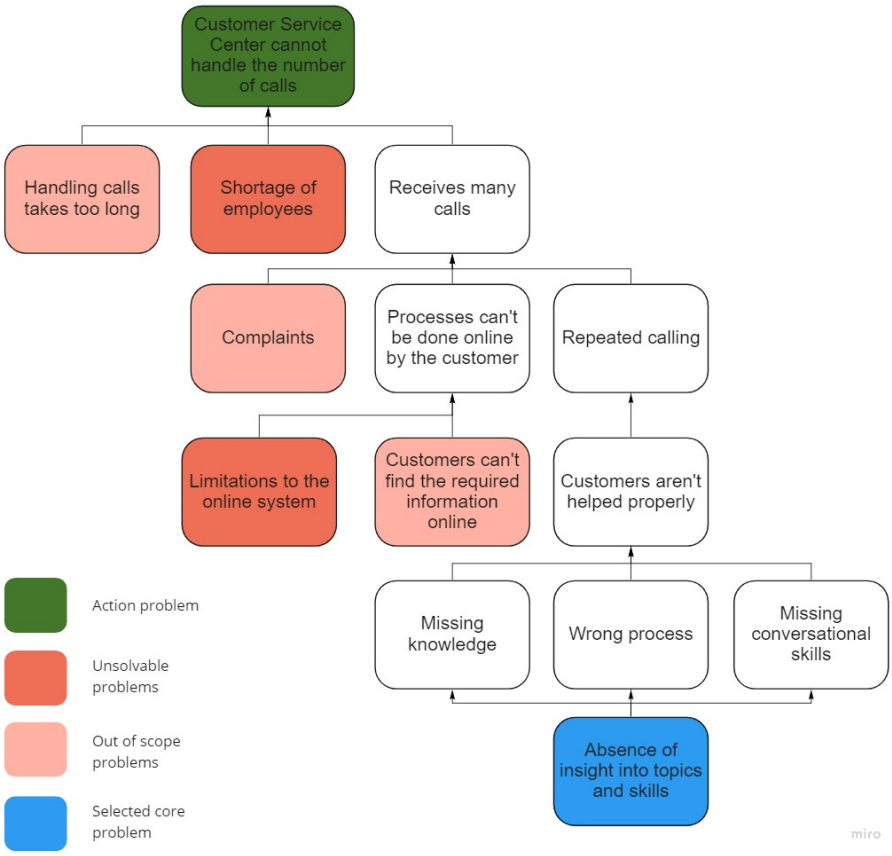


Figure 1: Problem cluster

1.2.3 Stakeholder analysis

Regarding the topic of Repeated Calls, multiple people and functions are involved. A stakeholder analysis has been done, to consider the different interests and involved parties. These stakeholders are my university supervisor, the company supervisor, the competence development specialists, the customer resolution managers, the business analysts, the team leaders, the call centers employees and the customers. This analysis can be found in Appendix A Stakeholders.

2 Research design

2.1 Research approach

The problem-solving method which will be used in this research is the *Design Thinking* approach. This method is identified as an exciting new paradigm for dealing with problems in many professions, most notably Information Technology (IT) and Business (Dorst 2011). It is an iterative process in which we seek to understand the user, challenge assumptions, and redefine problems in an attempt to identify alternative strategies and solutions while providing a solution-based approach to solving problems (Friis Dam and Yu Siang 2020). Instead of focusing on trying to understand reality, design science attempts to create things that serve human purposes (Peffers et al. 2007). The chosen design thinking approach of Peffers et al. 2007 uses six activities in a nominal sequence (see also figure 2 Design Thinking process);

1. *Problem identification and motivation*; For this first activity, the research problem is defined, and the value of a solution is justified. This has been done in the previous sections 1.2.1 Action problem and 1.2.2 Problem cluster and core problem. This way, the researcher and audience of the research are motivated to pursue the solution, and the reasoning associated with the researcher's understanding of the problem can be understood better.

2. *Define the objectives for a solution*; The objectives of a solution and knowledge of what is possible and feasible should be inferred. This understanding will be gained via focus group brainstorm sessions with employees in various departments within the organization. The result of this can be found in section 5 Requirements.

3. *Design and development*: The desired artifactt, most likely a dashboard resulted from the brainstorm sessions, should be created. In this activity, also the desired functionality and its architectures should be determined. In this research, a first version of the dashboard will be created after first doing the required literature research regarding the functionalities (KPIs and visualizations). This can be found in sections 3 Key performance indicators: A literature study and 4 Visualizations in PowerBI: A literature study.

4. *Demonstration*: Demonstration of the use of the artifact to solve one or more instances of the problem. It is important that it is known how to effectively use the artifact to solve the problem. The dashboard will be shared with the employees consulted before. The thought process behind the different elements present will be shared, and how the employees could use the dashboard to minimize the problem of repeated contacts. The prototype dashboard which is demonstrated as well as the underlying data structure can be found in sections 6 Context analysis: Structure of required data and 7 Dashboard.

5. *Evaluation*: After the demonstration, it should be measured how well the artifact supports a solution to the problem. This involves comparing the objectives of a solution to actual observed results from the use of the dashboard in the demonstration. Then, it can be decided whether to iterate back to activity 3, design and development, to try to improve the effectiveness of the artifact or to continue to the last activity of communication and leave further improvement to subsequent projects. Sections 8 Implementation and 9 Evaluation describes this phase.

6. *Communication*: The problem, its importance, the artifact, its utility and novelty, the rigour of its design, and its effectiveness to relevant audiences should be communicated. In this research, this will consist out of the full final thesis, which will be presented to the involved employees at the end of the research.

This process is carried out in a flexible fashion. The stages do not have to be sequential, and the iterative aspect of the method is essential (Friis Dam and Yu Siang 2021). This way, the artifact will be improved constantly, while keeping close contact with the users.

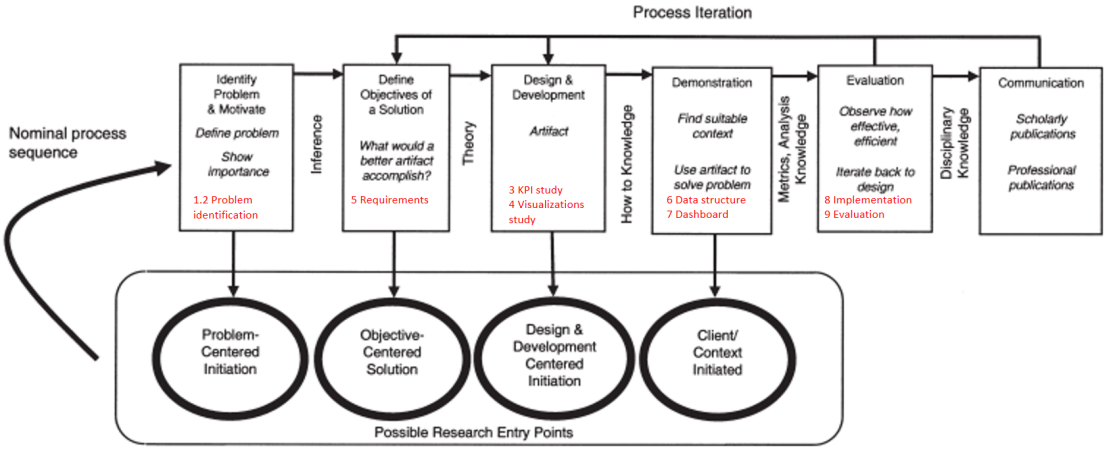


Figure 2: Design Thinking process

2.2 Scope

Again, the scope of the research is limited to the customer contacts via telephone. Although the CSC also handles chat and social media, to simplify the data source handling, only calls will be taken into consideration.
Employees can also transfer calls to other departments or consult them if they are not comfortable answering the question. Although looking into the topics of repeated consults is also an interesting subject, these internal calls are not considered now since this involves many more calls with slightly different characteristics. Leaving these out of this research enlarges the likeliness of a useful result, without sacrificing too many new insights.

2.3 Deliverables

The main intended deliverable of this research is a dashboard. This dashboard will have two focuses, providing information for training purposes, as well as information regarding the performance of operations. This dashboard will be made in PowerBI. The included visualizations and KPIs will be based on the user needs, which have been determined via focus group discussions and meetings to give updates and get new input.

Having this dashboard will make it possible to analyze the Repeated Calls, and find out what can be improved. A second deliverable will therefore be a broad recommendation regarding the cause of the RCs and how to diminish this number. This recommendation will also be based on a detailed analysis of some of the calls which caused further calling.

2.4 Research questions

In this research, the goal is to solve the core problem of a lack of insight into the RCs. Via a dashboard, insight will be provided so that then these RCs can be monitored. The research question to answer is, therefore;

How can the Customer Support Center of IKEA monitor the Repeated Calls?

Solving the core problem will be done in smaller steps. For each of these steps, knowledge questions have been determined. Answering these questions will help with answering the main research question, and therefore solving the core problem. These questions are answered in the different activities involved in the design thinking approach.

1. What does the current data analysis process look like?
The input of the dashboard will be the data that is created while calling. In order to find out what

can be used to get more insight into the RCs, the current data structure needs to be understood. Only then, the possible calculations and analyses can be determined since this will depend on the availability of the data. The CSC of IKEA uses PowerBI to visualize the processed data. With this Microsoft program, organizations can meet their self-service and enterprise business intelligence needs. The latest advances in Microsoft AI can be used to prepare data, build machine learning models, and find insights quickly (Microsoft 2021c). It is worth looking into how the CSC uses this program to be able to adjust the dashboard to their way of working.

1.1. Which types of data are collected which could be relevant for the case of Repeated Calls?
1.2. How is PowerBI used in the CSC for the analysis of data?

2. Which Key Performance Indicators should be visualized on the dashboard?
In order to make data understandable, Key Performance Indicators are used. These are general indicators of performance that focus on critical aspects of outputs or outcomes. Only a limited, manageable number of KPIs is maintainable for regular use, and having too many (and too complex) KPIs can be time- and resource-consuming. Systematic use of KPIs is essential as the value of these is almost completely derived from their consistent use over a number of projects. For performance measurement to be effective, the measures or indicators should be accepted, understood, and owned across the organization (Albert P.C. Chan and Ada P.L. Chan 2004). To be able to be consistent, first, literature research will be conducted to analyze KPIs used in call centers. Then, the KPIs which are relevant to the employees of the CSC will be selected. Currently, no KPIs regarding the RCs are in place. The first subquestion will be answered via literature research, the second by performing focus group sessions.

2.1. Which Key Performance Indicators are used in call centers?
2.2. Which Key Performance Indicators are relevant to the employees of the CSC?

3. Which visualizations should be used to represent the Key Performance Indicators?
Using KPIs only makes sense when the users actually understand the value they represent. Choosing the correct visualizations is therefore of importance. Graphic displays of KPIs need to be simple in design, easy to update, and accessible (Albert P.C. Chan and Ada P.L. Chan 2004). The different options will be evaluated based on the knowledge found in the literature research, after which the optimal ones will be processed further.

3.1. Which visualizations are used for which purposes?

4. How should the dashboard structure be designed?
The dashboard will give insight in the RCs to multiple departments in the CSC. It is, therefore, important to determine a clear structure beforehand to make sure that everyone can easily find the information they are looking for. Making clear which groups of end-users can be made based on shared interest will provide structure. These groups can be given the same access rights, and their desired information can be shown on one page. The different interests are determined via focus group sessions, and by discussing the existing structure with the business analysts, these groups can be formed.

4.1. Which end-user groups can be formed?

5. Which aspects of handling a phone call might influence the probability of a Repeated Call?
Before giving the recommendation regarding which changes could be made to diminish the number of Repeated Calls, the different possible aspects should be considered. The CSC already uses a format to determine the quality of a call. Looking into this will give insight into the important characteristics of calls. These characteristics can then be compared with calls that actually caused RCs to be able to quantify the influence on the probability of a RC. The characteristics are well-known to the development specialists. They provide information on this current method by showing which programs and questions they use.

5.1. What is already measured to determine the quality of the call?

6. Does the created artifact fulfil the established objectives?
In order to make sure that the artifact which was created in this research actually functions as a solution to the determined problem, an evaluation should be performed. The involved employees should get the chance to evaluate the product and communicate additional remarks. Sending out a questionnaire via e-mail is a suitable data collection method for this.

7. What recommendations can be made from this research?
Finally, after having made the dashboard and having used this to analyze which calls caused RCs, recommendations regarding the characteristics of calls that influence the probability can be made. These recommendations can be used to improve the quality of the calls and reduce the number of RCs to the CSC of IKEA.

7.1. Which steps are taken in calls that cause Repeated Calls?

3 Key performance indicators: A literature study

In this section, knowledge question *2.1. Which Key Performance Indicators are used in call centers?* will be answered. The validity of this research has been described in Appendix B Literature research KPIs validity. In order to find out which KPIs are relevant to show on the RCs dashboard, first, the available options will be considered. This is part of the *Design and development* activity of the design thinking approach.

A call center is a centralized office used for the purpose of receiving or transmitting a large volume of requests by telephone (Manzoor 2018). Outbound and inbound-focused call centers will have different interests. In this research, the CSC and thus an inbound call center is analyzed. This type is operated by a company to administer incoming product support or information inquiries from consumers (Manzoor 2018). With the current abundance of management information, many call centers have become preoccupied with measurements. A well-known concern is that call center management is measuring what is easy to measure rather than what is important to measure (Robinson and Morley 2006). For example, companies could use indicators like the total number of calls handled per day. As a result, the focus may be on increasing the average number of calls being handled per day by minimizing the time spent per call. However, such activities do not guarantee that the needs of the customer are being met. The objectives of the customer should therefore be aligned with the objectives of the company through the identification of appropriate Key Performance Indicators (Tate and Valk 2008).

In the case of a customer support center, customer satisfaction is the most important performance indicator. Top management and employees should therefore concentrate and take appropriate efforts to satisfy the needs and expectations of customers in the most efficient and economical ways (Manzoor 2018). Knowledge of KPIs is very important for optimizing customer support center operations, as they facilitate easy identification of elements that either positively or negatively affect the achieved results, thus making it easy to define areas that require improvement (Plaza and Pawlik 2021). They are also very good means for assessment of an organization's current position and useful in future strategy and planning. KPIs have the biggest impact on call center quality and call center cost by helping to reduce costs without sacrificing quality or affecting customer satisfaction (Manzoor 2018).

Among the large variability of KPIs available, similarities and differences can be considered, after which they can be captured in the most appropriate category. Since performance measurement implies a focus on individuals, groups, organizations, or systems, the following three groups have been extracted; employee attitude, employee performance, and company's system performance (Chicu, Ryan, and Valverde-Aparicio 2016).

Employee attitude

Employees play the leading role in the actions which lead to customer satisfaction. Only human service quality can bring about customer satisfaction, as tangible dimensions lead to customer dissatisfactions (Chicu, Ryan, and Valverde-Aparicio 2016). It has been found throughout call center literature that the correlation between employee satisfaction and customer satisfaction is reciprocal. Employee satisfaction and behavior can lead to customer satisfaction, and customer feedback, such as recognition or abuse, can create satisfaction, dissatisfaction, or emotional dissonance among employees. Therefore, not only will determinants of employee's attitude give an insight into how the calls are handled, but they also reflect customer satisfaction. Well-known for this type of determinant are employee satisfaction and communication, which can be specified into attentiveness, perceptiveness, and responsiveness (Chicu, Ryan, and Valverde-Aparicio 2016).

Employee's satisfaction can be measured by their attrition rate (Manzoor 2018), attendance, and punctuality. Here, attendance is defined as an agent showing up for work on the scheduled day. Punctuality is defined as an agent showing up on time for the shift, as well as being on time after breaks and lunch (Jouini, Koole, and Roubos 2013).

Communication quality can be determined when listening to tapes of the recorded conversations and assessing this via a comprehensive evaluation form. Common quality criteria include the

use of appropriate greetings and other call scripts, courtesy, and professionalism (Jouini, Koole, and Roubos 2013). For this, also the process of determining fatal flaws adds value. When these are determined and the occurrence of these has been measured, the cause of these flaws can be analyzed. These might then be avoided by better and additional training (Tate and Valk 2008).

Employee performance

The category of employee performance concerns the practicalities of the actual call. Again, the focus should be on measuring KPIs which contribute to customer satisfaction. Although it is not known yet whether it is a determinant of customer satisfaction or simply a related factor, in general, research does suggest a positive link between customer satisfaction and service level (Chicu, Ryan, and Valverde-Aparicio 2016). Service level is defined as the percentage of calls answered within a specified time limit (Jouini, Koole, and Roubos 2013). Other important performance indicators are the average handling time, and the number of calls handled per agent (Chicu, Ryan, and Valverde-Aparicio 2016; Manzoor 2018; Plaza and Pawlik 2021; Robinson and Morley 2006).

The average handling time (AHT) is built up of three different segments; the talk/engage time, the hold time, and the after-call work/wrap time. The engage time is the time that is spent actually talking with the customer, getting to know the issue, and giving the answer (Plaza and Pawlik 2021). The hold time only occurs when an agent does not know the answer to the customer's question or cannot fulfil the request. During this time period, the agent will consult a source of knowledge such as another employee, most likely a specialist in the required topic. The customer does stay connected but is not actively conversing. The third segment, the wrap time, takes place when the agent has to start a process at the request of the customer after having ended the call. This could be altering or cancelling an order (Chicu, Ryan, and Valverde-Aparicio 2016).

The number of calls handled per agent is a KPI that is easy to measure but should be used carefully. When call centers adopt the production-line approach and emphasize handling a large number of calls, they usually do not take the quality of the service provided into account (Chicu, Ryan, and Valverde-Aparicio 2016).

Company performance

Not only the call itself will influence the level of satisfaction of the customer, but also the performance of the system plays a role in this. Thus, determinants of caller satisfaction regarding this performance are of importance as well.

Among the important indicators is the abandonment rate. This can be calculated by dividing the number of callers who leave the waiting queue before speaking to an agent by the total number of callers. The customer will be dissatisfied if he finds himself forced to abandon the call without interacting with the agent (Abdullateef, Mokhtar, and Yusoff 2011). The reason for this could be the complexity of technology, busy signals, long waiting times, or answering machines. However, even if the system does not perform properly by making the customer wait longer than they were expecting to, employees can still achieve customer satisfaction by providing quality information (Chicu, Ryan, and Valverde-Aparicio 2016).
A second indicator regarding the management of the queues and waiting times is the probability of blocking. This measures the percentage of customers that are not able to access the center at a given time due to insufficient network facilities in place. By blocking the excess calls, a call center can always meet its speed-of-answer goal. Customer accessibility and satisfaction are greatly harmed, even though the call center appears to be doing a great job concerning queue management (Jouini, Koole, and Roubos 2013).

On a more individual level, queue management can be indicated via the longest delay in queue measure. This is the time the oldest call in the queue has been waiting. A real-time longest delay in the queue can be used to indicate when more staff need to be made immediately available. Also, past performance of the queue management can be evaluated using the historical longest delay to quantify the 'worst case' experience of a customer (Jouini, Koole, and Roubos 2013).

Whether the previously mentioned opportunity to improve customer satisfaction after a negative experience in the queue is fulfilled can be determined with the first call resolution (Chicu, Ryan, and Valverde-Aparicio 2016). This measures the percentage of customer issues resolved the first time. Maintaining a good first call resolution rate leads to a small number of calls coming from customers who call back because their issue was not resolved the first time. This way, high costs due to higher call volume, increased operating expenses, and dissatisfied customers can be avoided. It is therefore also used as a vague indicator of the RCs. Complicated with this indicator is that it is dependent on the opinion of the customer, which must first be collected. Since it is opinion-based, the KPI is also referred to as perceived first contact resolution (Jouini, Koole, and Roubos 2013).
Another way to determine whether the question of the customer is answered is by calculating the repeat call rate. Then, by going through the history of such cases, you can find the similarities in the issues that aren't being resolved in the first attempt by agents. The repeat call rate can be determined by dividing the number of repeat calls by the total number of calls (Chicu, Ryan, and Valverde-Aparicio 2016). This rate can then also be specified into different types of repeated calls, for example by subject or by the time between two calls.

Conclusion

The knowledge question of this literature research regarding the KPIs used in call centers has been answered. The relevant KPIs can be divided into three segments. Regarding the attitude of the employee, employee satisfaction can be measured by their attrition rate, attendance, and punctuality. Their communication quality can be assessed via a comprehensive evaluation form. The performance of the employee can be expressed in service level, the Average Handling Time and the number of calls handled per agent. Lastly, the performance of the company can be indicated via the abandonment rate, the probability of blocking, the longest delay in the queue, and the first call resolution. These different options can now be evaluated and possibly implemented in the further process of this research.

