IT related customer support
measurements from a different perspective

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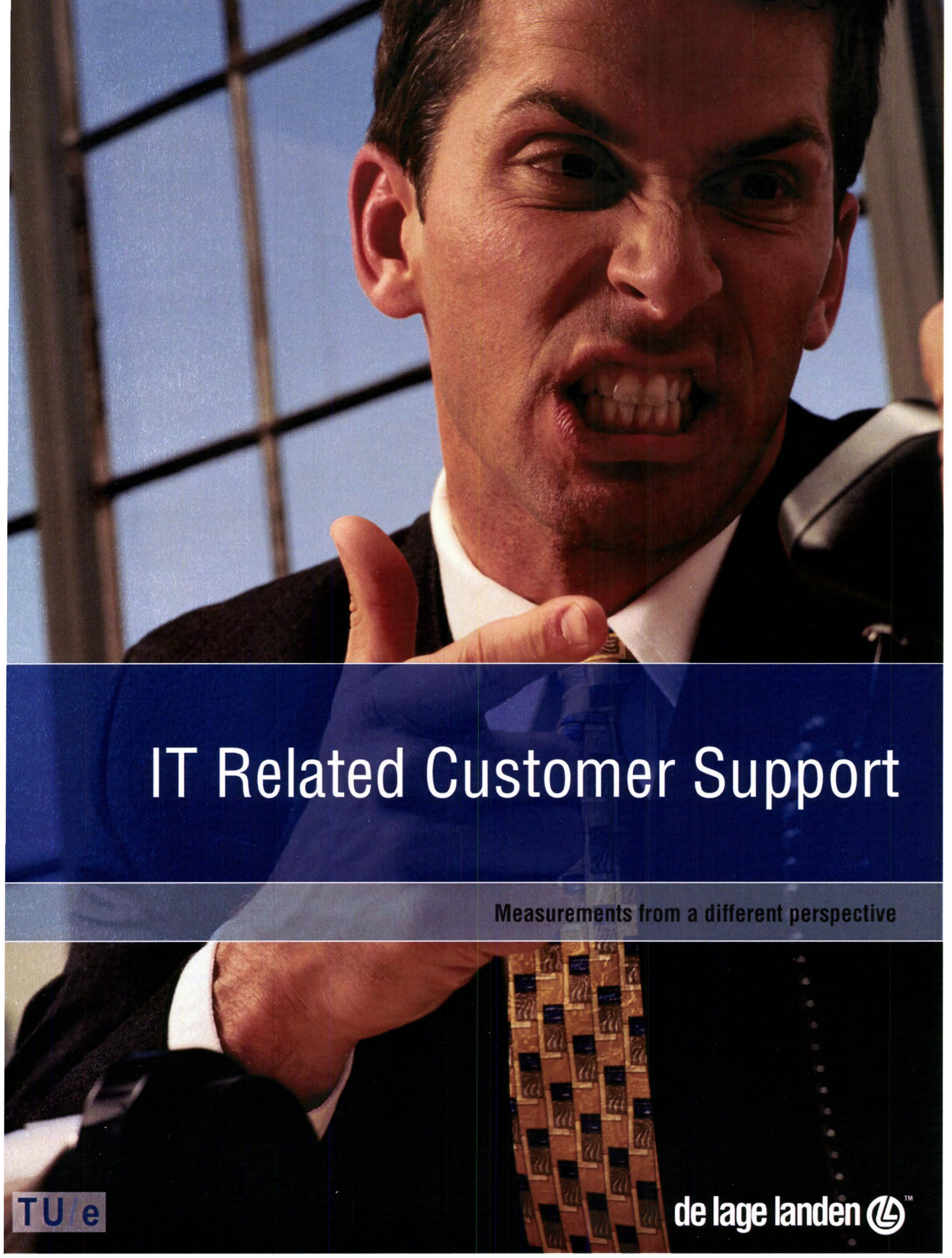

IT Related Customer Support

Measurements from a different perspective

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de lage landen

IT Related Customer Support,

Measurements from a different perspective.

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Abstract

This study describes a metrics program that is defined to provide better insights based on real life data. First of all the metrics give insights in the nature and origin of the service requests submitted to an IT related service desk. Secondly these give insights in aspects that do influence the request handling next to the incoming requests. These aspects are verified in several companies.

Preface

Several years ago in September 1999 I decided to start with the study Industrial Engineering and Management Science at the Eindhoven University of Technology, the Netherlands. It was a combination of a part time study program and a full time job. Quite often my family, friends and colleagues raised the question how I was able to combine a job with a study and a social life. The same question popped-up in my mind several times during the study. But at these moments the same people were supporting and encouraging me to continue.