Table 1: KPIs used in call centers

Category	**Aim**	**KPI**
Employee attitude	Employee's satisfaction	Attrition rate, attendance, punctuality
	Communication quality	Results on evaluation form
Employee performance		Service level, Average Handling Time, number of calls handled
Company performance	Queue management	Abandonment rate, probability of blocking, longest delay in queue
	Question answered	First call resolution, Repeat call rate

4 Visualizations in PowerBI: A literature study

Knowledge question *3.1 Which visualizations are used for which purposes?* has been chosen to find out which visualizations should be placed on the dashboard representing the desired KPIs. This section, answering this question, is also part of the *Design and development* activity. The validity of this research is described in Appendix C Literature research visualizations validity. This research is done to find out which visualizations are used in general, to later specify the ones to use for IKEA. It must be easy to interpret the values of these KPIs and understand the current situation. The visualizations can help to make the step from the data to the understanding, but only if the correct ones are chosen.

The rise of information technologies has led to the improvement of data storage and acquisition techniques (Few 2006). This caused huge accumulated data volumes in many applications. A significant challenge with these datasets is to gain insights from them to discover patterns or to originate relationships (Ibrahim, Albarrak, and Li 2017). The problem is not, at least not primarily, in the technology but in the inferior visual design. In order to discover the insights, dashboards must display a dense array of information in a small amount of space in a manner that communicates clearly and immediately. The design should therefore use the power of visual perception and it should process large quantities of information rapidly. To achieve this, this visual design should be central to the development process (Few 2006).

When working with high-dimensional datasets, identifying visualizations and determining the correct design which shows interesting variations and trends in data is not trivial. The analyst must manually specify the number of visualizations, explore relationships among various attributes, and examine different subsets of data before discovering visualizations that are interesting or insightful (Ibrahim, Albarrak, and Li 2017). However, if those who implement dashboards understand visual perception and apply that understanding through design principles and practices aligned with the way people see and think, the dashboards can tap into the tremendous power of visual perception to communicate (Few 2006).

Purpose

Within the category of 'dashboards', there is still great a variety of products. Although it is known that they are widely used for monitoring and analysis of business processes (Kintz 2012), this still leaves much space for interpretation. A broad definition creates confusion and makes it quite impossible to say anything useful about dashboards. A well-known definition is one established by Few 2006, who says that a dashboard is a "*visual display of the most important information needed to achieve one or more objectives which fits entirely on a single computer screen so it can be monitored at a glance*". These aspects are the essence of the product; the focus on objectives, it fits on one screen, and it is used for monitoring at a glance. Additionally, there are two supporting attributes; dashboards have small, concise, clear, and intuitive display mechanisms, and they are customized (Few 2006).

It is important to distinguish different types of screen-based displays which combine more than a single chart since not all of them can directly be classified as a dashboard. Whereas dashboards are used to monitor what is going on, displays combine several charts on a screen for analysis. A definition for this type of display comes from Few 2007, "*a 'faceted analytical display' is a set of interactive charts (...) that simultaneously reside on a single screen, each of which presents a somewhat different view of a common dataset, and is used to analyze that information.* When looking for guidelines on designing the desired product, the creator needs to have the purpose of the display clear. Displays used for monitoring require functionalities that are quite different from those of displays used to analyze data (Few 2006).

Rapid perception

In line with the purpose of a dashboard to monitor what is going on, much of the presented information is only of importance when something unusual is happening. These exceptional values, which require attention, should be highlighted and easily recognizable.
The early stage of visual perception that rapidly occurs below the level of consciousness, preattentive processing, is tuned to detect a specific set of visual attributes. The step afterwards,

attentive processing, is much slower. The four pre-attentive processing properties of visualization are color, form, spatial position, and motion (Hossain 2018). These properties should thus be used to highlight the aspects of the data which require attention.

Color is often described by three attributes, hue, saturation, and brightness. It is one of the most common properties to call attention (Hossain 2018). An interesting thing about color is that we don't perceive it in an absolute way, but it dramatically influences our view (Few 2006). The grey squares in the picture on the right are the same color each time but appear different. Taking this context into account and using it for the better is therefore essential. This means that consistency is key, and adding more colors should be only done when valuable.

Form applies to various attributes such as shape, size, grouping, distance, and more (Hossain 2018). An example of this is how bar charts are used; the bars that are longer or shorter than others will immediately catch attention.

Spatial positioning concerns the ability to perceive two or more object's positions in space relative to oneself and relative to each other. This psychology includes categories such as proximity, closure, continuity, connectedness, and similarity (Hossain 2018). Because of this, things that are aligned with one another appear to belong to the same group (Few 2006), as the separated lines in the picture on the right are often perceived as one dashed line.

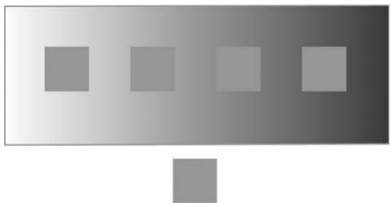


Figure 3: Color

Lastly, *motion*; something suddenly appearing within our field of vision, is a powerful method to get attention. When typing, for example, a cursor flickering helps to locate it. However, flicking objects on a screen will quickly become annoying to look at. It is most useful when immediate response is required in case of working with real-time data (Few 2006).

Figure 4: Spatial positioning

Media displays

However the analyst chooses to show the data will emphasize one feature over another. The previously described properties can be used in different types of visualizations to emphasize the proper aspect. In a single chart, not every possible question of comparison can be answered. Therefore, one should assess whether the chosen chart answers the question being asked (Wexler, Shaffer, and Cotgreave 2017). In different scenarios, different visualization types should be chosen to fulfil a particular task. Here, the five most used categories of media displays used to present actual data are discussed.

Graphs

Most dashboard display media are of the first category, graphs. This, because of the predominance of quantitative data on most dashboards. Almost all items in this category display quantitative data in the form of a 2D graph with X and Y axes (Few 2006).

Figure 5: Combo Chart

A bar chart uses length to represent a measure. Human beings are extremely good at seeing even minor differences in length from a common baseline. Especially when the bars are sorted, it can be a beneficial graph to spot the biggest/smallest items (Wexler, Shaffer, and Cotgreave 2017). Bar charts are standard for looking at a specific value across different categories (Microsoft 2021b), focusing on the individual values rather than the overall shape. A variation of this graph is the

stacked bar graph, which is helpful for specific purposes but
can easily be misused. Using this stacked bar graph to display a single series of part-to-whole data is recommended against. It can be a suitable choice when displaying multiple instances of a whole and its parts, emphasizing the whole. However, details regarding the changes in the distributions are still easily lost; using multiple bar charts is then a better option (Few 2006). Another good option for this situation is using a combo chart, where a column chart and a line chart are combined (Microsoft 2021b). The line can then represent the whole, and the bars the individual distributions.

Line charts are used to emphasize the overall shape of an entire series of values, usually over time (Microsoft 2021b). The time is represented by position on the horizontal x-axis, and the height and slopes of the lines let us see trends (Wexler, Shaffer, and Cotgreave 2017). The clearness of the overall shape of the data comes through, especially for line graphs, because their quantitative scale need not begin at zero (Few 2006).

Similar to line charts are the sparklines. These graphics are a highly condensed form of data display without a quantitative scale. The purpose is to provide a quick sense of historical context to enrich the meaning of the measure. Rectangles can give more information, such as the minimal or maximal acceptable number (Few 2006).

Figure 6: Sparkline

When a set of data is not fit to be summarized in a measure such as a sum or average, a box plot can be used to describe how the values are distributed across the entire range (Few 2006). In this box plot, the lowest value, the median, and the highest value are shown. This gives insight into the variety of the values, as well as the value of the majority.

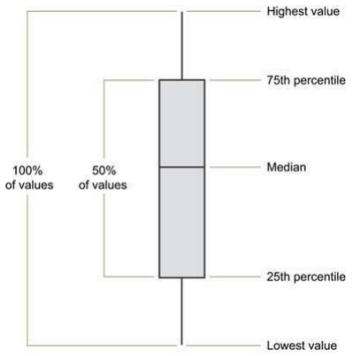


Figure 7: Boxplot

Treemaps is one type of graph that does not use a 2D graph with two axes. These maps are charts of colored rectangles, with size representing value. They can be hierarchical, with smaller rectangles nested within the main rectangles (Microsoft 2021b). Treemaps are usually interactive, providing the means to select a particular item in the hierarchy and then drill down into the next level of items that belong to the higher-level item selected (Few 2006). This makes it possible to gain further insights into the conditions occurring at the lower levels.

Then there are also types of graphs which are often left out of the recommendations. This, because there is a better option mentioned above or because they are not suitable for a dashboard. A well-known example is the pie chart. Although they were designed to represent part-of-a-whole communication, in many cases, a bar chart is more helpful for this purpose. However, when only a minimal number of slices is required, it might still be an option (Wexler, Shaffer, and Cotgreave 2017). Another graph in this category is the radar graph, a circular graph that encodes quantitative values using lines that radiate from the circle's center to meet the boundary formed by its circumference. This is simply a line graph with a categorical scale along the circular axis, making it harder to read. It can be tolerable when referring to, for example, hours of the day, which are also represented circularly on a clock (Few 2006).

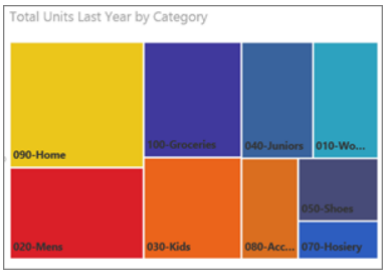


Figure 8: Treemap

Icons

Icons are simple images that communicate a clear and straightforward meaning. There are three main types of icons.

Alert icons are designed to draw attention to particular information on a dashboard. Although looking at what is going well is nice, the things going wrong are more likely to require attention. In order to let the icon work well, it should be simple and noticeable. Using too many variations of an alert icon is too complex, and also alert levels should be limited. A single alert icon catches the eye much more effectively than multiple icons with various meanings (Few 2006).

When choosing a scheme for the different alert levels, the traffic light scheme is a common one. However, approximately 8 percent of males and 0.5 percent of females have color vision deficiency. The most common form of color deficiency is red-green. People with this color vision deficiency have a harder time differentiating between red and green (American Optometric Association 2021). Therefore, making the alert icon these colors will make it hard for them to figure out what the icon is saying. There are color-blind-friendly palettes available, or using distinct intensities of the same hue is a suitable option in this situation (Wexler, Shaffer, and Cotgreave 2017).

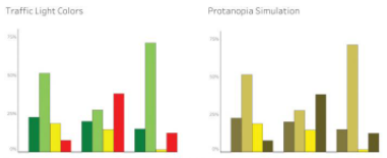


Figure 9: Color deficiency interpretation

The second type of icon used is the up/down icon. They convey the simple message that a measure has gone up or down compared to some point in the past, or is greater or lesser than something else (Few 2006). Proper use could be whether the sales have increased compared to last month, or whether a target was met.

Lastly, there are on/off icons. These serve as flags to identify some items as different from others (Few 2006). They can be used to indicate whether products are sold in a specific country or not. Again, sticking to a minimal range of icons is beneficial for the clearness of the dashboard.

Text

In every dashboard, some information will be encoded as text. Text is, for example, used for categorical labels to identify what is shown on graphs, and it is also appropriate to use when a single measure should be reported, without comparison (Wexler, Shaffer, and Cotgreave 2017).

Images

Placing images on dashboards is hardly ever valuable for typical business uses. A situation where they might add value is, for example, when including pictures of the employees for a trainer, but a name will quickly be sufficient as well (Few 2006).

Tables

Arranging sets of information in a particular manner can help to communicate clearly. All of the above displays can be placed into columns and rows to form tables. A table is already a familiar arrangement for text, but also structurally arranging graphs and icons is useful (Few 2006).

Multiple-view

Once all visualizations have been chosen and made, their structure on the dashboard should be considered. These multiple views of different types should be composited into a single cohesive representation (Chen et al. 2021).

Each visualization has at least two perspective attributes. The *view type* is the type of data display, often one of those described above, which is chosen. Menus, legends, and narrative texts are described as Panels. The second attribute is the *bounding box* which specifies the center position and size of the view in the display space. Then, additional attributes include the aimed users and the visualized data (Chen et al. 2021).

After having specified each of the visualizations, a proper arrangement should be designed. A suitable first step is to form groups aligned with business functions, with entities, or with uses of

the data. When organizing the data on a dashboard, learning precisely how the information will be used and how the pieces ought to be arranged to serve these uses best should be a start (Few 2006).

When delineating groups of visualizations, one could use grid lines, borders, and background fill colors, which are non-data pixels. In order to keep the dashboard most clear and organized, using the least visible non-data pixels is the best option. This is simply white space (Few 2006). When enough blank space surrounds a group of data to set it apart from other groups, the goal is achieved without adding any distracting visual content to the dashboard. In case of a shortage of spare space, subtle borders are an excellent second option.

Lastly, the position and size, the bounding boxes, of the visualizations should be set in a way to support meaningful comparisons and discourage meaningless comparisons (Few 2006). Placing the same type of visualization above each other makes it easy to compare them. If this is not desired, the composition should be done differently. Also concerning colors, consistency is vital. The same colors will quickly be interpreted as the same data. If this is not the case, the colors should be chosen and assigned differently (Wexler, Shaffer, and Cotgreave 2017).

Conclusion
In this section, the knowledge question regarding the visualizations in PowerBI has been answered. First, the current general situation of the translation of data into insight has been evaluated. The aim of a dashboard should only concern monitoring what is currently going on. This display should be visible on one computer screen. The four pre-attentive processing properties of visualization were discussed, which should be included in the visualizations to highlight the attention-requiring subjects. Each visualization uses these properties differently, which is why visualizations influence the clearness and functionality of the dashboard. Different displays and their features have been listed. Lastly, the chosen displays should be appropriately arranged. The attributes of the visualizations should be considered, after which the positioning can be determined.

It is now established that a dashboard is a view that fits on a single computer screen, whereas multiple dashboards are considered a 'report'. However, this report of multiple dashboards is among the employees commonly known as one dashboard with multiple pages. Therefore, in this thesis report, the name 'dashboard' will refer to the collection of the pages with the visualizations.

5 Requirements

This section describes the activity of *Define the objectives for a solution.* In order to make a dashboard that adds value to the company, the desired KPIs and visualizations should be placed on the dashboard. During multiple focus group meetings with the staff in the iterative process of producing an artifact according to the design thinking methodology, the requirements for the dashboards have been established. A detailed description of the data collection is described. Since a concrete data analysis can only be performed when the desired data has been established, in this section, the ideal and advised KPIs and visualizations are listed. Whether it is actually possible to realize these depends on the data structure described in section 6 Context analysis: Structure of required data. The actual included KPIs are then mentioned in section 7 Dashboard, describing the dashboard itself.

5.1 Data collection of requirements

Focus group
To find out which aspects should be included on the dashboard to make it useful, data had to be collected regarding the wishes of the different departments. Since we are looking at the specific wishes of the employees of IKEA, primary data collection will be used. This means that the data is collected by the researcher from first-hand sources. The research has a qualitative nature, which is why interviews and focus groups are the two most common methods for this type of research. For this data collection, the approach with focus groups has been chosen (Gill et al. 2008.

A focus group is a group discussion on a particular topic organised for research purposes. This discussion is guided and monitored by a researcher. They are useful for generating information on collective views, the meaning behind those views, and generation a rich understanding of a participants' experiences and beliefs (Gill et al. 2008). The method helps to allow participants to generate their own questions, frames and concepts, and to pursue their own priorities (Kitzinger 2005). This makes it suitable for this research because the participants have time to find out what they wish to see on the dashboard. This is a valuable advantage, because the participants have not worked with Repeated Calls yet, and therefore do not know exactly what they wish to see. On the other side, the researcher gets to understand the meaning behind these wishes. If during this conversation it becomes clear that there is a better way to meet the wishes than the way the participant requested, the dashboard will be of higher quality.

Discussions
To establish the requirements for the dashboard, the first meetings were with the manager of the Customer Knowledge and Insights (CK&I) team, who is also the company supervisor for this research, and the business analysts. These meetings had the purpose to find out to which parts of the organization the dashboard would be useful, as well as what the possibilities of this dashboard would be. Also, some of the general specifics, such as the exact used definition of a Repeated Call, were determined.

The second type of focus group discussions was with the development specialists. In the first meeting the reason and the approach of tackling the problem of RCs were established and with that the needed variables and visualizations. After the first design had been made, more meetings were planned to keep improving the product. These started with an explanation of the alterations and the reasoning behind the choices made. Again, the focus group was a very suitable method, because the participants had time to get to know the dashboard and the intention of the researcher, and give feedback.

The first list of requirements for the operations part had been established after the conversations with the CK&I manager. A brainstorming session with the business analysts provided more insight into the intentions behind the existing dashboards for operations. This was then used as an inspiration for the RC dashboard. The first prototype was then presented to the Management Team of the Customer Support Centre, after which a discussion was held to determine whether wishes were met and what possible further implementations could be.

5.2 General specifics

First, the definition of a RC for IKEA had to be established. A repeated call in general is a call by the same person within a short time frame. The time frames determined by IKEA are a call within 3 hours, a day, a week and a month. The Repeated Calls will fall in one of the categories, meaning that if a customer calls again within 2 hours, the corresponding category is '3h' and it will not be counted in the 'day' category as well. There are no current statistics available, but they are planning on drawing up individual target values.

Since the RCs are very time-sensitive, the KPIs are as well. Although it is not preferred, in this dashboard, the value of KPIs of previous weeks can change depending on the upcoming weeks. For example, in week 4, one can determine how many calls of week 3 caused a RC of the categories '3h', 'day' and 'week'. However, if a customer who was helped in week 3 calls again in week 5, this call will be placed in the category 'month'. The number of calls which caused a RC of week 3, will then increase by one. Therefore, although calendar-wise week 3 will be finished in week 4, the numbers are not set in stone yet. They are only certain after a month has passed, since the calls after this period are not considered 'repeated' anymore.

The last specific which has been established is the focus on the employee who answered the original call. For example, a customer first speaks with agent A, then calls again and agent B answers this phone call. Agent B was in no way responsible for this RC. The agent who caused the RC, and who thus could have avoided this increased number of contacts, is agent A.

The dashboard will have two focuses, providing information for training purposes, as well as information regarding the performance of operations. The requirements of these two aspects will therefore also be considered separately.

5.3 Development

The development department of IKEA will be focusing on the RCs with training purposes in mind. They want to find out which teams and which agents are 'outliers', causing abnormally many RCs. Improving their skills will hopefully result in a decrease in RCs. These skills include the conversational skills of the agent, as well as their knowledge regarding the procedures, products and services.

Filters

In order to find out the outliers, the performances of the individuals subjects should be visible. An important filter for the visualizations is therefore the department (Customer Resolution or Sales), the team the individual agent belongs to, and the name of each agent individually.

Since IKEA also outsources a part of their customer services to Teleperformance and WebHelp, the dashboard should also include a filter to separate the results of these departments of the averages.

Lastly, a date-related filter should be added to the dashboard. Since the goal of the development team is to improve the skills of the agents to reduce the number of RCs, evaluating this number over time can be used as an indicator of whether the improvements are working. Looking at individual days will be too detailed, since this can depend on to many influencing factors, but filtering per week should show a reduction in the number of RCs if the right weakness has been found and refined.

Output

Not only the number of RCs caused by an agent is of importance, but the subject of these calls are as well. If a certain agent causes an average number of RCs, but they all concern the topic of returning the purchased items, this is an outlier that should be handled as well. Maybe the agent does not have the required knowledge, maybe he is insecure regarding this topic, or he thinks he knows the required information but this is not correct. In order to find out what exactly is going on, and to find out which skills should be improved, the next step is to listen to the recorded calls.

All calls done by the agents are recorded. These calls can then be identified again within the program Speechminer based on the date of the call and the name of the agent. Instead of pointing out an ID, the agent's full name and exact timestamp of a call that caused a RC should therefore be provided by the dashboard. Then, after listening to multiple calls, recurring aspects can be identified. For example, if someone keeps forgetting to completely round up the call by asking whether the customer has any other questions, this could leave the customer with incomplete information, causing them to call again. This is quite sensitive information, which is why it should be treated as such. In section 7.1 Structure, this approach is described.

Listening to the recorded calls using Speechminer was already done before this research regarding the RCs. Using an established form, specialists check the quality of the calls. The questions on this form can be found in Appendix D Quality monitoring form. Since finding out whether some of these aspects match with a higher number of RCs can already give a clear indication of desired improvements, the data of this quality monitoring will also be included in the dashboard. The performances of an agent regarding the RCs as well as regarding the quality of their calls will be made visible. If certain aspects of this quality monitoring appear to be a cause of RCs, targeted research into these aspects can be done.

Similar to the quality monitoring values, the Average Handling Time might also be an indicator of a cause of a high number of RCs by one agent. A very short AHT might mean that the agent was more aiming for a quick service level, rather than properly handling the question.

KPIs

The development department is thus mainly interested in the individual performances of the agents. This performance is expressed in Key Performance Indicators.

The goal is to diminish the number of repeated calls. However, when looking at an individual level, this number does not say enough anymore. If an agent handled a hundred calls in a week, of which five caused another call, this is a reasonable number. If another agent only handled ten, of which five caused another call, this is definitely a reason for further investigation. The number of RCs should, therefore (also) be expressed as a percentage. The percentage of RCs will be calculated by dividing the number of caused RCs by the number of handled calls.

And yet, knowing only the percentage is not enough. If an agent only worked for a short time in the selected period of time, the percentage might be unreasonably high. The employees with the function of a specialist, for example, only handle calls on the topic of their expertise. It might be the case that they only answered two calls within the selected time frame. A RC percentage of 50% is then very high, but will not influence too much. Linking a high percentage to the actual number is important, and should therefore be easy to do on the dashboard.

Once an outlier has been found, a certain employee caused many RCs in the past month, these KPIs should be made clear regarding the performance of this single agent. The cause for a RC is likely to be different for the different time-related categories. If the customer calls again within a week, it is more likely that this depends on the topic and the case itself. Whereas if the customer decides to call again within 3 hours, it is likely that the way the agent handled the call influenced this decision. The development department should therefore also have insight into the distribution of the calls over the different categories. A high number of calls within 3 hours is probable to be caused by the skills of the agent.

The mentioned quality monitoring which is already done uses the established form. For each of these 15 aspects, the evaluator answers either *yes* or *no*. The *yes* is then considered as 100%, and the *no* as 0%. For any team or individual agent, the average of how often they include a certain aspect in their calls can be calculated, expressed in a percentage.

Since an AHT can only be short in comparison to other calls on the same topic, the KPI regarding this aspect is the AHT of RC minus the AHT of the original call. A large value of this KPI means that the original call was indeed way shorter than the call which followed, showing that trying to be quickly is not worth it when a long call is the result.

5.4 Operations

The second focus is the operations department. They will be looking into the RCs with the purpose of improving the processes in mind. As established in 1.2.2 Problem cluster and core problem, one of the causes of RCs is a sub-optimal process.

Filters

Instead of focusing on who handled the call which is the cause of a RC, in the operations dashboard, the focus will be on the topic of these calls. If a certain topic frequently causes RCs, this topic is also the cause of a lot of unnecessary traffic. It is quite likely that this then does not depend on the skills of the agents, but on the established procedure for this topic. Therefore, an important filter for these pages is the Reason For Contact (RFC), which is assigned by the agent.

Also for the operations department, a date-related filter adds value. Once an unsatisfactory process has been identified and altered, evaluating the results over time will show whether the alterations have improved the situation. Since diving into the details of the process, finding problems and coming up with solutions is likely to be an extensive project, the filter should not be too detailed. Displaying the results per month will be sufficient.

Output

The focus for the visualizations is on the topic of the calls, to find out which subject causes many RCs. Using KPIs, these topics can be identified. Then, similar to looking into the skills of individual agents, Speechminer can be used to find out which procedures are performed regarding this topic. Together with the protocol for this topic, possible problems and improvements can be identified.

In order to find out which of the topics should be prioritized, the AHT can be used again. If two topics cause around the same quantity of RCs, but the calls of one of the two are twice the length, it makes sense to first improve the procedure of this topic. Also, similar to the development part, a large difference between the second and original call might indicate that the standard procedure is not sufficient. It is likely that the original call will have followed the procedure, but apparently, this was not enough to solve the issue, since the customer called again. This second call will have required a 'new' procedure, which involves creativity and a search for a better solution, causing a longer AHT.

A second, additional way to determine priority is using the Non Value Adding Contacts. IKEA uses a system to determine whether contacts have added value to either the customer and/or IKEA. Each call will be placed in one of the quadrants, either *Automate, Solve, Simplify* or *Nurture*. This quadrant can be found in Appendix E NVAC quadrant. Of these four, *Automate* and *Solve* are classified as NVAC. This classification depends on the RFC assigned by the agent. If a certain topic causes both a lot of RCs which are also NVAC, and also have a long AHT, this should be given priority.

Once has been decided on which reason and procedure will be focused, it should be possible to get more detailed information regarding this reason. Section 6 Context analysis: Structure of required data explains how the employees use the RFC tool to assign a reason to the call. Next to the main reason, more specific topics can be selected. These topics give more insight into which aspect of a certain procedure is not sufficient. Likewise, the agent can enter a 'customer feedback', adding to the specificity of the problem in a procedure.

KPIs

Also the performance of the operations can be expressed in KPIs. Similar to the performances of the individual agents, both the count as well as the percentage of RCs is of importance. Showing how the RCs are divided over the different topics (count) gives insight into which topic often causes a customer to call again. Showing which percentage of the calls of a certain topic are RCs, gives insight into the quality of the procedure. The percentage is valuable here, because the quality depends on the share of the RCs, regardless of the total number of calls on a topic.

Still, the count of RCs per reason is also important. Although it might be a reasonable per-

centage of the whole, apparently this topic is often a reason to call in the first place. Improving this situation by even a couple percents, will have a large impact because of the high volumes.

Regarding the AHT, this will be made comprehensible by showing the averages of the RCs for each reason. This will make clear which subject leads to long RCs. Also, likewise to the development part, the difference between the AHT of the second and the original call will be shown.

The NVAC is usually visualized as a percentage, thus now as a '*NVAC Share of RCs*'. Over time, this percentage should decrease, since customers should only call again with value adding questions. Also, the NVAC proportions of the different reasons should be visualized as percentages.

5.5 Conclusion

In this section, the requirements for the desired dashboards have been established. The dashboard will be used with two separate focuses in mind, the development and operations departments. For each department, the desired filters, output and KPIs have been discussed. Whereas the development department will focus on the performances of the teams and the individual agents, the operations department will wish insight into the performances of different processes. Both these performances use both the count and the percentage of RCs to determine this performance, as well as some additional KPIs, such as the AHT, the quality monitoring results and the NVAC.

6 Context analysis: Structure of required data

In order to be able to visualize the desired KPIs, the required data first has to be collected and processed. This is part of the *Demonstration* activity. For this purpose, two datasets are necessary; the IFR and the RFC dataset.

IKEA uses Google Big Query to store the data. Here, pipelines are created to automatically write data to the correct files. Using authorized credentials, a dashboard in PowerBI can load datasets from this online platform into the model. Updating the data and therefore the visualizations can then be done easily.

6.1 Interaction Flow Report

The direct telephone data is written to the Interaction Flow Report (IFR). This includes the start time of the call, the end time, the duration, the phone number of the customer, the phone number which was called, an ID, the source queue, the agent's name, and the technical result (completed, transferred etc.). This database is used as the basis for the calculations of the RCs. Based on the phone number of the customer and the difference in start time, a call is placed in one of the categories of a RC, if any.

6.2 RFC

The Reason For Contact tool is used by the employees to enter the topic of the call. This way, the reasons why the customers reach out to the Customer Support Centre can be determined. This tool can be accessed via an online website. It is pictured in Appendix F RFC Tool.

Options

The first option to select is the way of contact. On the top right, one of the four blue icons can be selected. These represent the way of communication; phone, mail, chat or social. As mentioned in section 2.2 Scope, this research only focuses on the repeated calls. The RFC entries will therefore be filtered on phone as the contact method.

When an agent starts filling in the tool, the first step is to assign the reason. This is one of the blue boxes on the left. Once one of these reasons is selected, certain further options are highlighted. This can also be seen in the pictures in Appendix F RFC Tool. These highlighted options are often matched with the selected main reason. In this example, once the main reason *modify* is selected, it is more likely that it concerns modifying an *order* than modifying a *stock check*.

The different categories to select are the main reason, an additional topic, the touchpoint, and the service. Different entries require different specifics until an entry can be sent.

Quality

Since the RFC is filled in manually by the agent, the quality is quickly compromised. This leads to a distorted picture of reality. However, since large volumes are evaluated, small errors will not have too much effect.

There are multiple types of errors that could influence the quality. The first possibility is that an agent simply forgot to enter a RFC for the call. On the other hand, he might also do it twice by accident, for example at the start as well as at the end of the call.

If the agent does not open the webpage via the correct route, the ID of the RFC will not be matched to the ID of the call. There will then be a call without a RFC. On the other hand, if the employee forgot to fill in the previous RFC and enters two to the current call, the topic of that specific call is hard to determine. In this research, it was decided to handle this problem by always selecting the first RFC matched to a call.

6.3 Connection

To be able to determine not only the count of RCs, but also determine what the topic of these calls was, the IFR has to be connected to the RFC data. For an individual call, this means that the

specifics of this call, such as the duration and the agent who answered, are matched to the entered RFC. Also, additional datasets such as employee credentials and dates are connected. This results in a datamodel.

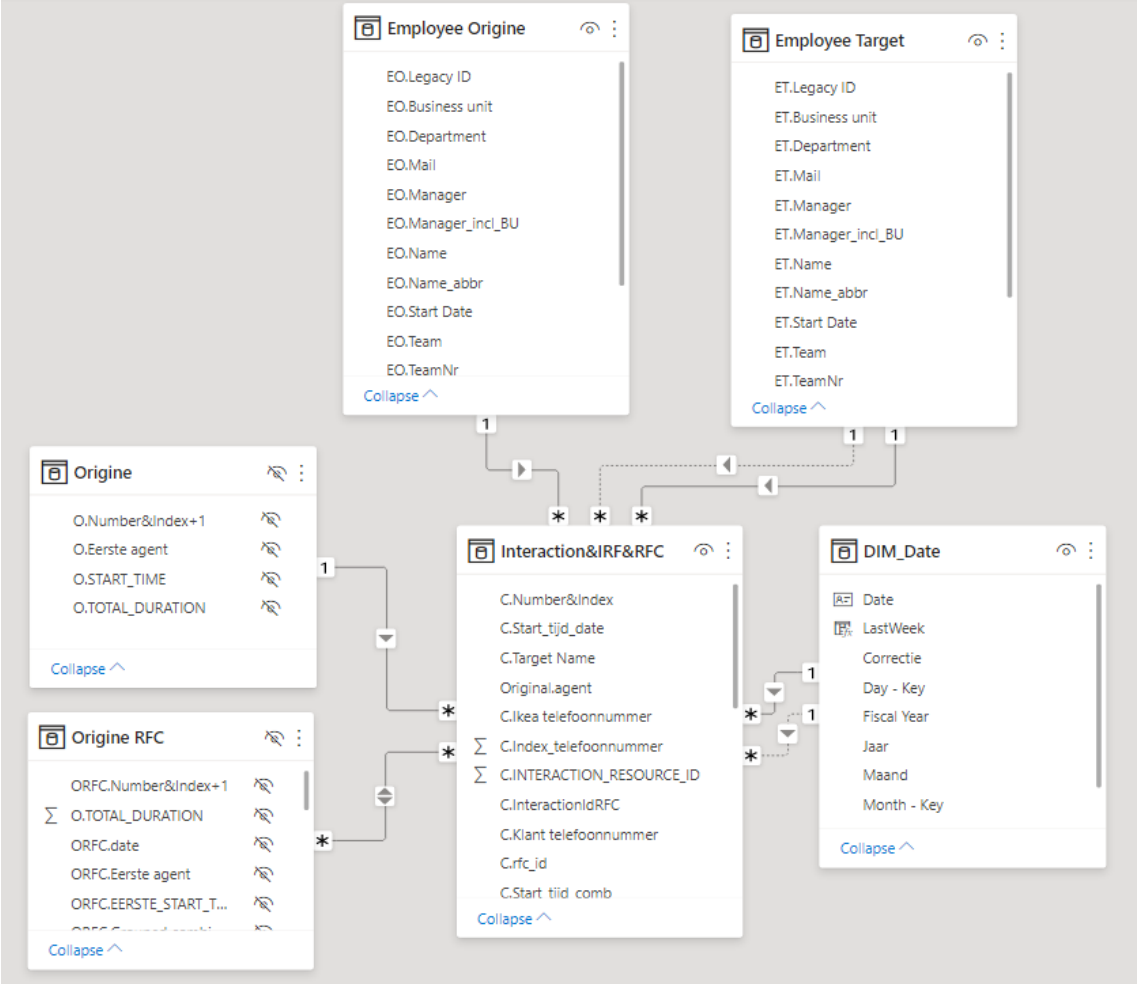


Figure 10: Data model

Unfortunately, there is no direct shared ID between the IFR and the RFC. To be able to connect the datasets, another dataset is used, called the Interaction Resource Fact (IRF). IDs from both the IFR and the RFC are included in this additional set. However, unfortunately, this overlap is not 100%. From the IFR to the additional data set about 67% is covered, then to the RFC leaves an overlap of 46%. These percentages have been calculated by means of an initial dataset, consisting out of one week of data. The connections within this data have been visualized in Appendix G Connections in initial dataset. A significant reason for this lack of quality is that when an agent enters a RFC via another route than the one using the assigned webpage, the ID of this RFC is not matched to that of the call. This quality can be improved when it is communicated to the employees that using the correct route and webpage has high consequence.

Important to note is that the number of RCs is calculated merely on the data in the IFR. The count and percentage of these is thus complete. However, when making the step to the RFC, there is a loss of completeness. It is likely that this 46% represents the entire dataset, but this cannot be known for sure.

The data model behind the dashboard is visualized as a star schema. This mature modelling approach requires modellers to classify their model tables as either dimension or fact. Dimension tables describe business entities, where fact tables store observations or events. The fact table(s) are then placed at the center of the 'star', with the dimension tables surrounding them. They

support the data in the fact tables, and give background information (Microsoft 2019). In this model, the InteractionIRFRFC is the fact table that is connected to the dimension tables.

The tables on the left are fact tables with information regarding the original call which caused a RC. The reason that the connection with 'Origine RFC' is a many-to-many relationship is because not all RFCs are properly logged, as mentioned in this section. However, these two tables have been merged with the InteractionIRFRFC table to simplify the use of the data in the dashboard itself. Here, the first logged RFC has been matched to the call.

The two employee tables on top include the personal credentials of the employees themselves. This includes among others their full name, their department, their email, and their first date of employment. Two tables are used to separate the agent who handled the original call (Employee Origine) and the agent who handled the RC (Employee Target). These are many-to-one relationships, one agent handles multiple calls. 'Employee Target' is connected to the fact table in two ways. The active relationship is matched to the 'C.Target Name' (the receiver of the call), the unactive relationship is matched to the 'Original.agent'. This way, the number of RCs is correctly calculated, even when filtering on a specific target employee. This inactive relationship is namely made active when calculating the KPI of the count of RCs.

Lastly, the dimension of the date is connected to the fact table. This dimension table contains more details regarding the date, such as the month abbreviation and the week number. This relationship is one-to-many, since multiple calls were handled on one day. Also for this connection, there is an inactive relationship with the date of the original call. Via that connection, days on which many RCs were caused can be identified.

6.4 Conclusion

In conclusion, two datasets from the online platform Google Big Query will be used. The IFR will give information regarding the specifics of the call itself, whereas the RFC dataset will include the entered RFC. Because of a lack of a shared ID, the overlap is unfortunately not 100%, but for now, it is assumed that this part represents the full data.

7 Dashboard

This section describes the prototype created in the *Demonstration* part of the design thinking process. Currently, there was only a limited dataset of one week available to build the dashboard upon. However, the same datasources will be used once the automization has been completed. The dashboard will therefore have the same layout and visualizations. In this section, these different visualizations and choices are described, as well as encountered limitations.

A dashboard in PowerBI is chosen as the correct way of providing insight in the topic of the Repeated Calls. The Customer Support Centre of IKEA already has quite some dashboards up and running, regarding for example the Reason For Contact or the performances of the agents regarding the Average Handling Time. These dashboards are built using an existing template, which has for example specified which colors to use. In order to keep the bar for understanding and using the dashboard low, this template will also be used for the RCs dashboard.

7.1 Structure

PowerBI dashboards can be accessed from either the desktop application or the web app. In the web app, the dashboards can easily be shared with other users. Each individual can be assigned a certain role, which can have access to certain datasets. This is called row level security (Microsoft 2021a). Placing the dashboard in the online application gives everyone who has access to the app also access to the dashboard. Since the information in the dashboard in sensitive, this is not the right approach.

The number of RCs caused by a certain agent can be viewed as how well one is doing their job. Although this is of course valuable for the team leaders and development specialists, distributing this information to everyone would be wrong. Therefore, the right people should have access to the right datasets. In this case, the established end users can have access to all the datasets included in this dashboard. Two roles are therefore created, one who has access to all data and pages, and one who does not. Certain established distribution lists will be used to assign the correct access role to the correct people. Everyone not on this list, will not have access.

7.2 KPIs

In section 5 Requirements, all desired KPIs and information were established. Many of these have indeed found their way onto the dashboard. Appendix H Calculation of KPIs in PowerBI includes the calculation of these.

Unfortunately, two aspects, one for the development part and one for the operations part, of the wishes could not be included.

The way that the quality of the calls is currently checked is by listening to the recorded calls and ranking different aspects on the quality monitoring form (Appendix D Quality monitoring form). As was established, it would be useful to see whether the calls which ended up causing RCs have some aspects in common. This would reduce the work afterwards since maybe part of these calls was already evaluated. Currently the quality monitoring process is matched to the agents as well as the calls in speechminer. However, the ID on which they are matched to speechminer, cannot be used for matching the evaluation to a call in the Interaction Flow Report which is used for the dashboard. This means that if the quality monitoring data is included in the RCs dashboard, this would only be on agent-level. However, there is already an entire separate dashboard dedicated to this. Adding a part of the information which does not really add too much value is therefore not very useful.

The second aspect which is not included yet is the customer feedback. Next to the RFC, the topic, the store, and the service provider, an agent can also add customer feedback. This gives more insight into the exact message of the customer. Because this customer feedback is not yet added in the RFC dataset accessible for the dashboard, it is not available on the pages. If the headquarters add it to the data source, it will be possible to include. On short term, this is not yet possible.

7.3 Pages

In this section, the pages of the dashboard are described and shown. For each page, a general introduction is given regarding the purpose of the page. The visualizations are discussed individually, as well as the included filters.

General

This page consists out of supporting information. To ensure that everyone understands the dashboard, extra support is given here, but none of the information is required to understand the other pages. After the first test and evaluation session, it was clear that hardly any of the users really looked at this page. Rather, they went to the pages they considered most interesting and tried to figure it out on the way. Therefore, the 'general' page, cannot include essential information.

Visualizations

Three text blocks are placed on this page. If someone does not have a clear understanding of the concept of a RC, this is defined here. Also the legend throughout the dashboard is included. Since color recognition is very important for the users, the meanings of the colors are consistent over all pages. Lastly, a text visualization with the structure and main end-users is included.

Two line charts show the two main KPIs over time. In one glance, the user can see whether the progress of the RCs is improving or not. To get more detailed information, they can visit the other pages. By skipping this page and thus these graphs, the user does not miss any information since it is included in the other pages as well.