The graduate assignment focused on my direct working environment within De Lage Landen International B.V. I would like to thank De Lage Landen and especially my company supervisor Mattie Smulders for his support. In addition I would like to thank Huib Burmanje, Liesbeth Mevissen and Mike Liauw for their willingness to help me in generalizing the results of this study. They are all working in a customer support environment within different companies. Furthermore I want to express my thanks to Michiel van Genuchten and Hajo Reijers as my supervisors of the university. For their support and valuable input, but also for being very understanding with regard to the fact that I combined a study with a full time job.

Last but not least I would like to thank my Saskia who is very important to me. She supported me al those years which was not always easy for her. Al those evenings and weekends she had to miss me! Of course I would like to thank Lars as well. My son who is 21 months old was asking a lot for his daddy, while I was studying.

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Eindhoven
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Management Summary

Introduction

De Lage Landen International B.V. provides asset-based financing products to help manufacturers, vendors and distributors. Applications are in place to facilitate business operational processes around these products. People that are using these applications can contact a service desk if they need support. De Lage Landen organized this IT related Customer Support decentralized. Customers have to contact different service desks for application related support or i.e. office related support. This study focuses on application support in a sales and credit environment. This Front Office area is supported by a separate service desk.

There is a lack of insight in the requests that are submitted to this service desk and in aspects that will influence the handling of these requests. Customers often expect that their requests will be handled immediately or at least in a very short time frame. These expectations cannot always be met. A thorough analysis has to provide better insights that can be used to define improvements regarding customer support. A study to provide better insights has been performed by order of De Lage Landen. The objectives of this study are summarized below:

- *Provide insights in the nature and origin of the submitted requests.*
- *Provide insights in factors that will influence the handling of submitted requests.*
- *Define improvements and recommendations based on these insights.*
- *Estimate the impact of the improvements and verify these estimations in practice whenever possible.*
- *Verify whether the outcomes are De Lage Landen specific or can be generalized to other companies as well.*

Research methodology

A quick scan has been executed to get a first impression of the situation. A metrics program has been defined based upon the results of this quick scan. A systematic approach called the Goal-Question-Metric paradigm [3] is used to define the metrics. Two goals have been taken into account that are both related to the process of handling service requests (Incident & Problem Management process). These goals focus on the process input and not on the process itself. Figure 1 shows service requests as process input. Metrics have been defined to give insights in these incoming requests. Other metrics have been defined to find out whether more input factors exist as well. An overview of all these metrics is given in Table 1.

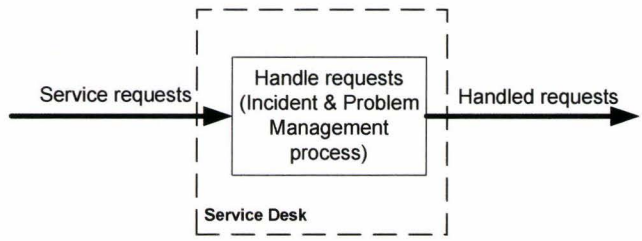


Figure 1: Process of handling service requests

Table 1: Defined metrics

Goal		Question		Metrics	
G1	A better understanding of the nature of all service calls	Q1.1	What kind of service calls can be distinguished?	M1.1.1	Average number of standard changes
				M1.1.2	Standard deviation of this average
				M1.1.3	Classes of standard changes
				M1.1.4	Average number of incidents
				M1.1.5	Standard deviation of this average
				M1.1.6	Classes of Incidents
G2	Insights in factors that influence the call handling process	Q2.1	Does a relation exist between the number of hours spent to resolve a service call and the throughput time?	M2.1.1	Effort spent per service call.
				M2.1.2	Throughput times per service call.
		Q2.2	Has the channel via which service calls are submitted any influence on the throughput time?	M2.2.1	Possible input channels
				M2.2.2	Throughput time per service call per channel
		Q2.3	Does a relation exists between the input channel used to submit requests to the service desk and the country the requestor is working in?	M2.3.1	Serviced countries.
				M2.3.2	Categories per country
				M2.3.3	Input channels per country.

Results

The analyses of the incoming service requests revealed the nature of these requests. They can be divided into two major categories, standard changes and incidents. Almost 60% of all requests are categorized as standard changes. A standard change is a request that normally requires routine actions that can be handled by the service desk employees themselves. Almost 40% of all requests are categorized as incidents. An incident is a disruption experienced by the customer. Sometimes these can be resolved by the service desk employees, but often experts have to handle these calls. Both standard changes and incidents have been analyzed in more detail as well. Different classes of standard changes and incidents have been determined.