Table 2: General page

Users	**Filters**
All users	-

Table 3: General page

Visualizations KPIs	**Type**	**Purpose**
#RC	Line chart	Count of RCs over time
%RC	Line chart	Percentage of RCs over time

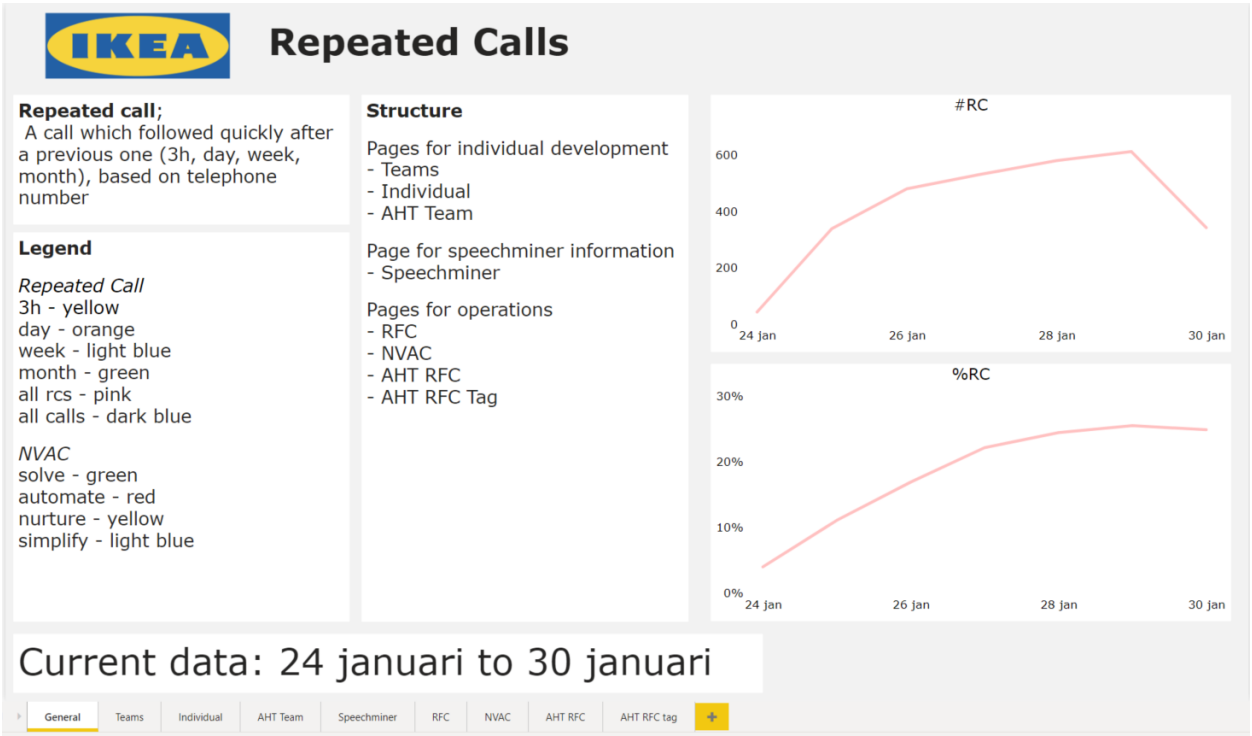


Figure 11: General page

Teams

The first page showing data is the 'Teams' page. This page is made for the development purpose. Since it is quite a broad page, also the Management Team will have use of this. It can be used to identify outliers, either teams or individuals who cause many RCs. These teams / agents are then the subject of further research into the reason for their high number of Repeated Calls.

Filters

To be able to see the performances of the agents over time, the first filter is based on the months, weeks or days. Since the development of the skills of the agents will most likely take a while, a large scale has been chosen.

The second filter is on the team / employee level. If the results of a specific (team of) agent(s) is desired, this can be made visible this way. However, since this page is meant to highlight these outliers, filtering on one outlier will not give the most interesting results.

Lastly, there are two filters to specify in which department you wish to identify the interesting parties. Generalists answer many calls, whereas specialists only support questions in their expertise. Because of this, they handle fewer calls, which influences their statistics. Using the specialist/generalist button, this separation can be made. As mentioned, Webhelp supports the Customer Support Centre of IKEA by answering calls. If the managers wish to see only the results of their own teams, they can select these teams easily via these buttons.

Visualizations

The left '%RC types' stacked bar chart is used to determine which team has the highest percentage of RCs. This type is used because there is an emphasis on the 'whole', while still being able to show the multiple instances of this. A longer chart represents a high percentage, and also a long bar of one color is easily recognizable.

The top right '%RC individual' alternative clustered bar chart is used to determine which individual agent has a high percentage of RCs. When selecting a team on the left, this visualization will filter on the agents in this team, making it easy to recognize which agents are causing the high percentage of the team. In this visualization, the performance of this week as well as the previous week are made visible. This way, the results of possible additional feedback or training can be monitored.

The two text visualizations '#RC' and '%RC' enable the user to quickly get an idea of the current situation regarding the RCs. The progress over time is represented in other visualizations, clearly communicating the current specific value is the aim of these ones. Also these visualizations adjust when other specifics such as a team are selected.

The 'proportions types RC' visualization on the right is a clustered bar chart that shows the distribution of the RCs over the categories of 3hour, a day, a week or a month. This is especially valuable when a single agent has been selected.

Lastly, the line chart showing the percentages of each of the categories of the RCs overtime on the bottom right gives insight into the progress. Improvements and alterations can be monitored here. Selecting a team or a specific agent will show their process specifically.

Table 4: Teams page

Users	Filters
Development	Month, Week, Day
Team leaders	Team / Employee
MT	Employee title
	Webhelp / CSC

Table 5: Teams page

Visualizations KPIs	Type	Purpose
%RC types	Stacked bar chart	Determine which team has the highest percentage of RCs
%RC individual	Alternative clustered bar chart	Determine which agent has the highest percentage of RCs, also compared to last week
#RC	Text	Specific value of count of RCs
%RC	Text	Specific value of percentage of RCs
Proportions types RC	Clustered bar chart	Distribution of the RCs over the categories (especially for individuals)
%RC	Line chart	Distribution of the RCs categories over time

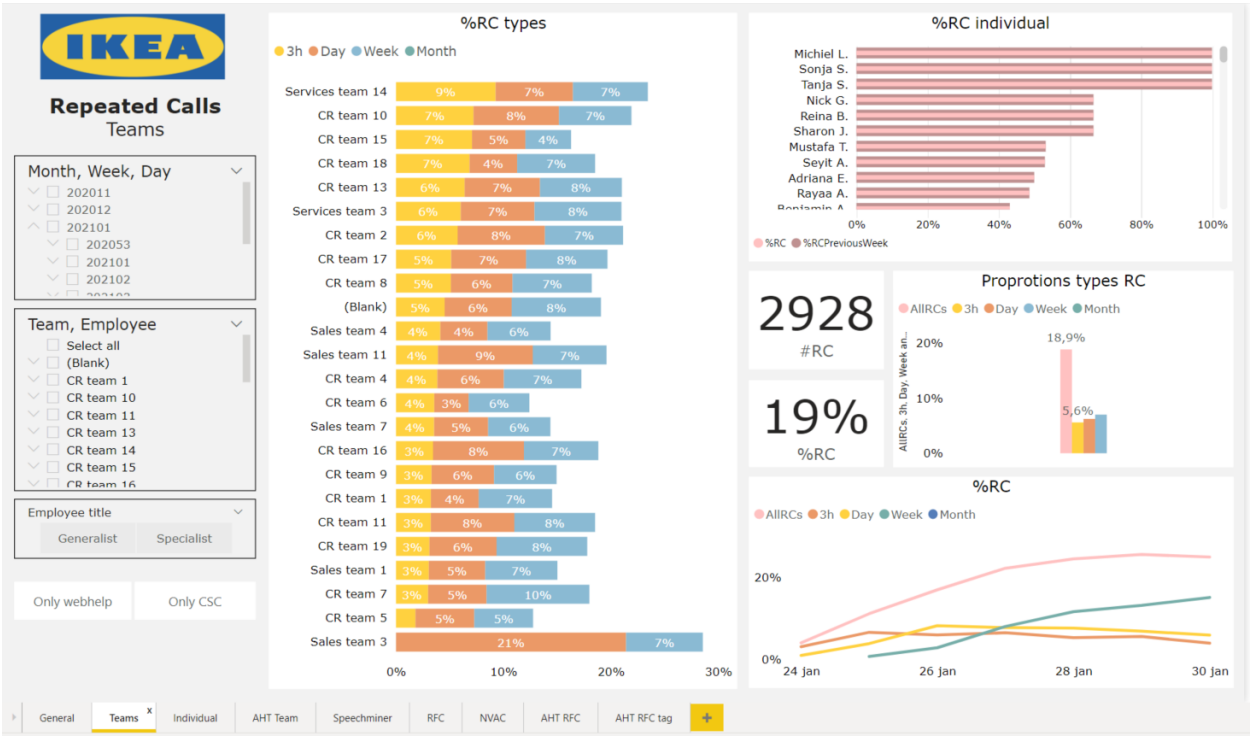


Figure 12: Teams page

Individual

The Individual page is meant to give detailed insight into the performance of a specific team or agent. After additional feedback or training has been provided, this page can be used to monitor whether it has had an effect. As mentioned before in section 5 Requirements, both the percentage and the count are of importance. Both these KPIs are therefore visualized.

Filters

Again, there is great emphasis on time and the progress of the performance during a period. The filter of month, week and day is therefore included again. Being able to select a team or an agent is essential for this page, since it can be used to find specific information regarding them. The team / employee filter can be used for this. If it becomes clear that an agent causes many Repeated Calls within 3 hours, it is interesting to find out which topic caused these. It is therefore possible to filter on a specific category of RCs. Lastly, filtering the other way around is also an option; selecting a certain Reason For Contact and then monitoring the distribution of the RCs over the different reasons.

Visualizations

This page includes three line charts, and a block with various text visualizations. The three line charts show the performance of a team / agent over time. As explained, it is important to be able to see whether the situation improves after taking certain actions. This performance is expressed in percentages as well as a count. It was established that both outliers in the categories of the RCs are worth extra attention, as well as outliers in the RFC. Therefore, the count of both of these are shown. Regarding the RFC, only the count is visible, instead of also the percentage. This, because the quality of the data is not good enough to get trustworthy percentages on this small level. Determining the frequency of the topics of the Repeated Calls is enough.

Top right on the page is a block of text visualizations. These are used to give the current value of some of the KPIs, in this case mainly the distribution of the RCs over the four categories. A manager will be able to quickly find the current values. If it is clear that for example the number of RCs in a day is quite high, the two left visualizations can be used to see whether this is a long term trend or just today. And if it is only today, the bottom right visualization can be used to find out on which topic were so many RCs within a day.

Table 6: Individual page

Users	**Filters**
Development	Month, Week, Day
Team leaders	Team / Employee
	Repeated contact type
	RFC.Reason

Table 7: Individual page

Visualizations KPIs	**Type**	**Purpose**
%RC (by type)	Line chart	Performance over time
#RC (by type)	Line chart	Performance over time
#RC (by RFC)	Line chart	Performance over time
%RC, #RC, #StartTimes, #RC3h, #RCday, #RCweek, #RCmonth	Text	Specific value of KPIs

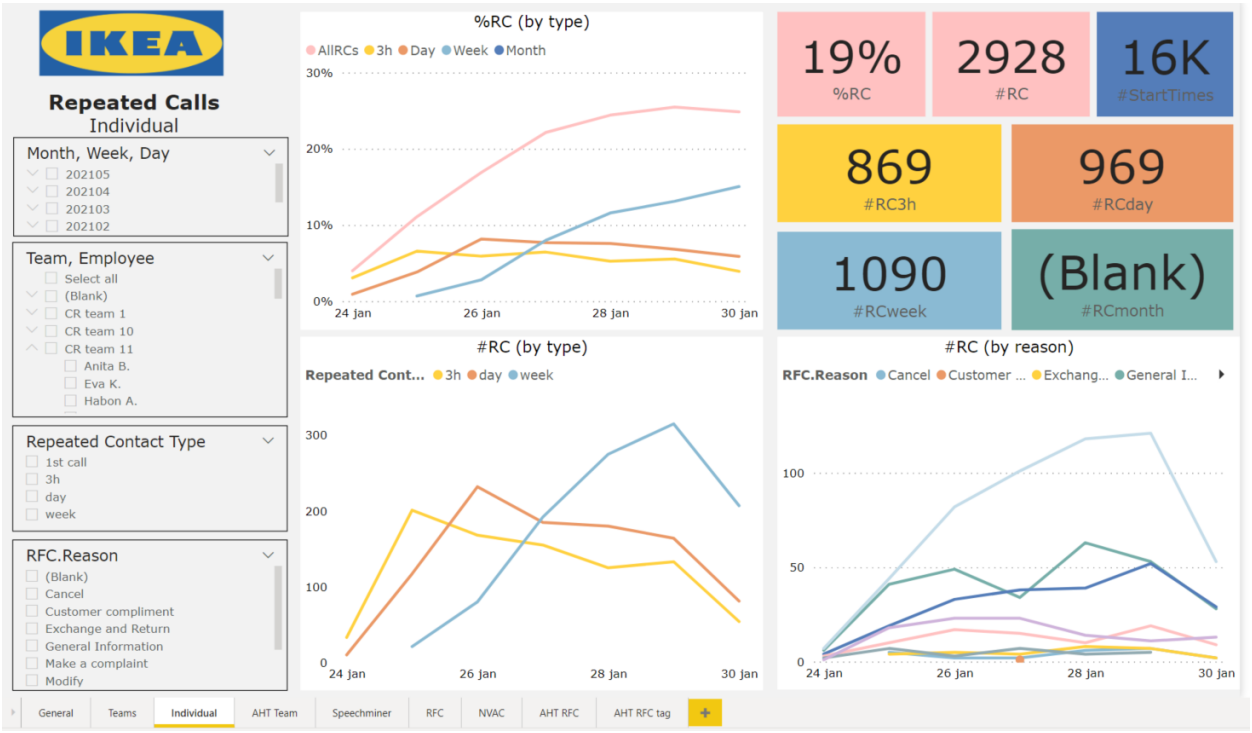


Figure 13: Individual page

AHT Team

The page of AHT Team provides insight into the influence of the Average Handling Time on the RCs. Do the RCs of a certain team take longer than others, and why? The calls which most likely could have been avoided (RCs) and also take long to handle, have a high priority to get more insight in. It is also possible that the customers call again because the original call has not been handled properly, but was rushed. It is better to answer the question properly the first time, than try to answer it quickly but not well.

Filters

Once again, the month, week, day filter is included to be able to monitor progress. Although in general all four categories of the RCs are included in the visualizations of this page, it is possible to filter. As established, it is more likely that RCs within 3 hours or a day are a result of limited skills of the agents. Filtering on these categories will make it easier to compare the few bars left.

Another filter is the department filter. Customer Resolution agents answer all general questions, while Sales agents focus more on selling the products. Different types and topics of calls lead to different AHTs. If a certain department should be analyzed, this can be done with this filter.

Lastly, the team / employee filter is included. Instead of showing all teams, only one can be highlighted this way. This is especially useful when levelling down to the agent level, when only the agents of one team should be visualized. This can be done easily using the Teams and Agents bookmarks, which level down the visualizations. Due to the complicated data structure, two separate team / employee filters are required for the two visualizations. This, because one RC is connected to two agents, the one who answered it and the one who 'caused' it (answered the previous call).

Visualizations

There are two main visualizations on this page. The clustered bar chart on top shows the average AHT of the RCs. The purpose is to find which calls take the longest, separated by category and either team or agent. Using the length of these bars is a good way to do so. These then get high priority to do research on, to avoid them in the future. Because of the high number of teams and agents, the visualization is quite large. It is placed horizontally, with vertical bars. Since the names of the teams are short, it is not necessary to use a vertical layout, and placing the filter next to

the visualization makes it easy to intuitively understand the connection between the two.

Similar to the top visualization is the one on the bottom, also a clustered bar chart showing values separated by RC category and teams. However, this one shows the difference in the AHT between the RC and the original call. A large difference indicates that the original call was way shorter than the following call. Instead of showing both AHTs of the RC and the original call, it is much better to directly show the difference. As was found in the literature for section 4 Visualizations in PowerBI: A literature study, humans have trouble comparing values when they cannot see both of them simultaneously next to each other.

The three text visualizations on the side show the average of different KPIs over all calls. This makes it easier to compare whether the results of a team were truly remarkable. Using the bar charts, the outliers can be visually be found. Whether this is a significant difference can be determined using these averages.

Table 8: AHT Team page

Users	**Filters**
Development	Month, Week, Day
Team leaders	Team / Employee
	Repeated contact type
	Department

Table 9: AHT Team page

Visualizations KPIs	**Type**	**Purpose**
Difference AHT (RC - Original call)	Clustered bar chart	Compare AHT of RC and First call
AHT of RC	Clustered bar chart	Determine who has longest AHT of RCs
Average AHT Original call, Average of Difference AHT, Average of AHT RCs	Text	Specific value of KPIs

Figure 14: AHT Team page

Speechminer

The speechminer page has the clear purpose of providing the information needed to find specific calls in speechminer. The recorded calls can be listened to via this program. This page therefore does not include visualizations to determine the outliers, this is done using one of the other pages. When the step towards the specific characteristics of the call has to be made, this page is used.

Filters

In order to find the specific calls requested, many filters are included on this page.

The first filter is the month, week, day filter. Although no progress will be visualized here, this filter is used to select a certain period. If an employee has had additional training, calls from either before or after this training can be selected. This specific employee can be filtered using the team / employee filter, and a specific type of repeated contact can be found via the repeated contact type filter.

If it has been established that a certain topic causes many RCs, whether this is done on employee-level or company-wide, this specific reason can be selected using the RFC.Reason filter. Even more specifics regarding the Reason For Contact can be added using the RFC.tag combination filter. This filter is a search bar, since many combinations are possible. Using a list for this would cause a very long and unstructured enumeration. The RFC.Value model filter is added to filter out the automate or solve calls, since these should be avoided in the future. Lastly, a bar is included to select calls with high difference between the different AHTs.

Visualizations

Two text visualizations are included on this page. The first top left one is quite small. It provides information regarding which specifics can be found in the other visualization. For example, in said visualization both the duration of the original call, as well as the duration of the repeated call is included. In the small text visualization it is explained which specifics belong to which call.

The other, large, text visualization covers almost the entire page. In this visualization, the text it placed in such a way that it forms a table. It is not meant to quickly show aspects which require attention, but it gives in depth information of the desired calls. A style with alternating colors for the rows has been chosen, to make it easier to follow the same call through the width of the table.

Table 10: Speechminer page

Users	**Filters**
Development	Month, Week, Day
Team leaders	Repeated Contact Type
Operations	Team / Employee
	RFC.Reason
	RFC.Value Model
	RFC.tag combination
	Difference AHT

Table 11: Speechminer page

Visualizations KPIs	**Type**	**Purpose**
	Text	Provide information
	Text	Provide specifics of RCs

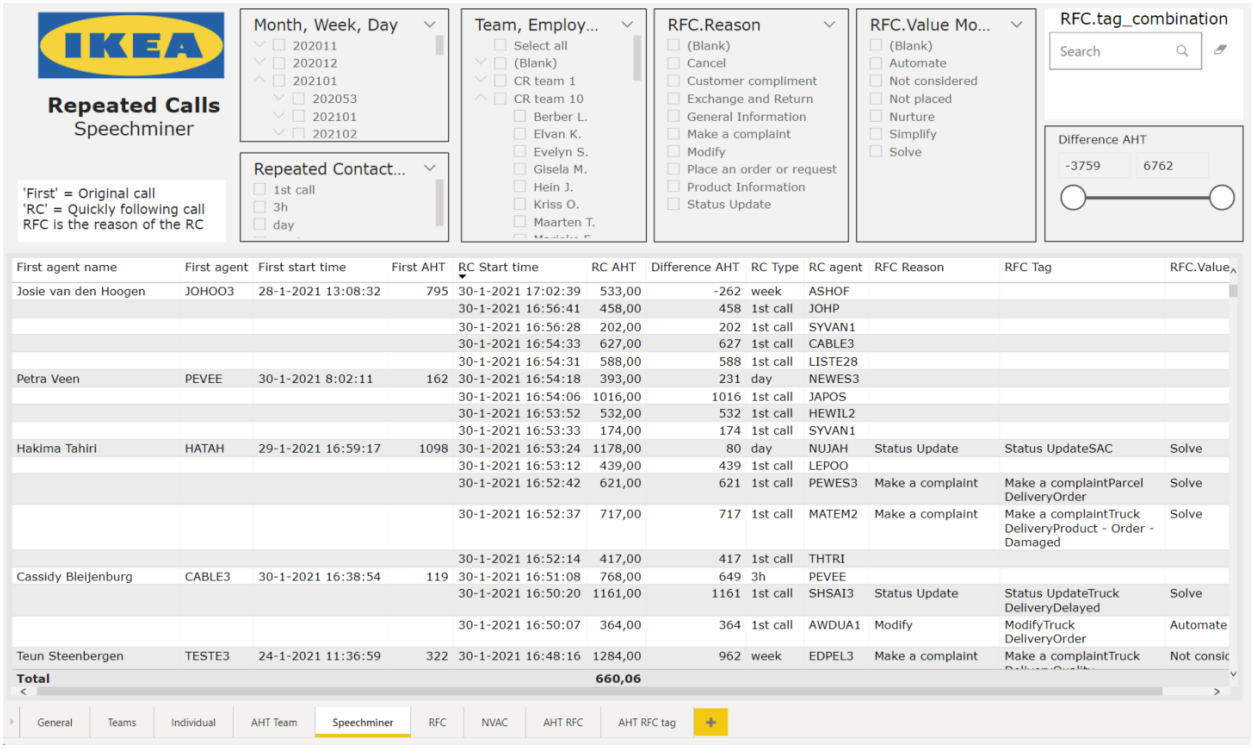


Figure 15: Speechminer page

RFC

The RFC page is the first one to fully focus on the operations purpose of the dashboard. It highlights which Reason For Contact caused many RCs. The processes belonging to these reasons should be checked and analyzed to figure out whether this is in fact the optimal procedure, or if there are improvements possible. Important with this page, is that the step from merely the RCs to also the RFCs behind it has been made. This means that only the data which overlaps was used for these visualizations.

Filters

The first filter on this page is the RFC.Reason filter. Using this, all visualizations on the page will show the KPIs regarding this specific reason. This is especially valuable for the visualization showing the top 25 reasons and topics on the bottom right, since then the top 25 topics matching this reason are selected.

The second filter of the Repeated Contact Type enables the user to find reasons which show exceptional results regarding one of the four categories. Also, the month, week, day filter is included to be able to monitor the progress over time. Lastly, a team / employee filter is included. This is mainly to be able to separate the teams which are part of the internal IKEA organization, and those part of the outsource partners.

Visualizations

On this page, five visualizations are placed. The one in left bottom is a slightly different one than the others. Instead of visualizing the data itself, it shows the quality of the data. It is a line chart, showing the percentage of RCs with an RFC over time. Since the represented data depends on the overlap between the two datasources, which again depends on how well the agents enter the RFC, realizing how trustworthy the visualizations are is important. The quality of this input is an important aspect of the RFC, which is why the progress over time is visualized. Whether we are going in the right direction can then be determined.

The other four visualizations do show how the RCs are distributed over the reasons. On the top left, the count of RCs by the RFC is shown in a stacked bar chart. This type is used because there is an emphasis on the 'whole', while still being able to show the multiple instances of this.

A longer chart represents a high total count, also a long bar of one color is easily recognizable.

The top right visualization, a clustered bar chart, shows the percentage of RCs over the reasons. This type of visualization is chosen, rather than a stacked bar chart, because in this case the percentages of the same RCs category, 3-hour, day etc., are comparable over the reasons. Whereas the count is not comparable, because of the difference in the total number of calls, the percentage is. The bar chart on the bottom left shows the count of RCs distributed over the reasons. However, instead of splitting this up over the different RC categories, the count of last week is added. This way, the progress can easily be monitored. Lastly, a treemap is included on this page. It shows the top 25 reasons and topics (sub categories of the reasons) by count. Only the top 25 are chosen to keep the visualization clear and valuable. Each color represents a reason, each block represents a topic. Selecting a block, and thus a specific topic, will also highlight the share of this topic within the reason on the other visualizations.

Table 12: RFC page

Users	**Filters**
Operations	RFC.Reason
MT	Repeated Contact Type
	Month, Week, Day
	Team, Employee

Table 13: RFC page

Visualizations KPIs	**Type**	**Purpose**
%RC with RFC	Line chart	Quality of data over time
#RC	Stacked bar chart	Distribution of RCs over RFCs
%RC	Clustered bar chart	Share of RCs for each reason
#RC	Bar chart	Count of RCs over each reason compared to last period
Top 25 reasons & topics by #	Treemap	Determining largest topic for each reason

Figure 16: RFC page

NVAC

As mentioned, IKEA uses a value model depending on the RFC to determine whether a call adds value. This NVAC page shows which share of the RCs is valuable, and which part of these calls should be avoided in the future.

Filters

The first filter on this page is once again the month, week, day filter, enabling the user to see the progress of possible improvements regarding the RCs and their value. The second filter, regarding the repeated contact type, can give insight into the value shares regarding one of the categories.

Visualizations

There are two text visualization placed on this page. The bottom one, like one of the visualizations on the RFC page, shows the quality of the data used for the other visualizations. This is expressed as a percentage of RCs with an RFC. Instead of a line chart showing this percentage over time, this visualization shows merely the current value. The RFC page also concerns this progress and possible improvement, whereas this is not the focus when determining the NVAC share. This share is the main purpose of the entire page. It is therefore visualized twice; once in the second text visualization and once in a line chart. The text visualization shows the current share only, to quickly determine what the current performance is.

The second visualization showing the NVAC share of the RCs is the bottom left line chart, showing this percentage over time. The progress of reducing the calls which should have been avoided can be monitored this way. The layout is chosen to be exactly the same as the visualization showing the NVAC share of all calls in another dashboard, to enable quick understanding of the employees. To understand the size of the set of calls we are looking at in this graph, the visualization above shows the percentage of RCs of all calls. It is a line chart with an x-axis displaying the values over time, at the same scale as the NVAC share below.

The top two visualizations are both even more detailed regarding the NVAC and the RCs. The left one is a pie chart, showing both the count of the RCs with a certain value model as well as the percentage. Since only four categories are used, and this number will not increase, this chart is useful to get an idea of the distribution of the value models over time. The exact numbers are not important, merely the fact that currently the majority of the RCs are placed in either the automate or the solve quadrant. When this distribution should not be determined over all RCs but over the individual categories, the top right clustered bar chart can be used. This type has been chosen because both the value models within a category can be compared, as well as the different categories for a specific value model.

Lastly, the bottom right visualization, a stacked bar chart, shows how the Repeated Calls of a specific Reason For Contact are divided over the value models. These proportions can not be compared over the different reasons, since some of them are way more likely to be assigned a certain quadrant than another. It should be used to determine whether a certain reason causes many RCs of a value which should be avoided.

Table 14: NVAC page

Users	Filters
Operations	Week, Day
	Repeated Contact Type

Table 15: NVAC page

Visualizations KPIs	Type	Purpose
%RC with a RFC	Text	Specific value of KPI
%NVAC share of RC	Text	Specific value of KPI
Count NVAC value of RCs	Pie chart	Division of value models over RCs
Count NVAC value of RCs	Clustered bar chart	Division of value models over categories of RCs
%RC	Line chart	Distribution of RCs over time
NVAC share of RCs	Line chart	NVAC share of RCs over time
%NVAC value	Stacked bar chart	Division of value models over RFCs

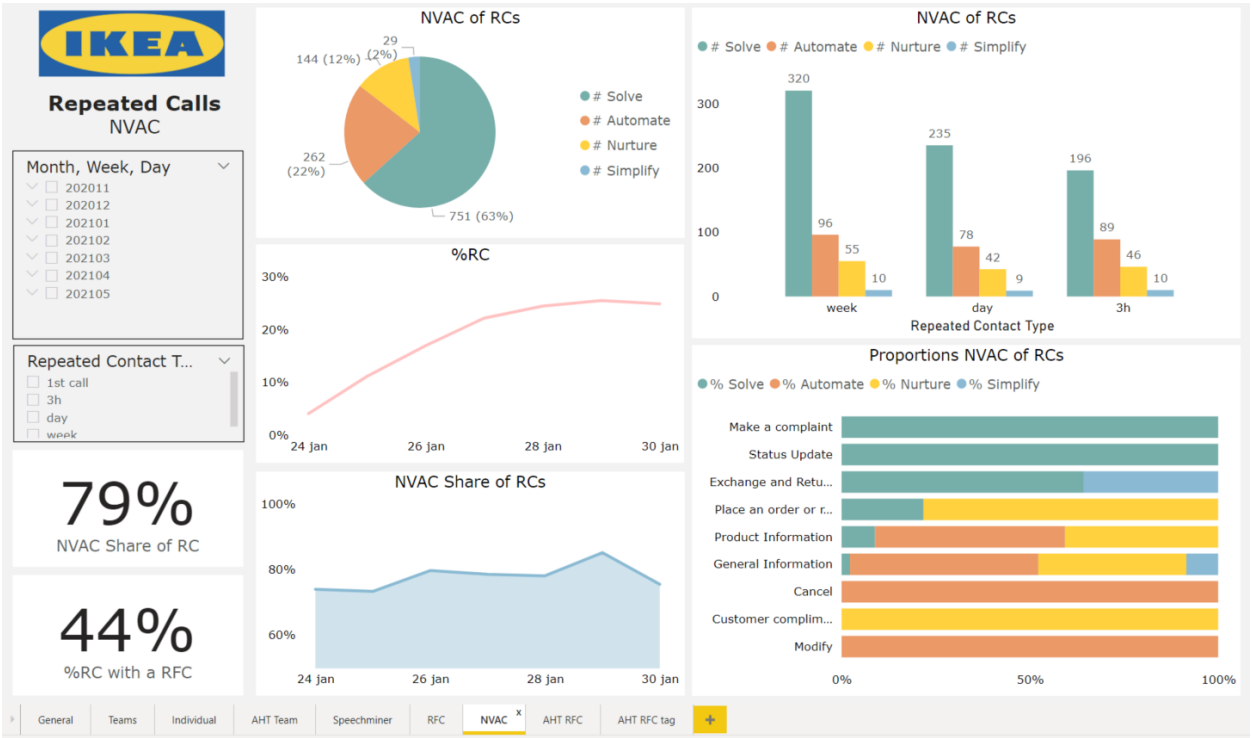


Figure 17: NVAC page

AHT RFC

The page of AHT RFC provides insight into the relationship between the Average Handling Time, the RCs and the RFC. It has two purposes. Firstly to highlight the calls with which reasons take very long to handle, and thus have priority to be avoided. Secondly, the page shows whether there was a large difference in the AHT of the original calls and that of the RC. If this difference is, on average, large, there is most likely a difference in type and topic of the call. Looking into this process might give new information regarding the way certain reasons are handled within the company.

Filters

The filters on this page are mainly used to highlight different segments. The first filter is the RFC.Reason. Although most of the visualizations already separate the data over the reasons, selecting one reason in this filter will show only the relevant data. The repeated contact type filter will highlight this type for each reason, reducing the number of bars from 4 to 1. Lastly, the month, week, day filter will show the results over the weeks.

Visualizations

The visualizations on this page all show different aspects of the AHT combined with the RCs and RFCs. The two text visualizations on the bottom left show the averages of the two types of AHT considered in this dashboard, the one of the call which caused a RC and that of the RC itself. This can quickly show whether there is still a large difference between the two, which indicates a difference in type and topic of the call.

The top two bar charts show the average AHT. The left one separates them over the different reasons, the right one over the RCs categories. These already give some insight by themselves, such as which category has the longest AHT, but is especially insightful when using the filters on the left.

The bottom two visualizations are similar to the clustered bar chart on the AHT Team page. However, now the AHT are shown for each RFC. The left visualization shows the average values, where the '1st call' bar represents the length of a first call. Again, the difference between the AHTs is visualized as well. Large differences can be identified, which require more attention. Apparently, the customer has a very different question the second time he calls.

Table 16: AHT RFC page

Users	**Filters**
Operations	RFC.Reason
	Repeated Contact Type
	Month, Week, Day

Table 17: AHT RFC page

Visualizations KPIs	**Type**	**Purpose**
AHT of RCs	Text	Current value of KPI
AHT of Original call	Text	Current value of KPI
AHT all calls	Bar chart	Average lengths of calls over the different RFCs
AHT all calls	Bar chart	Average lengths of calls over the different RC categories
AHT of RCs	Clustered bar chart	Average lengths of categories of RCs for each RFC
Different AHT (RC - Original Call)	Clustered bar chart	Compare AHT of RC and First call

Figure 18: AHT RFC page

AHT RFC Tag

The purpose of this final page is to find very in-depth details into which topics cause many calls and how long these calls take to handle. After the RFC to improve has been chosen using the previous three pages, this AHT RFC tag page can be used to look into the topics belonging to this RFC. The topics which occur often and have a long AHT should get priority.

Filters

The most important filter for this page is therefore the RFC.Reason. Once a reason to investigate has been chosen, selecting this in the filter will limit the visualized topics to those belonging to this reason. Knowing that 'status update' causes many RCs is not enough, but knowing that 'status update-parcel delivery-order' causes many calls gives way more information. Apparently the offered information regarding this topic in the original call is not sufficient yet. Also the RFC.tag combination filter is added, again as a search bar to avoid a very long list. If all reasons with the topic of parcel delivery are required in the visualizations, this can be done via this filter.

The repeated contact type is added to be able to compare the performances of different reasons and topics within one category. Lastly, the month, week, day filter is included to show progress over time.

Visualizations

In order to determine the topics which require the most immediate attention, two large visualizations are included on this page. The top one is a stacked bar chart showing the count of calls over the different topics, using a color-based legend to separate the first calls from the different categories of the RCs. When looking into reasons and topics to do more research on, improving frequently occurring topics will have a large influence, and are thus a logical choice. The emphasis in this graph is on the whole.

The visualization below is a clustered bar chart, displaying the AHT of the calls over the different topics. If two topics occur almost as often, reducing the AHT of the one with the highest current value will have the most impact. A clustered bar chart is chosen because there is no emphasis on the whole, but each individual bar should be comparable with another.

Table 18: AHT RFC Tag page

Users	Filters
Operations	RFC.Reason
	Repeated Contact Type
	Month, week, day
	RFC.tag combination

Table 19: AHT RFC Tag page

Visualizations KPIs	Type	Purpose
#Calls	Stacked bar chart	Determine which topic causes the most calls
Average AHT	Clustered bar chart	Determine topic with longest AHT

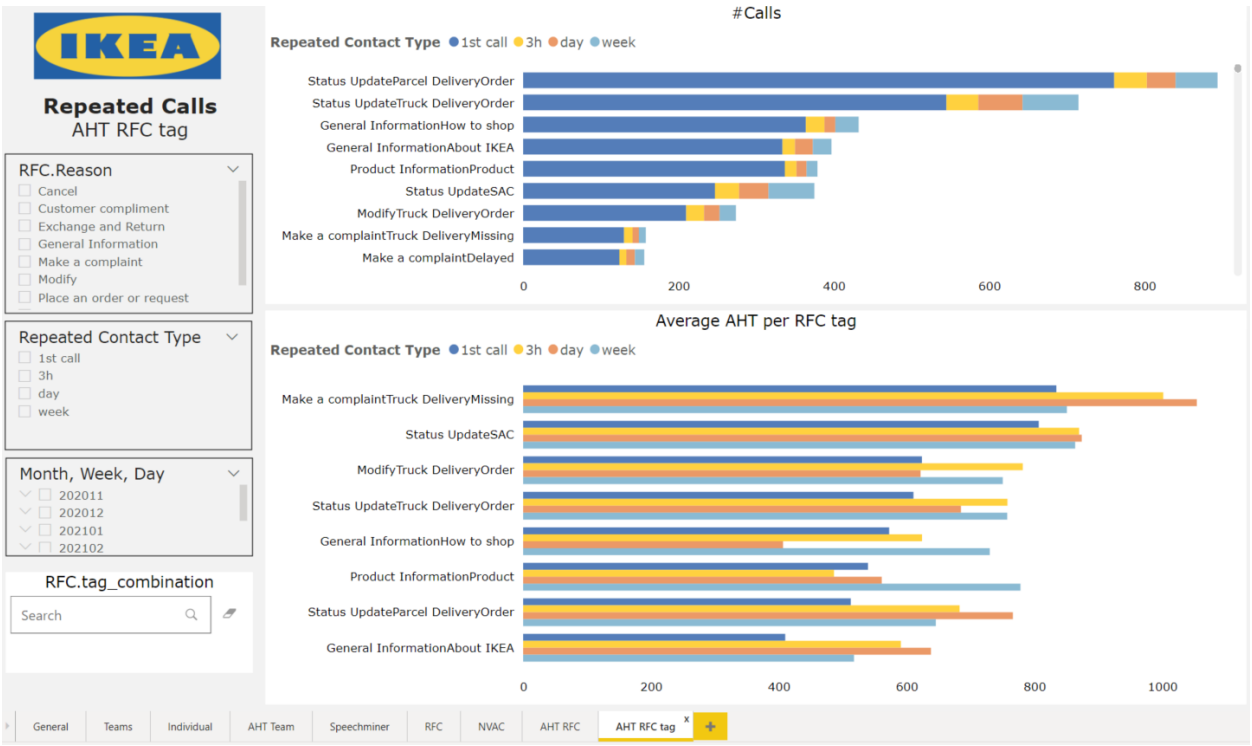


Figure 19: AHT RFC Tag page

7.4 Conclusion

In this section, the created dashboard is discussed. Using the row-level security, the correct people will have access to the desired data, while the sensitive data will remain protected. Many of the desired KPIs have been included in the dashboard, and the previous literature framework is used to build the visualizations and pages in an attractive and efficient way. Unfortunately, with the current data structure, two aspects could not be included yet. These remain possible future improvements.

8 Implementation

The implementation process is part of the *Evaluation* activity of the design thinking approach. The product has been created and is now implemented, taken into use and evaluated.

8.1 Access and communication

As explained in section 7.1 Structure, the PowerBI dashboards created by the business analysts of IKEA are published onto a web application. The employees have access to this application, and can then use the dashboards to monitor the performances of their department. Using row-level security, sensitive data can be protected, and only the persons who have rights will be able to use the dashboard.

In consultation with the manager of Customer Knowledge and Insights, the right target groups were selected for this dashboard. This includes the development specialists, team leaders, and operations managers. Several distribution lists were created to make sure that the correct people could easily be reached. Together with the business analysts, these lists were used to assign the rights and restrictions to the users.

Since Google BigQuery is used as the data source, this is automatically updated. In order to update the dashboard in the application, someone of the business analysts team will have to open the dashboard in the desktop version. After refreshing the data in the desktop version of PowerBI, the updated version can be published to the application. The new data will then be available online. Since each morning someone of the team refreshes all dashboard in a similar way in the 'daystart', this dashboard can be added to that procedure. The dashboard will therefore be updated daily, showing the most recent data to the end-users, so that they can react in a timely manner.

The dashboard has been published to the application, and all interested parties have received a message of this, together with an explanation of the final product. Many of them have been invested in the process as well, and will thus have seen part of the functionalities already. However, if there are still questions left, there is a Microsoft Teams chat specified for the purpose of asking questions regarding the dashboards, so the users can reach the business analysts via this way.

Although extensive research has been done to optimize the dashboard, so that it includes the required KPIs and the most meaningful visualizations, it is still likely that more questions and wishes will arise when the dashboard has been taken into use for a little while. The steps taken and the choices made when creating the dashboard have therefore been properly noted and logged, so that alterations can be included. This can also be communicated via the said Microsoft Teams chat, or via e-mail.

8.2 Detailed investigation

The dashboard can be used to monitor what is going on, and to determine outliers. The development specialists, for example, will be able to identify the teams and agents which cause many RCs. Using the 'Speechminer' page, these individual calls can be found, and listened to in this Speechminer program.

To make sure that this step can be performed properly, and to get an idea of possible causes for the RCs, a case study has been done. Because Speechminer only includes recent calls, unfortunately the limited dataset of one week could not be used directly via the dashboard anymore. Therefore, an additional step using the Interaction Flow Report was performed. Once the automization is complete, this is not necessary anymore since then the Speechminer page of the dashboard can be used. Using the dashboard with the limited dataset of one week and looking at the teams of IKEA itself only, *CR team 10* was identified to generate many RCs within 3h and a day. As was established, these are the relevant RCs for the development purposes. Then, the Interaction Flow Report of Tuesday the 25th of May has been created. Using conditional formatting, repeating phone numbers were highlighted. The names of the agents in said CR team 10 were filtered, to identify which of the RCs were caused by these agents. Of the 11 agents in this team, 5 were working Tuesday the 25th of May. An overview was created to visualize which calls by the same customer were caused by these team members. This overview can be found in Appendix I Case study CR

team 10. Now the agents and the time stamps were known, the step to Speechminer could be made.

8.2.1 Recurring aspects

The identified RCs and their corresponding previous/following calls were listened to. Using an Excel table, details on these calls were noted down to be able to analyse recurring aspects later. This table can also be found in Appendix I Case study CR team 10. Three noticeable characteristics were identified.

Cut off when on hold

The most striking aspect was the high number of calls that were cut off while in hold. The hold-option can be used by the agent to take some time to investigate into the topic of the question of the customer without extending the Average Handling Time, and without having to keep communicating with the customer while doing the research. However, from the 35 investigated calls, in 5 of them the connection was cut off while in this hold stage. In each of the 5 cases, the customer called again within half an hour. This is also quite reasonable, since the agent was working on their question but never got the chance to answer it.

Customer does not properly understand next step

Two calls were rounded off without the customer fully understanding what he or she should do. In both cases, the customers were not able to repeat which next step should be taken. In one of them, the customer even literally said that he will call again after having received the mail which was promised, and the agent said 'oke' to this. Since this will definitely cause a new call, this is not the proper answer. The agent should have talked the customer through the rest of the process.

Both these calls were held with English speaking customers. It is possible that the agents were less comfortable talking in English. This might have complicated the communication between the agent and the customer. Also, the agent might have been inclined to end the call as soon as possible, and let another agent handle the question.

Rude tone of voice of one agent

IKEA has many guidelines for the tone of voice of the agent. They should for example never blame their colleagues and should not say what is not possible, but highlight what is possible instead. One of the agents was involved in three RCs, and all of the three original calls did not have the proper tone of voice. The agent was not looking for opportunities nor working together with the customer, but rather trying to prove she was right. None of the customers was properly helped or comforted, one even requested to speak to another agent.