Three questions have been defined to get insights in factors that will influence the call handling process (Table 1). The first one is about a relation between the number of hours spent to resolve a request and the throughput time of the request. A relation between both variables exists for standard changes only. Service desk employees will use the characteristics of standard changes in terms of effort to determine the handling order. For incidents such a relation does not exist.

The second question focuses on the influence of an input channel on the throughput time. The input channel used by the customer to submit a request to the service desk will influence the process output in terms of throughput time. Figure 2 shows the different input channels and the throughput times per input channel. The telephone is the best channel to use if a request has to be handled fast. If a customer finds out it can influence his or her media choice.

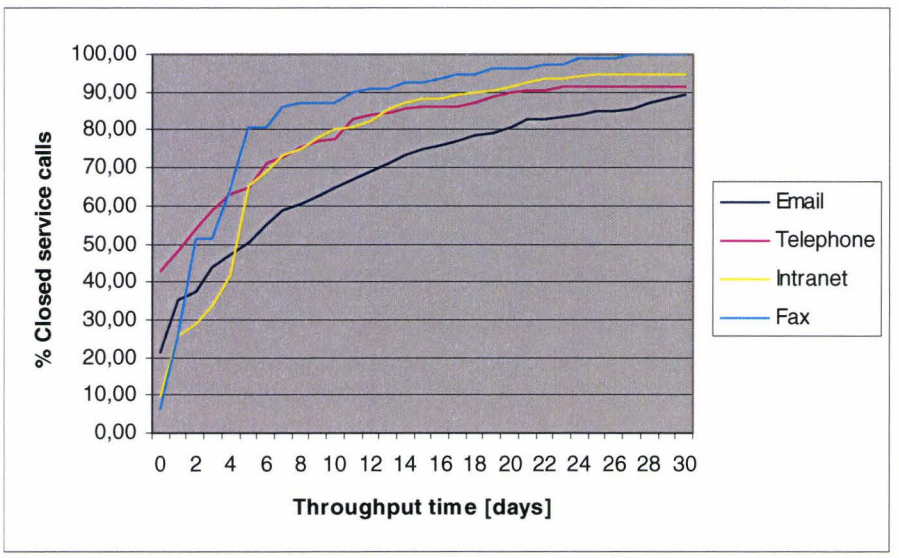


Figure 2: Throughput times per input channel

The last question asks whether a relation exist between the used input channels and the country the customer is working in. This relation exists. Input channels are used differently across Europe. A questionnaire revealed that customers across Europe also prefer different input channels. The same questionnaire showed that the type of request will influence the media choice as well.

The results as described above are visualised in Figure 3.

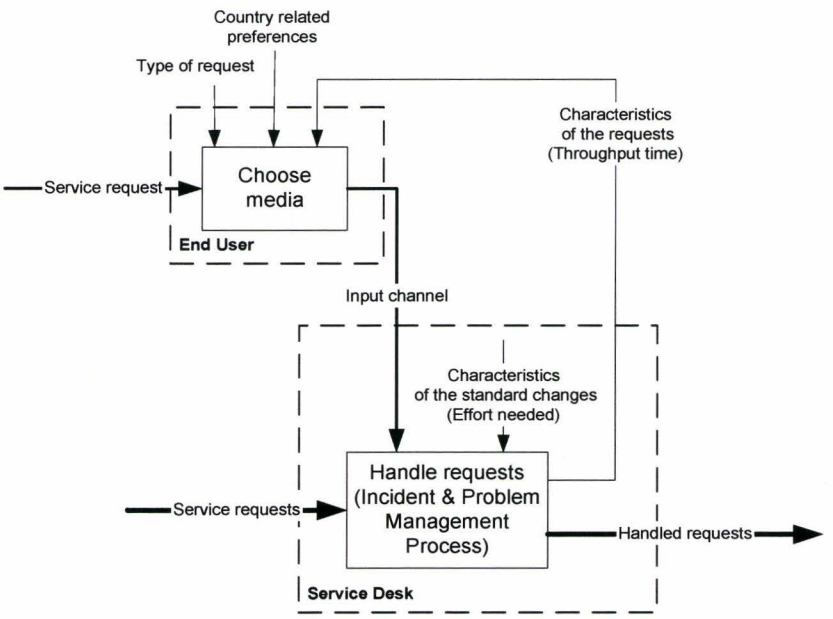


Figure 3: Process inputs

The analyses were performed within De Lage Landen. To find out whether the results are applicable for other companies as well three companies were visited. All provide financial services. Table 2 shows which questions can easily be answered because of the availability of the defined metrics.