It is possible that this agent was simply having a bad day and was providing proper service the other days. However, it is important to help the customer properly regardless of one's personal situation. In any case, it is worth looking into this case further.

8.2.2 Communication and further steps

The three main aspects which were identified in this detailed investigation were communicated to the persons of interest. These findings are the recommendations that resulted from this case study.

The first topic of cut off calls when on hold has been discussed with the Customer Knowledge and Insights team manager. He was quite surprised and dissatisfied with this high number of disconnected calls. He directly gave more priority to this topic, and asked another member of the team to look into the frequency of occurrence of this event.

The second and third aspects have to do with the development aspect of the RCs. These aspects were discussed in a meeting with one of the development specialists. When following the protocol, an agent always asks whether the customer fully understands the answer or if there are any other questions. This is called the *proefafsluiting*, a form of checking if the call can be ended. This could avoid RCs when a customer did not understand the process correctly. The importance of this check is thus highlighted again. The specific calls of the agent who did not use the correct tone of voice were checked by her also, to make sure that she fully agreed on the remarkable aspects. This was indeed the case, and she communicated this further to the team leader of this specific agent. He

will then talk with the agent to discuss these calls.

The striking recurring aspects therefore lead almost immediately to further actions. This shows that the dashboard helps to identify which agents and which aspects of calls are relevant to the problem of RCs. Once more data is included, also recommendations regarding the operations part of RCs can be given.

9 Evaluation

After having created the dashboard, the possible end-users were informed that it was now available for them. Since they have all been involved in the process, no very extensive information was required. Additionally, the dashboard has been created to be easy to use intuitively. This communication and the received feedback is part of the *Communication* activity.

9.1 Method

To determine whether the created dashboard supports a solution to the problem, the Unified Theory of Acceptance and Use of Technology will be used. It is a tool to assess the likelihood of success for new technology introduction. The tool uses different constructs which all contribute to the use behavior. Questions in each of these categories will be asked to quantify the different determinants of intention (Venkatesh et al. 2003).

1. **Performance expectancy**: The degree to which an individual believes that using the system will help him or her to attain gains in job performance.
2. **Effort expectancy**: The degree of ease associated with the use of the system.
3. **Social influence**: The degree to which an individual perceives that important others believe he or she should use the new system.
4. **Facilitating conditions**: The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system.
5. **Attitude towards technology**: An individual's overall affective reaction to using a system.
6. **Self-efficacy**: A person's belief in his or her ability to succeed in a particular situation.
7. **Behavioural intention**: The intention to work with the system and accepting it in the daily operations.

A questionnaire based on these constructs is established, and shared with the end-users of the system who have been in contact during the creation of the dashboard. The questions can be found in Appendix J Questionnaire regarding use of the dashboard. A Likert scale is used. There is a numerical scale of 1 to 5, which represent the range of possible responses to the statement. This varies from 'strongly disagree', 'disagree', ' neutral', 'agree', to 'strongly agree'. It is designed to measure people's attitudes, opinions, or perceptions (Jamieson 2013).

9.2 Results

The questionnaire has been sent to five involved employees of the CSC. They have given their feedback, of which the results can be found in Appendix K Evaluation results.

All employees ended up with an average score of at least 4.29 out of 5, which is a very good average. A few results stand out. For example, the business analysts rated the performance expectancy questions lower than some of the others, which was also expected when performing the stakeholder analysis. They will not use the dashboard while doing their own work. The questions regarding the facilitating conditions were answered positively, showing that the implementation of the dashboard is done well. This includes the choice of PowerBI, the access via the application and the access to assistance. The lowest scoring section is the self-efficacy section, which represents how well the users could complete a task using the dashboard by themselves. On average, this section scored a 3.93. Especially question SE-3 has a low ranking. This question considered the possibility of managing a job without any help. Since this is not at all necessary, there is definitely help available, a score of 3.93 is still very sufficient. Finally, the question of whether the respondent intends to use the dashboard was rated with a 5 every single time, showing the willingness and excitement to start working with the dashboard.

At the end of the form was a space for additional input and wishes. One of the business analysts gave detailed tips regarding the layout and design of the dashboard. When in accordance with

the requirements and the available data, these tips were directly processed afterwards to create a dashboard of even higher quality. All the employees were very enthusiastic and happy with the product.

9.3 Conclusion

To determine whether the created dashboard actually meets the requirements, an evaluation procedure has been performed. Evaluation forms based on the Unified Theory of Acceptance and Use of Technology have been sent to involved employees in different areas of the company. Their feedback has been analyzed and processed when possible. All in all, they were very content and eager to use the product.

10 Conclusions and discussion

In this chapter, the conclusions, limitations and possible future work are discussed. The core problem and the research question are first summarized. Then, in section 10.1.3 Sub research questions, the sub research questions are answered, which lead to answering the main research question in section 10.1.4 Answering the main research question.

10.1 Conclusions

10.1.1 Core problem

The core problem which was found at the CSC of IKEA was a lack of insight into the RCs. The high number of calls they are receiving has three causes, of which the topic of RCs has been chosen for further research. Although three possible underlying reasons have been identified, their influence and details are not known. Gaining more insight into the topics and agents leading to the RCs will enable the CSC to diminish this number.

10.1.2 Research question

The corresponding research question therefore had to result in a way to gain insight into the RCs. The chosen research question is;

How can the Customer Support Center of IKEA monitor the Repeated Calls?

To answer this question, multiple aspects had to be considered, such as the current information structure as well as the required information regarding these RCs. Therefore, subquestions were created to divide this main question into smaller steps.

10.1.3 Sub research questions

The current data analysis process has been analyzed. The data which is collected is processed by the business analysts, and made visible via dashboards in PowerBI. The employees can then access these dashboards via an online application. The datasets which could be interesting for this research have been evaluated, after which the useful three have been included in the dashboard. This has been described in section 6 Context analysis: Structure of required data.

A literature research has provided insight into the KPIs which could be interesting for this dashboard. In section 3 Key performance indicators: A literature study, multiple options were presented, varying from the categories employee attitude, employee performance and company performance.

In section 4 Visualizations in PowerBI: A literature study, a second literature research was performed to gain knowledge regarding possible visualizations for the dashboard. The visualizations should focus on enabling rapid perception of the aspects which require attention. Different media displays can pull attention to a specific detail, which is why the relevant one should be selected.

During multiple focus group sessions, the requirements of all different teams and specialists have been determined, which can be found in section 5 Requirements. From these conversations, the different wishes were combined into dashboard pages. Using row-level security, the right groups of people were given access to the right pages.

Different aspects of the calls could influence the probability of a RC. These have been discussed in the focus group sessions, and include the Average Handling Time, the RFC and the conversational skills of the agent. These skills are quantified using the quality monitoring form.

Lastly, in the investigation described in section 8.2 Detailed investigation, a concrete example was given on how to use the dashboard for development purposes. Already from this small research, some useful recommendations could be given.

10.1.4 Answering the main research question

After having answered all sub research questions and conducting the first focus group sessions, the dashboard has been produced. During multiple follow-up focus group session, multiple improvements were made to provide a dashboard which matches the wishes of its end-users. A description

of this product can be found in section 7 Dashboard.

The research question has therefore been answered, since now the multiple departments of the CSC of IKEA have access to a dashboard providing the information needed regarding the RCs. They can access this via the online application, and possible questions or further requests can be communicated via the Teams PowerBI group or by contacting the business analysts team via for example mail.

10.2 Limitations

Finally, some limitation due to the method and the provided data will be addressed.

Firstly, this research is performed as a graduation assignment for the bachelor of Industrial Engineering and Management. This means that there was limited time available to complete it. Already early in the process, the datasets needed were identified. These datasets were not all available in the required format, which is why a request for these has been made towards the global department of IKEA. A limited dataset of a week was provided quite quickly, after which a meeting was held to show what was done with the given set. However, the full dataset, an automized pipeline providing the data in the correct format, was still not available at the end of the time period for the assignment.

This limited dataset was very useful for creating the dashboard. Because of it, the focus group meetings could be held, and a first look at which RC insights are possible could be made. However, when not only checking whether the dashboard suffices, but also actually using it for insights, a larger dataset is necessary. Using performances of an agent of only a week is not enough to find a long term pattern. This limitation has been dealt with as well as possible by using it for a very detailed investigation, but it is possible that it would have been better to choose another team and another day.

Secondly, due to the fact that this is the first time a research in the RCs is done, there are no target values yet. It is therefore hard to determine whether the current values are truly out of proportions compared with other call centers, or if they are not so bad.

Lastly, the problem of RCs is not unique to the CSC of IKEA, but it is call center-wide. It is likely that other call centers will be interested in the same KPIs as IKEA, thus the dashboard will be interesting to them as well. However, since they might use other datasources than IKEA does, this could not be tested. Whether this product is useful to other businesses in the same branch is therefore likely, but not proven.

10.3 Future work

Although there has been extensive research on the requirements for the dashboard, and there has been great effort to provide the most complete dashboard possible, there is still some future work possible.

The first and foremost step is to include more data in the dashboard. The global department at the headquarters in Sweden have been working on providing a pipeline for months now, but this is not complete yet. This luckily has not stood in the way of producing a complete dashboard, since a limited dataset of a week could be used for this purpose. However, the visualizations and conclusions are now still based on a small quantity of data. Including the pipeline would ensure an automatic dataflow, providing new and accurate insights. The data input structure is already built to simplify this step.

Once the dataflow with the currently included columns and information is automatized, additional aspects could be added. In the requirements, the customer feedback and the quality monitoring values were established to be useful. However, due to the data structure, this is not possible yet. Adding the customer feedback should not be too complicated once it is added to the RFC dataset which is loaded into the dashboard. Combining the quality monitoring values to the calls however, will be more complicated since a new shared ID should be identified. If this is done, the process of listening to calls is simplified since some calls might already have been listened to.

When performing the detailed investigation, it became apparent that many calls were disconnected while on hold. If this problem is not solved on short term notice, it will remain a large cause of RCs. Including a percentage of calls which ended while in hold will therefore be an interesting Key Performance Indicator.

The third possible future work involves the other currently existing dashboards. Many dashboards are included in the application used by the employees. These contain visualizations on for example the RFC, the sales or the AHT. Adding a visualization with for example the percentage of RCs could add value when looking for a quick overview on the performances of the CSC or a specific team.

References

Abdullateef, Aliyu Olayemi, Sany Sanuri Mohd Mokhtar, and Rushami Zien Yusoff (2011). "The mediating effects of first call resolution on call centers performance". In: *Journal of Database Marketing and Customer Strategy Management* 18.1, pp. 16–30. ISSN: 17412439. DOI: 10.1057/dbm.2011.4.

American Optometric Association (2021). *Color vision deficiency*. URL: https://www.aoa.org/healthy-eyes/eye-and-vision-conditions/color-vision-deficiency?sso=y#:~:text=People%20who%20are%20totally%20color,caused%20by%20injury%20or%20illness..

Chan, Albert P.C. and Ada P.L. Chan (2004). *Key performance indicators for measuring construction success*. DOI: 10.1108/14635770410532624.

Chen, Xi et al. (Feb. 2021). "Composition and configuration patterns in multiple-view visualizations". In: *IEEE Transactions on Visualization and Computer Graphics* 27.2, pp. 1514–1524. ISSN: 19410506. DOI: 10.1109/TVCG.2020.3030338.

Chicu, Dorina, Gerard Ryan, and Mireia Valverde-Aparicio (May 2016). "Determinants of customer satisfaction in call centres". In: *European Accounting and Management Review* 2.2, pp. 20–41. ISSN: 2385-3921. DOI: 10.26595/eamr.2014.2.2.2.

Dorst, Kees (2011). "The core of 'design thinking' and its application". In: *Design Studies* 32.6, pp. 521–532. ISSN: 0142694X. DOI: 10.1016/j.destud.2011.07.006. URL: http://dx.doi.org/10.1016/j.destud.2011.07.006.

Few, S. (2006). *Information dashboard design : the effective visual communication of data*. O'Reilly, p. 211. ISBN: 0596100167.

— (2007). *Dashboard Confusion Revisited*. Tech. rep.

Friis Dam, Rikke and Teo Yu Siang (2020). *What is Design Thinking and Why Is It So Popular?* URL: https://www.interaction-design.org/literature/article/what-is-design-thinking-and-why-is-it-so-popular.

— (2021). *5 Stages in the Design Thinking PRocess*. URL: https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process.

Gill, P. et al. (Mar. 2008). "Methods of data collection in qualitative research: Interviews and focus groups". In: *British Dental Journal* 204.6, pp. 291–295. ISSN: 00070610. DOI: 10.1038/bdj.2008.192.

Hossain, Pri (2018). *Preattentive processing and how to use it in design*. URL: https://uxplanet.org/preattentive-processing-and-design-e59eba74373e.

Ibrahim, Ibrahim A., Abdullah M. Albarrak, and Xue Li (May 2017). "Constrained recommendations for query visualizations". In: *Knowledge and Information Systems* 51.2, pp. 499–529. ISSN: 02193116. DOI: 10.1007/s10115-016-1001-5.

IKEA (2021). *Visie & Bedrijfsconcept*. URL: https://www.ikea.com/nl/nl/this-is-ikea/about-us/visie-and-bedrijfsconcept-pub9cd02291.

INGKA (2021). *The Ingka Group story*. URL: https://www.ingka.com/this-is-ingka-group/.

Jamieson, S (2013). *Likert Scale*. URL: https://www.britannica.com/topic/Likert-Scale/additional-info#history.

Jouini, Oualid, Ger Koole, and Alex Roubos (2013). "Performance indicators for call centers with impatient customers". In: *IIE Transactions (Institute of Industrial Engineers)* 45.3, pp. 341–354. ISSN: 0740817X. DOI: 10.1080/0740817X.2012.712241.

Kintz, Maximilien (2012). *A Semantic Dashboard Description Language for a Process-oriented Dashboard Design Methodology*. Tech. rep.

Kitzinger, J (2005). "Focus group research using group dynamic". In:

Manzoor, Sheik (2018). "A study on key performance indicators and their influence on customer satisfaction in call centres". In: ISSN: 0972-9380. URL: https://www.researchgate.net/publication/325485509.

Microsoft (2019). *Understand star scheme and the importance for Power BI*. URL: https://docs.microsoft.com/en-us/power-bi/guidance/star-schema.

— (2021a). *Row-level security (RLS) with Power BI*.

— (2021b). *Visualization types in Power BI*. URL: https://docs.microsoft.com/en-us/power-bi/visuals/power-bi-visualization-types-for-reports-and-q-and-a.

— (2021c). *Why Power BI*. URL: https://powerbi.microsoft.com/en-us/why-power-bi/.

Peffers, Ken et al. (Dec. 2007). "A design science research methodology for information systems research". In: *Journal of Management Information Systems* 24.3, pp. 45–77. ISSN: 07421222. DOI: 10.2753/MIS0742-1222240302.

Plaza, Miroslaw and Lukasz Pawlik (2021). "Influence of the Contact Center Systems Development on Key Performance Indicators". In:

Robinson, George and Clive Morley (2006). "Call centre management: Responsibilities and performance". In: *International Journal of Service Industry Management* 17.3, pp. 284–300. ISSN: 09564233. DOI: 10.1108/09564230610667122.

Tate, Wendy L. and Wendy van der Valk (Sept. 2008). "Managing the performance of outsourced customer contact centers". In: *Journal of Purchasing and Supply Management* 14.3, pp. 160–169. ISSN: 14784092. DOI: 10.1016/j.pursup.2008.04.002.

Venkatesh, Viswanath et al. (2003). "User acceptance of information technology". In: *MIS Quarterly*.

Wexler, Steve, Jeffrey Shaffer, and Andy Cotgreave (2017). *The big book of Dashboards: Visualizing your data using real-world business scenarios*.

Appendices

Appendix A Stakeholders

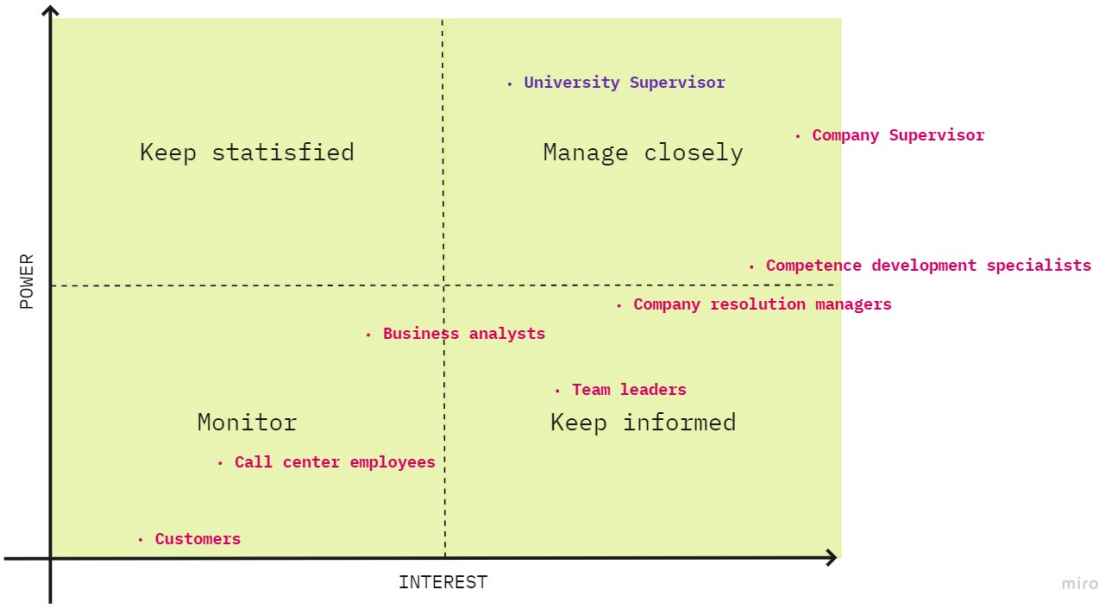


Figure 20: Stakeholders

Table 20: Stakeholders

Name	Why	Interest	Power	Quadrant
University supervisor	Helps me to meet the requirements of the University of Twente	Mediocre	High	Manage closely
Company supervisor	Problem owner	High	Mediocre	Manage closely
Competence development specialists	End-users	High	Mediocre	Keep informed
Customer resolution managers	End-users	High	Mediocre	Keep informed
Business analysts	Help creating dashboard	Mediocre	Mediocre	Monitor
Team leaders	Influenced by results of dashboard	Mediocre - High	Mediocre	Keep informed
Call center employees	Influence by results of dashboard	Little - Mediocre	Little - Mediocre	Monitor
Customers	Influenced by results of dashboard	Little - Mediocre	Little	Monitor

Appendix B Literature research KPIs validity

For the literature study regarding the KPIs, a systematic literature review was conducted. The research question '*Which Key Performance Indicators are relevant to call centers?*' was chosen as aim of the research. Inclusion criteria were the Key Performance Indicators and call centers. The exclusion criteria were the target group of the literature, the publication date should be after 2005, and the source should be freely accessible via the university. The three chosen databases are Business Source Elite, the Web of Science and Scopus. This resulted in the following results.

Table 21: Search String

Search string	Scope	Date of search	Date range	Number of entries
Search protocol for Business Source Elite				
(KPI OR Key Performance Indicator) AND (Call Center OR Contact center)	*no selected fields*	2 April 2021	2005-2021	44
Search protocol for Web of Science				
TS = ((KPI OR Key Performance Indicator) AND (Call Center OR Contact center)	Topic	2 April 2021	2005-2021	46
Search protocol for Scopus				
(KPI OR Key Performance Indicator) AND (Call Center OR Contact center)	Title, abstract, keywords	2 April 2021	2005-2021	54
Total in Mendeley				**85**
Removing duplicates				-21
Selecting based on inclusion criteria				-50
Selecting based on exclusion criteria				-4
Removed after detailed reading				-3
Total selected for review				**7**

The chosen seven sources, which are used for the theoretical framework, are the following.

- "The mediating effects of first call resolution on call centers' performance" by Abdullateef O, Zien R, Sanuri S (2011)
- "Determinants of customer satisfaction in call centres" by Chicu D, Ryan G, and Valverde-Aparicio M (2016)
- "Performance indicators for call centers with impatient customers" by Jouini O, Koole G, Roubos A (2013)
- "A study on key performance indicators and their influence on customer satisfaction in call centres" by Manzoor S (2018)
- "Influence of the Contact Center Systems Development on Key Performance Indicators" by Plaza M and Pawlik L (2021)
- "Call centre management: Responsibilities and performance" by Robinson G, and Morley C (2006)
- "Managing the performance of outsourced customer contact centers" by Tate W, and van der Valk W (2008)

Appendix C Literature research visualizations validity

For the literature study on the visualizations in PowerBI, the basis are the two books; Information Dashboard Design by Stephen Few and The Big Book of Dashboards by Steve Wexler, Jeffrey Shaffer and Andy Cotgreave. After looking at multiple data visualization book recommendations by different data analysts, these two came forward as the most suitable which were also accessible for this research. The topics covered by these writers in these books were the basis for the structure of the theoretical framework. Since this thesis aims to create a dashboard in PowerBI, this research also focused on the visualizations in this program. The possible options presented were therefore limited to the available visualizations in PowerBI, which were found on the Microsoft site.

Next to these three sources, the sources which cited one of the books, were also considered in this research. If a to this research very relevant topic was only shortly discussed, another source was considered. This way, more knowledgeable insight on for example the pre-attentive processing

properties of visualizations or the properties of visualizations could be included in the framework.

This resulted in the following sources for this theoretical framework.

- "Information Dashboard Design" by Stephen Few (2006)
- "The Big Book of Dashboards" by Steve Wexler, Jeffrey Shaffer and Andy Cotgreave (2017)
- "Constrained recommendations for query visualizations" by Ibrahim Ibrahim, Abdullah Albarrak and Xue Li (2017)
- "A Semantic Dashboard Description Language for a Process-oriented Dashboard Design Methodology" by Maximilien Kintz (2012)
- "Dashboard Confusion Revisited" by Stephen Few (2007)
- "Preattentive processing and how to use it in design" by Pri Hossain (2018)
- "Visualization types in Power BI" on the website of Microsoft
- "Color vision deficiency" on the website of the American Optometric Association

Appendix D Quality monitoring form

These questions are originally in Dutch. For the purpose of this English thesis, they have been translated.

1. **End User Critical**
   - 1.1. Until the request of the customer is clear, you use open, situational, and aimed questions.
   - 1.2. You comfort the customer and mention the emotion of the customer if this is literally indicated in the conversation or when you hear the need for this by their intonation.
   - 1.3. You check whether you have understood the request of the customer fully and correctly by summarizing or repeating the customer's question.
   - 1.4. You give the correct answer based on the information in the knowledge base and/or decision tree, and give alternatives proactively if the standard answer is not sufficient.
   - 1.5. You summarize the solution and decisions, indicate what the customer can expect and perform a closing.
   - 1.6. During the conversation, you adjust the conversation to the situation of the customer by proposing a relevant product or a relevant service.
   - 1.7. You end the conversation in a personal way by referring to the details of the conversation.
   - 1.8. You communicate with a positive language use and speak in opportunities, not in problems.
2. **Business Critical**
   - 2.1. First contact resolution: You solve the problem of the customer to the extent of your possibilities (incl. compensation). You make sure that the solution is initiated properly and you perform the tasks agreed with the customer.
   - 2.2. Product quality: You recognize severe irregularities regarding product quality, such as risk reports and call back actions.
   - 2.3. Self help tools: You proactively promote the opportunities for a customer to remedy the question. You do this so a customer can solve the problem themselves in the future, or will look online for the possibilities first.
   - 2.4. SAC: You create a SAC when necessary, and make you that there are no unnecessary SAC's in queue. This means that you close SAC's when they can be closed, you actively close double SAC's (when you run into them) and you don't create any unnecessary SAC's.

2.5. SAC - Reporting: You leave a note at every moment you open a SAC. In this note, you answer the question why you opened the SAC, what you did/agreed on or why you did nothing. You leave a summary if the situation asks for it.

3. **Compliance critical**

3.1. Customer verification: You perform customer verification in customers when necessary. Here, you asks for the full customer name (on the order/in the SAC) and the address details (zip code and house number).

3.2. AVG Privacy: You work within the borders of the AVG. This means that you record the information of the customer on the correct locations and you recognize AVG-requests. Also, you do not share personal information that you have not verified and treat personal information diligently.

Appendix E NVAC quadrant

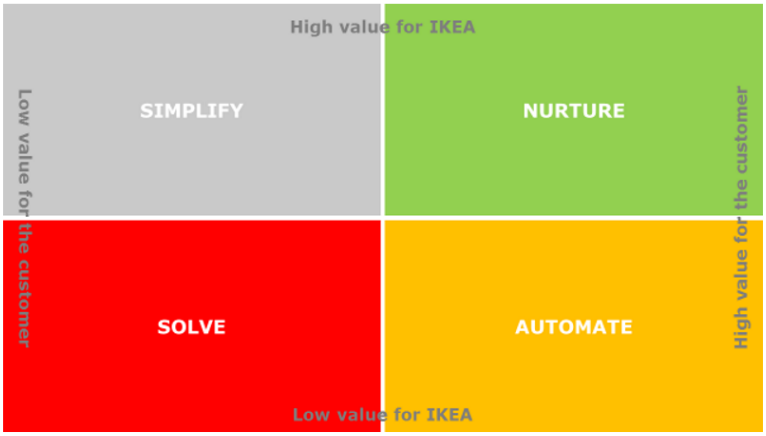


Figure 21: NVAC quadrant

Nurture; contacts we wish to keep, such as product information of offering help when placing an order
Simplify; contacts we cannot or do not want to avoid, but we can simplify for the customer. Such as enabling exchanging and returning via online, or making the stock levels easily accessible, so that customers know whether their selected product is in stock.
Solve: contacts which could have been avoided if sometime during the process something would have been done differently. For example; giving status updates on delivery, filing a complaint, missing parts or damaged products.
Automate: contacts which could have been avoided if we would have offered automated options. For example, make stock information easily accessible, make it possible to alter or cancel an order online, or questions regarding opening hours.

Appendix F RFC Tool

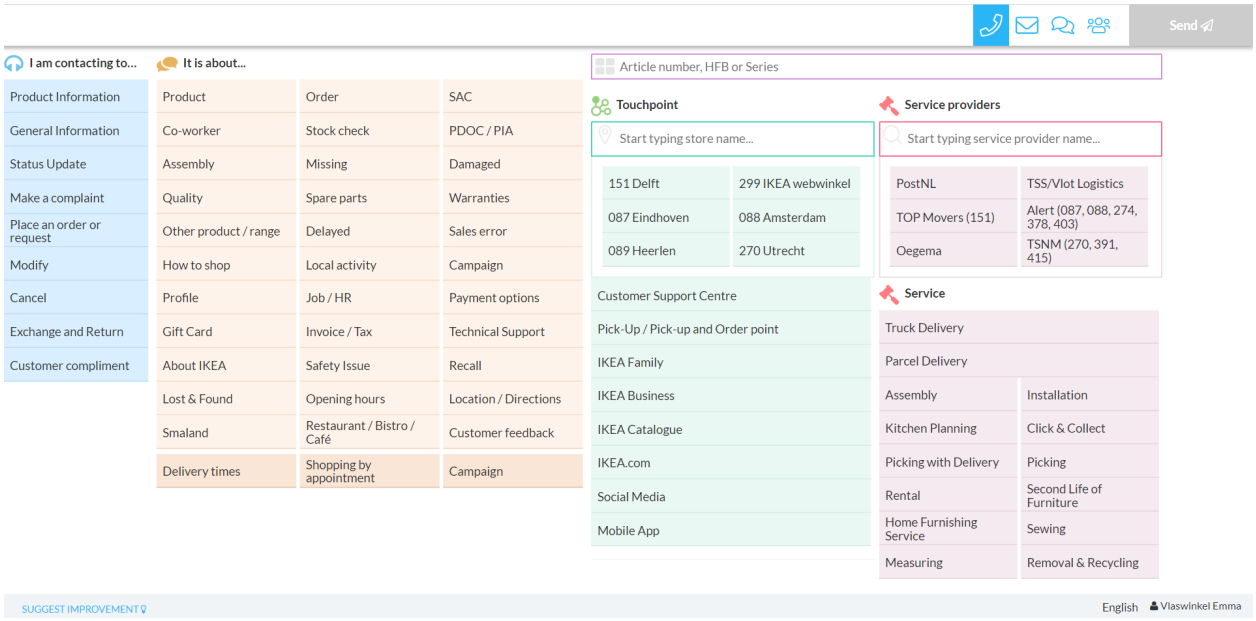


Figure 22: RFC Tool

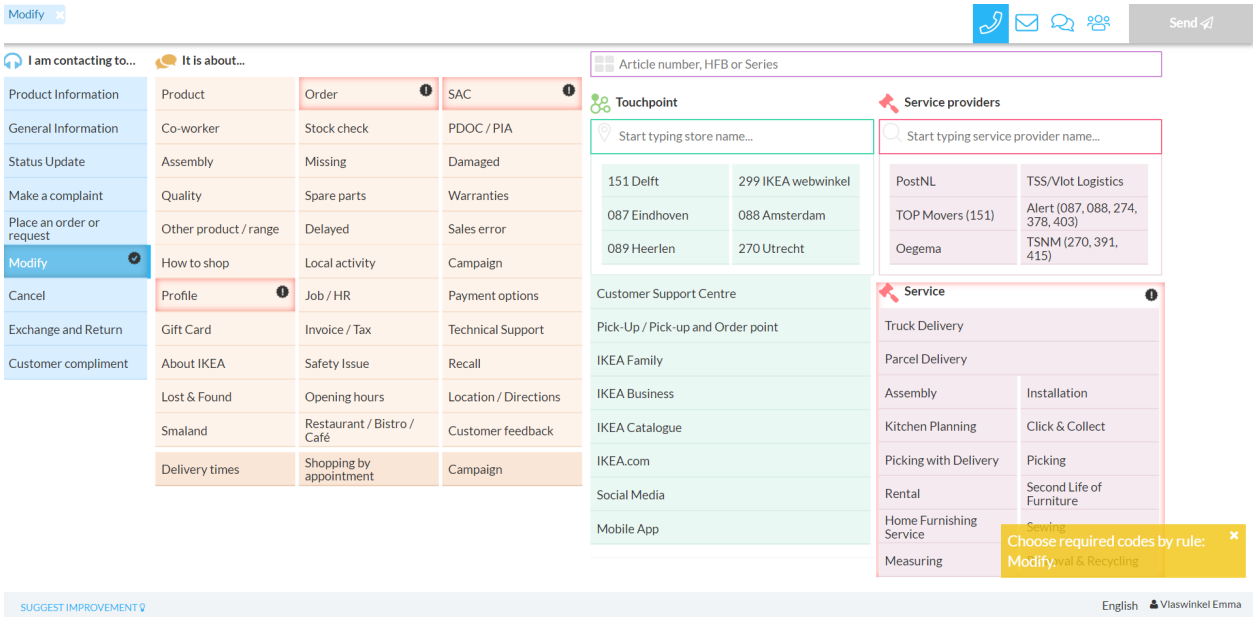


Figure 23: RFC Tool, Modify

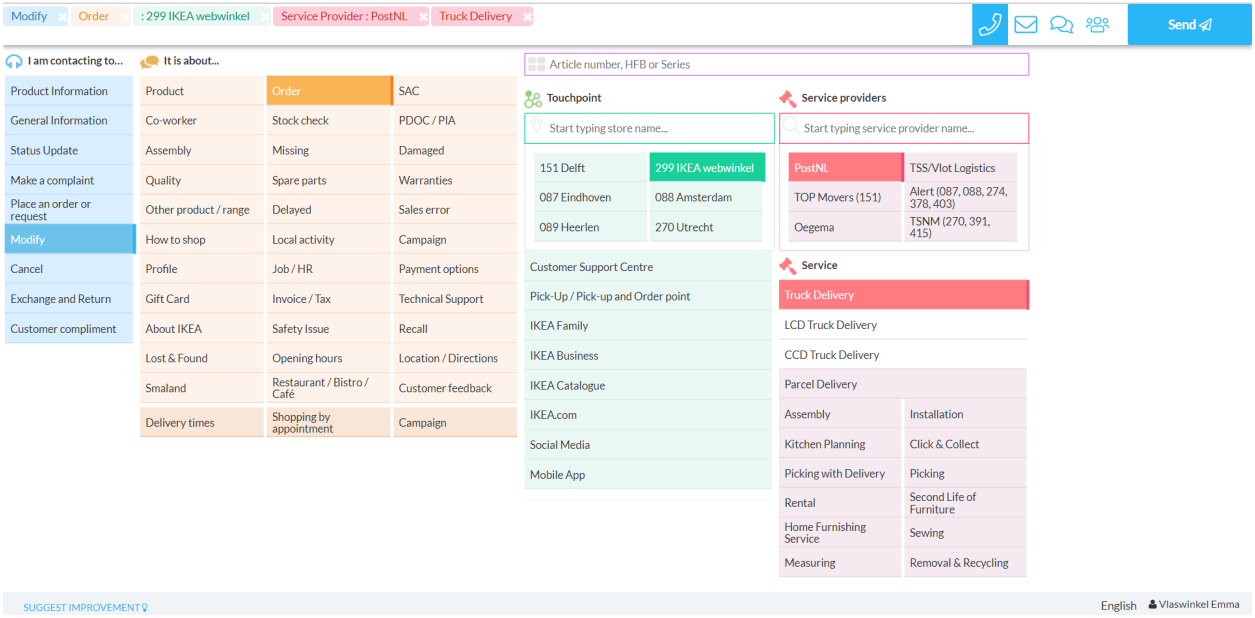


Figure 24: RFC Tool, full entry

Appendix G Connections in initial dataset

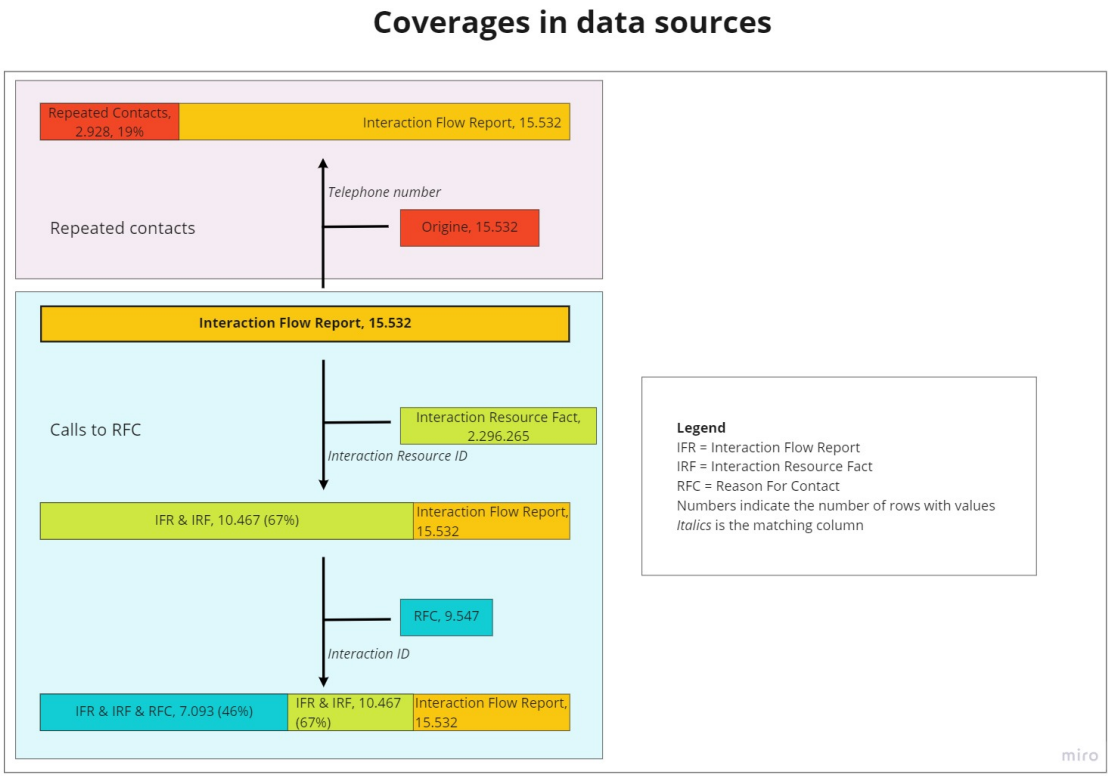


Figure 25: Coverages

In the figure above, the coverages of the used datasets are visualized. These datasets consisted of data of one week, from the 24th of January to the 30th of January. The basis of the figure is the Interaction Flow Report, which contains all the information on the calls themselves. In this case this dataset consisted out of 15.532 records. Going upwards in the visualization, this IFR

is compared with itself, with the repeating phone numbers identified as RCs. From these 15.532, 2.928 phone numbers matched with previous rows, meaning that 19% of the calls were RCs.

Starting with the IFR and going downwards follows the steps of matching the call data with the RFC. The first match is done between the IFR and the Interaction Resource Fact, based on the Interaction Resource ID. Although the IRF contains many rows, 2.296.265, the match is only 67%. Then, this merged dataset is again matched to the RFC on the Interaction ID, which by itself contains 9.547. This means that, even leaving the possible mismatch in chosen webpage/path to enter the RFC, the total number of RFCs covers only 61% of the count of calls. When not simply comparing the total number of entries, but also actually matching them on their shared ID, this leaves a percentage of 46%.

Then, as explained, some calls contain two RFCs. Since this is not possible, the first one, based on time of entry is chosen in these cases. Using the calculation possibilities in PowerBI, the final number of established RCs with a RFC ended up to be 44%. This final number is also visualized in the dashboard (in a line chart on the RFC page and as a text box on the NVAC page).

Appendix H Calculation of KPIs in PowerBI

The established KPIs to include in the dashboard first had to be calculated in PowerBI.

First, two columns have been added to the combined dataset. The first one is the Repeated Contact Type. This column calculates the difference between the start time of the original call and the quickly following call in minutes. Then, a value is assigned based on this difference. If the difference is less than 180 minutes, the RC is assigned to the category '3h'. This continues for 'day', 'week', and 'month'. If the call does not fall into one of these categories, it is not considered to be a RC, and thus a '1st call'.

The second added column calculates the difference in the AHT of the original call and the quickly following call. Since the RC is usually longer, the AHT of the original call is subtracted from this one.

The other KPIs have been calculated via measures. The corresponding formulas are included below.

Count NVAC values

#**Automate** = CALCULATE(COUNT('Interaction&IRF&RFC'[C.Start_tijd_comb]), 'Interaction&IRF&RFC'[RFC.Value Model]= "Automate") + 0.4* CALCULATE(COUNT ('Interaction&IRF&RFC'[C.Start_tijd_comb]), 'Interaction&IRF&RFC'[RFC.Grouped combinations]= "Product Information")
#**Nurture** = CALCULATE(COUNT('Interaction&IRF&RFC'[C.Start_tijd_comb]), 'Interaction&IRF&RFC'[RFC.Value Model]= "Nurture") - 0.4*CALCULATE(COUNT('Interaction&IRF&RFC'[C.Start_tijd_comb]), 'Interaction&IRF&RFC'[RFC.Grouped combinations]= "Product Information")
#**Simplify** = CALCULATE(COUNT('Interaction&IRF&RFC'[C.Start_tijd_comb]), 'Interaction&IRF&RFC'[RFC.Value Model]= "Simplify")
#**Solve** = CALCULATE(COUNT('Interaction&IRF&RFC'[C.Start_tijd_comb]), 'Interaction&IRF&RFC'[RFC.Value Model]= "Solve")
#**NVAC** = [# Automate]+[# Solve]

Percentage NVAC values

%**Automate** = DIVIDE([# Automate],[#RC])
%**Nurture** = DIVIDE([# Nurture],[#RC])
%**Simplify** = DIVIDE([# Simplify], [#RC])
%**Solve** = DIVIDE([# Solve], [#RC])
%**NVAC of RCs** = DIVIDE(([# Automate]+[# Solve]), [#RFC],0) (filter on 'Repeated Contact Type is not '1st call')

Count RCs

RC = CALCULATE(COUNT('Interaction&IRF&RFC'[C.Start_tijd_comb]), KEEPFILTERS('Interaction&IRF&RFC'[Repeated Contact Type] IN "3h","day","week","month"), USERELATIONSHIP('Employee Target'[ET.Legacy ID],'Interaction&IRF&RFC'[Original.agent]))
RC 3h = CALCULATE(COUNT('Interaction&IRF&RFC'[C.Start_tijd_comb]), 'Interaction&IRF&RFC'[Repeated Contact Type]="3h",USERELATIONSHIP('Employee Target'[ET.Legacy ID],'Interaction&IRF&RFC'[Original.agent]))
RC day = CALCULATE(COUNT('Interaction&IRF&RFC'[C.Start_tijd_comb]), 'Interaction&IRF&RFC'[Repeated Contact Type]="day", USERELATIONSHIP('Employee Target'[ET.Legacy ID],'Interaction&IRF&RFC'[Original.agent]))
RC week = CALCULATE(COUNT('Interaction&IRF&RFC'[C.Start_tijd_comb]), 'Interaction&IRF&RFC'[Repeated Contact Type]="week", USERELATIONSHIP('Employee Target'[ET.Legacy ID],'Interaction&IRF&RFC'[Original.agent]))
RC month = CALCULATE(COUNT('Interaction&IRF&RFC'[C.Start_tijd_comb]), 'Interaction&IRF&RFC'[Repeated Contact Type]="month", USERELATIONSHIP('Employee Target'[ET.Legacy ID],'Interaction&IRF&RFC'[Original.agent]))
RC previous week = CALCULATE([#RC], USERELATIONSHIP('Interaction&IRF&RFC'[C.Start_tijd_date], DIM_Date[LastWeek]))

Percentage RCs

% **RC** = [#RC]/[#StartTimes]
% **RC 3h of all** = DIVIDE([#RC3h],[#StartTimes])
% **RC 3h of RCs** = DIVIDE([#RC3h],[#RC])
% **RC day of all** = DIVIDE([#RCday],[#StartTimes])
% **RC day of RC** = DIVIDE([#RCday],[#RC])
% **RC week of all** = DIVIDE([#RCweek],[#StartTimes])
% **RC week of RC** = DIVIDE([#RCweek], [#RC])
% **RC month of all** = DIVIDE([#RCmonth],[#StartTimes])
% **RC month of RC** = DIVIDE([#RCmonth],[#RC])
% **RC previous week** = CALCULATE([%RC], USERELATIONSHIP('Interaction&IRF&RFC'[C.Start_tijd_date], DIM_Date[LastWeek]))

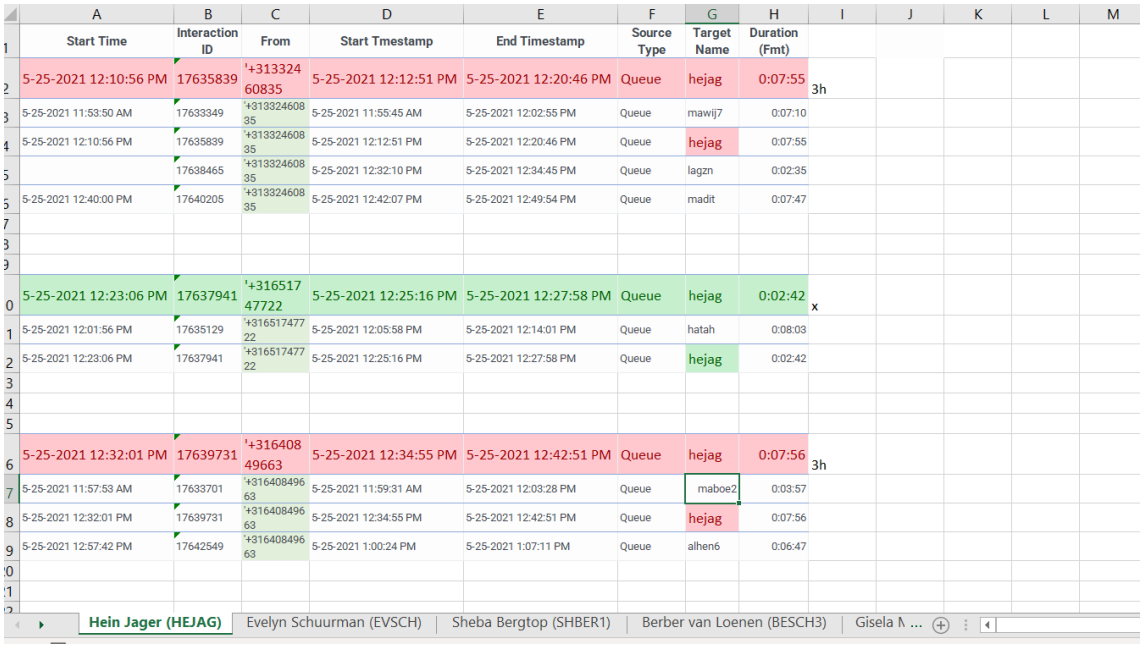
Count all calls

RC with RFC = CALCULATE(COUNT('Interaction&IRF&RFC'[C.Start_tijd_comb]), KEEPFILTERS('Interaction&IRF&RFC'[RFC.Reason] <> ""), KEEPFILTERS('Interaction&IRF&RFC'[Repeated Contact Type]<>"1st Call"), USERELATIONSHIP('Employee Target'[ET.Legacy ID],'Interaction&IRF&RFC'[Original.agent]))
RFC = CALCULATE(COUNT('Interaction&IRF&RFC'[C.Start_tijd_comb]), 'Interaction&IRF&RFC'[RFC.Reason] <> "", USERELATIONSHIP('Employee Target'[ET.Legacy ID],'Interaction&IRF&RFC'[Original.agent]))
Starttimes = CALCULATE(COUNT('Interaction&IRF&RFC'[C.Start_tijd_comb]))

Percentage all calls

% **RC with RFC of RCs** = DIVIDE([#RCwRFC], [#RC])

Appendix I Case study CR team 10



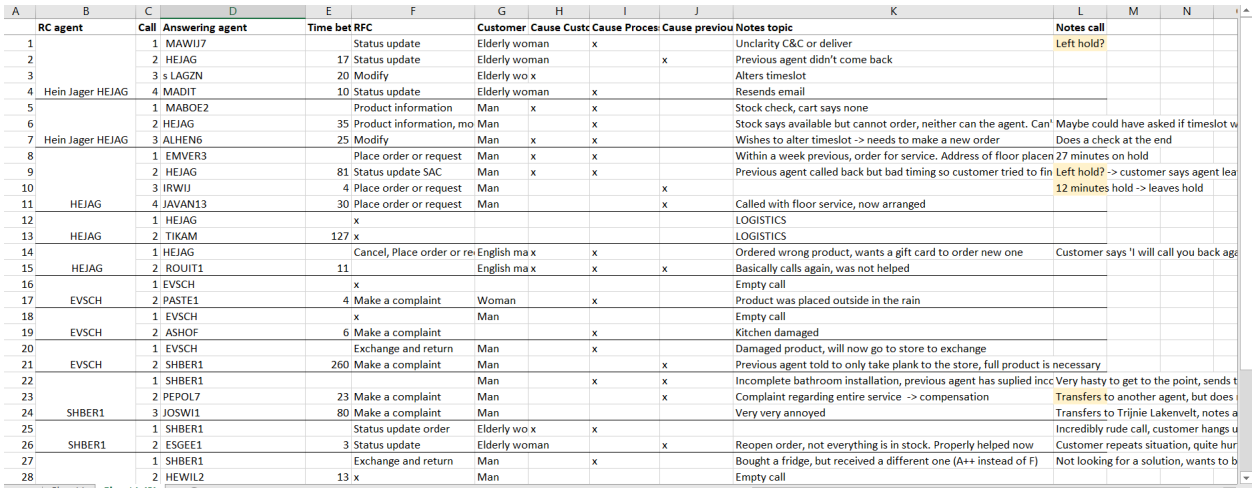
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Start Time	Interaction ID	From	Start Tmestamp	End Timestamp	Source Type	Target Name	Duration (Fmt)					
2	5-25-2021 12:10:56 PM	17635839	'+31332460835	5-25-2021 12:12:51 PM	5-25-2021 12:20:46 PM	Queue	hejag	0:07:55	3h				
3	5-25-2021 11:53:50 AM	17633349	'+3133246083 5	5-25-2021 11:55:45 AM	5-25-2021 12:02:55 PM	Queue	mawij7	0:07:10					
4	5-25-2021 12:10:56 PM	17635839	'+3133246083 5	5-25-2021 12:12:51 PM	5-25-2021 12:20:46 PM	Queue	hejag	0:07:55					
5		17638465	'+3133246083 5	5-25-2021 12:32:10 PM	5-25-2021 12:34:45 PM	Queue	lagzn	0:02:35					
6	5-25-2021 12:40:00 PM	17640205	'+3133246083 5	5-25-2021 12:42:07 PM	5-25-2021 12:49:54 PM	Queue	madit	0:07:47					
7													
8													
9													
10	5-25-2021 12:23:06 PM	17637941	'+3165174772 2	5-25-2021 12:25:16 PM	5-25-2021 12:27:58 PM	Queue	hejag	0:02:42	x				
11	5-25-2021 12:01:56 PM	17635129	'+3165174772 2	5-25-2021 12:05:58 PM	5-25-2021 12:14:01 PM	Queue	hatah	0:08:03					
12	5-25-2021 12:23:06 PM	17637941	'+3165174772 2	5-25-2021 12:25:16 PM	5-25-2021 12:27:58 PM	Queue	hejag	0:02:42					
13													
14													
15													
16	5-25-2021 12:32:01 PM	17639731	'+3164084966 3	5-25-2021 12:34:55 PM	5-25-2021 12:42:51 PM	Queue	hejag	0:07:56	3h				
17	5-25-2021 11:57:53 AM	17633701	'+3164084966 3	5-25-2021 11:59:31 AM	5-25-2021 12:03:28 PM	Queue	maboe2	0:03:57					
18	5-25-2021 12:32:01 PM	17639731	'+3164084966 3	5-25-2021 12:34:55 PM	5-25-2021 12:42:51 PM	Queue	hejag	0:07:56					
19	5-25-2021 12:57:42 PM	17642549	'+3164084966 3	5-25-2021 1:00:24 PM	5-25-2021 1:07:11 PM	Queue	alhen6	0:06:47					
20													
21													

Hein Jager (HEJAG) | Evelyn Schuurman (EVSCH) | Sheba Bergtop (SHBER1) | Berber van Loenen (BESCH3) | Gisela N ...

Figure 26: Hein Jager RCs

Agent	Calls handled	Total RCs		RC 3h		RC day	
HEJAG	19	5	26%	5	26%	0	0%
EVSCH	21	3	14%	2	10%	1	5%
SHBER1	22	3	14%	3	14%	0	0%
BESCH3	13	2	15%	1	8%	1	8%
GIMEE	6	0	0%	0	0%	0	0%
Average	16,2	2,6	14%	2,2	11%	0,4	2%
Total	81	13		11		2	

Figure 27: Overview CR team 10, 25th of May



	RC agent	Call	Answering agent	Time bet	RFC	Customer	Cause Custo	Cause Proces	Cause previou	Notes topic	Notes call
1		1	MAWIJ7		Status update	Elderly woman		x		Unclarity C&C or deliver	Left hold?
2		2	HEJAG	17	Status update	Elderly woman			x	Previous agent didn't come back	
3		3	s LAGZN	20	Modify	Elderly wo	x			Alters timeslot	
4	Hein Jager HEJAG	4	MADIT	10	Status update	Elderly woman		x		Resends email	
5		1	MABOE2		Product information	Man	x	x		Stock check, cart says none	
6		2	HEJAG	35	Product information, mo	Man		x		Stock says available but cannot order, neither can the agent. Can'	Maybe could have asked if timeslot w
7	Hein Jager HEJAG	3	ALHEN6	25	Modify	Man	x	x		Wishes to alter timeslot -> needs to make a new order	Does a check at the end
8		1	EMVER3		Place order or request	Man	x	x		Within a week previous, order for service. Address of floor placen	27 minutes on hold
9		2	HEJAG	81	Status update SAC	Man	x	x		Previous agent called back but bad timing so customer tried to fin	Left hold? -> customer says agent lea
10		3	IRWIJ	4	Place order or request	Man			x		12 minutes hold -> leaves hold
11	HEJAG	4	JAVAN13	30	Place order or request	Man			x	Called with floor service, now arranged	
12		1	HEJAG		x					LOGISTICS	
13	HEJAG	2	TIKAM	127	x					LOGISTICS	
14		1	HEJAG		Cancel, Place order or re	English ma	x	x		Ordered wrong product, wants a gift card to order new one	Customer says 'I will call you back aga
15	HEJAG	2	ROUIT1	11		English ma	x	x	x	Basically calls again, was not helped	
16		1	EVSCH		x					Empty call	
17	EVSCH	2	PASTE1	4	Make a complaint	Woman		x		Product was placed outside in the rain	
18		1	EVSCH		x	Man				Empty call	
19	EVSCH	2	ASHOF	6	Make a complaint			x		Kitchen damaged	
20		1	EVSCH		Exchange and return	Man		x		Damaged product, will now go to store to exchange	
21	EVSCH	2	SHBER1	260	Make a complaint	Man			x	Previous agent told to only take plank to the store, full product is necessary	
22		1	SHBER1			Man		x	x	Incomplete bathroom installation, previous agent has suplied incc	Very hasty to get to the point, sends t
23		2	PEPOL7	23	Make a complaint	Man			x	Complaint regarding entire service -> compensation	Transfers to another agent, but does
24	SHBER1	3	JOSWI1	80	Make a complaint	Man				Very very annoyed	Transfers to Trijnie Lakenvelt, notes a
25		1	SHBER1		Status update order	Elderly wo	x	x			Incredibly rude call, customer hangs u
26	SHBER1	2	ESGEE1	3	Status update	Elderly woman			x	Reopen order, not everything is in stock. Properly helped now	Customer repeats situation, quite hur
27		1	SHBER1		Exchange and return	Man		x		Bought a fridge, but received a different one (A++ instead of F)	Not looking for a solution, wants to b
28		2	HEWIL2	13	x	Man				Empty call	

Figure 28: Analysis RCs

Appendix J Questionnaire regarding use of the dashboard

1. **Performance expectancy**
   PE-1: I would find the dashboard useful in my job.
   PE-2: Using the dashboard would improve my job performance.
   PE-3: Using the dashboard would increase my productivity.

2. **Effort expectancy**
   EE-1: My interaction with the dashboard would be clear and understandable.
   EE-2: It would be easy for me to become skilful at using the dashboard.
   EE-3: I would find the dashboard easy to use.

3. **Social influence**
   SI-1: In general, the organization has supported the use of this dashboard.

4. **Facilitating conditions** *FC-1*: In have the resources necessary to use this dashboard.
   FC-2: A specific person (or group) is available for assistance with dashboard difficulties.
   FC-3: Using the dashboard fits into my work style.

5. **Attitude towards using technology**
   ATUT-1: I like the idea of using the dashboard.
   ATUT-2: The dashboard makes work more interesting.
   ATUT-3: The actual process of using the dashboard is pleasant.

6. **Self-efficacy**
   I could complete a job or task using the dashboard...
   SE-1: If there was no one around to tell me what to do as I go.
   SE-2: If I could call someone for help if I got stuck.
   SE-3: If I had a lot of time to complete the job for which the dashboard was provided.

7. **Behavioral intention to use the system**
   BI-1: I intend to use the dashboard in the next months.

Appendix K Evaluation results

Table 22: Evaluation numerical results

Question	Business Analyst	Business Analyst	Team manager CK&I	Development Specialist	Staff Planning (Operations)	Average
PE-1	5	5	5	5	5	5
PE-2	4	4	4	4	4	4
PE-3	3	4	5	5	4	4.2
PE						4.4
EE-1	4	4	5	5	4	4.4
EE-2	5	5	5	5	4	4.8
EE-3	4	4	5	5	4	4.4
EE						4.5
SI-1	5	5	5	4	5	4.8
SI						4.8
FC-1	5	5	5	5	5	5
FC-2	5	5	5	5	5	5
FC-3	4	4	5	4	5	4.4
FC						4.8
ATUT-1	5	5	5	5	4	4.8
ATUT-2	4	5	5	5	5	4.8
ATUT-3	4	5	5	5	4	4.6
ATUT						4.7
SE-1	4	5	4	4	4	4.2
SE-2	5	3	5	5	3	4.2
SE-3	3	1	5	5	3	3.4
SE						3.9
BI-1	5	5	5	5	5	5
BI						5
Average	4.35	4.35	4.88	4.76	4.29	4.53

Table 23: Evaluation comments

Function	Comment
Business Analyst	Add a Select all option in the filters could be useful Add some explanation boxes to reduce possible questions asked Some of the graph/line titles are hard to read. %RC3hOfAll. Maybe put more info in the title of the graph and then simplify in the legends. -> 3 hours, 1 day or 1 week. Some graphs are a bit small to show all legends/axis titles Some lines have more or less the same color (AHT team for example.). Makes it harder to read. All in all I think you did an amazing job Emma ! Very useful findings and report you build! I can only think of are some small layout things (as described above). Just to make it clearer for the audience that will use it.
Business Analyst	Can't wait to have more data included, such that we can use the dashboard! The dashboard gives insights we never had before, so I am very curious what we will find.
Team manager CK&I	I am a bit biased as I am the sponsor from MT, but I can honestly say that I think the dashboard and steering on the figures the dashboard show will make a significant impact on the steering of our co-workers on repeat contact and in steering the organization via the costs per RFC, now that we can enrich this data with AHT and repeat contact for the years to come.
Development Specialist	SI-1: yes, the organization has helped but it depends on what level you're looking at organization: not keeping the promise of providing the data at certain times didn't help with the dashboard.
Staff Planning (Operations)	This dashboard is very useful from forecasting point of view, till now there was only assumption on the repeat % however with this dashboard we will have concrete numbers. I really liked the detail of categorizing it by RFC reason codes, this will help us to also find resolution to decrease repeat calls.

Appendix L Reflection on professional functioning

Due to the corona situation, the process of graduating has been different from the start. Around the end of November/the beginning of December, I started looking for a bachelor assignment. Taking the current situation in mind, I figured that a large part of the companies might not be open to guiding an intern. Additionally, I was very interested in working for a larger company, since I was curious to how the communication within the department, but also with other parts of company would be. Since mainly the larger companies actually place their vacancies online, this matched very well. After extensive research into companies and functions I was interested in, among others I applied to the function of intern with the business analysts team of the CSC of IKEA. After an online interview I got a call with the positive news, and I was immediately very excited to start. The corona situation therefore did not affect my search for an assignment to much.

It did, however, affect doing the assignment itself. IKEA was closed throughout most of the time of the research, and when it did open, it was too far away to visit daily. Luckily, the team made great effort to keep connected while working at home. Four of the five days we had weekly daystarts, in which we either discussed our weekend, our current work/projects or just played some fun games. This way, I felt like I was part of the team without ever having met them in real life. The daystarts also helped me a lot to get behind my desk and get started. Although I am quite good at getting myself to work already, having someone to say goodmorning to each day helped a lot to get started. It was also simply obvious to be on time for these meetings, and I made sure to be so every time.

I really liked my direct team and colleagues. They were very welcoming from the start, and guided me into the operation. Even though I would only be with the company for a limited time, they never gave me the idea that I was not worth their time, but instead invited me for team activities such as an escape game as well. This made it easier for me to reach out with questions, but also to share my weekend and just laugh with each other.

I do think that it might have been easier to build a truly personal connection with the colleagues if the work was physical. The colleagues who were not in my direct team, I hardly spoke to at all, making it harder to reach out with questions. However, I noticed how seriously the Management Team took me during one of the focus group discussions when I presented my work up to that moment. That reminded me that I was working on a project which was truly interesting to them, which is why it did not feel like I was bothering them whenever I had a question.

I learned a lot on how to work with people in different teams and functions this way. One of the hardest aspects was the communication with the global team in Sweden. Having the complete automated dataset would have improved my product and assignment even more, but unfortunately it did not arrive on time. Although it did not fully succeed, I did learn how to put a bit more pressure by showing how important something is to you, and how to express this professionally.

Regarding the assignment itself, I can only say that I am very happy with how everything worked out. In the vacancy, they highlighted the required interest in Microsoft Excel and that they are working with Microsoft PowerBI. Since I like using Excel, and did enjoy working Tableau during the studies, I was also interested in PowerBI. Therefore, I already thought that I would like working on the assignment as well. Because of the great guidance at the beginning of the research, I never felt lost in the program, but was excited to find out more about the program and its functionalities. When my younger brother surprisingly had to make a small dashboard in PowerBI for his own studies, I was very happy to share my gained knowledge with him. This gives me more confidence that this might indeed be a field in which I want to work later.

Since the complete dataset still had not arrived when I was finished with the produced dashboard, I was a bit stuck. I could not do the detailed investigation using the data in the dashboard anymore because these calls were already deleted from Speechminer. Maybe it would have helped if I had put even more pressure on getting the data, but in the end I am happy that I found a way to avoid this problem, and get the required call information via another way.

I found the first period, during module 11, the hardest. Combining the lectures and assignments with working at the company was a bit confusing, since so many little projects and things to do were mixing together. At this point, I also did not have very clear yet what I was supposed to for both the university and the company. After a while, this became more clear, and the assignment really felt as my own personal project.

All in all, I am very happy with the assignment and everything that came with it. I am proud of the result I can now present!