Table 2: Availability of the metrics in other companies

Company	Q1.1	Q2.1	Q2.2	Q2.3
De Lage Landen	✓	✓	✓	✓
Insurance company 1	✓	×	×	*n/a*
Insurance company 2	✓	×	✓	*n/a*
Bank 1	✓	×	×	*n/a*

✓ : ***Metrics available***
× : ***Metrics not available***
n/a : ***Not applicable***

An analysis of the incoming service requests can be done in every company. The results are dependent of the domain and will be company specific. The relation between the effort needed to resolve a call and the throughput time cannot be analysed since the required data is not directly available. The influence of an input channel on the throughput time could only be analysed within insurance company 2. Here also the telephone is the best performing input channel. The last question regarding the countries is not applicable because all visited support organisations are focused on the Dutch market only.

Conclusions & Recommendations

The study results in some major findings regarding IT related customer support:

- ***A metrics program can provide better insights:***
  The program performed in the context of this study showed that not only incoming service requests have to be considered as process input. Aspects like input channel and effort are inputs as well.

- ***The media choice is based on multiple factors***
  The media choice is important because the chosen input channel will influence the throughput time. This choice is influenced by the type of request and by the preference of a customer. The media choice can be affected by the throughput time if a customer finds out that he can better use a specific input channel like i.e. the telephone. This will create a feedback loop that makes it more difficult to control the process output

- ***The input channel influences the throughput time:***
  The input channel is determined by the media choice of the customer. The channel that will be chosen has impact on the throughput time. In fact the telephone is the best performing input channel.

- ***Improvements can be realised based upon the insights provided by a metrics program:***
  An efficiency improvement has been realized for a specific standard change. This improvement will probably result in a decrease of 22% in incoming service requests. It will also result in fewer activities for the service desk employees. These savings have been estimated on 9 hours a month. The estimations have not been verified in practice.

- **Not all results could be generalized:**
  The question whether the results of the analyses are De Lage Landen specific could only be answered partially. Some results are company specific. Some are applicable for in a broader perspective while others could not be generalized because data was not available or because the results were not applicable at all.

The following recommendations can be given based on the outcomes of this study:

- ***De Lage Landen should continue with metric programs:***
  Improvements can be defined based upon the outcomes of such programs. The expected results the improvements will realize should be verified in practice and reported towards management. This will create management commitment and gives opportunities for other programs.

- **De Lage Landen should define the requirements they have regarding a support application and determine whether the current system covers these requirements:**
  The current application has little flexibility and insufficient reporting possibilities. Sufficient reporting possibilities i.e. are a pre-condition for the success of future metric programs.

- **De Lage Landen should pay more attention to the media choice of the customer:**
  This can prevent a feedback loop that will influence the media choice of the customer. Such a feedback loop will make it more difficult to control the process output. The media choice can also be influenced proactively i.e. to promote a specific input channel. The usage of a structured and asynchronous input channel should be promoted above a synchronous input channel like the telephone.

- ***De Lage Landen should define clear priority mechanisms:***
  A clear priority mechanism will result in an unambiguous order in which the requests have to be handled.

1 Introduction

The IT Europe department of De Lage Landen International B.V. is organized in a matrix structure and is based on four different service lines (Refer to Appendix II for more detailed information). Every service line has its own responsibilities in serving the business with the development of new services and the maintenance of existing ones. This master thesis focuses on the maintenance part and the problems that arise in this area, especially in the Front Office service line.

1.1 Problem definition

The service desk of the Front Office registers each month a lot of service calls. There is an expectation that all these service calls will and can be closed within a short period of time. Unfortunately these expectations are not based on an analysis of the maintenance area. The maintenance area includes a service desk and a software maintenance team. So a thorough analysis is necessary in order to give better insights in the situation. Based on this, the following problem description has been defined:

There is a lack of insight in the nature and origin of the requests submitted to a service desk on an IT related customer support department of De Lage Landen International B.V. Furthermore there is no insight in possible aspects that influence the call handling.

1.2 Objectives

Better insights should be provided by an analysis of the situation in the Front Office service line. Based on these insights recommendations have to be defined to improve the customer service on the one hand and to set realistic expectations on the other hand. The outcomes of the analyses will be generalized to other companies as well. In other words, do other companies deal with the same issues in a customer service area?

This can be summarized as follows:

- *Provide insights in the nature and origin of the submitted requests.*
- *Provide insights in factors that will influence the handling of submitted requests.*
- *Define improvements and recommendations based on these insights.*
- *Estimate the impact of the improvements and verify these estimations in practice whenever possible.*
- *Verify whether the outcomes are De Lage Landen specific or can be generalized to other companies as well.*

1.3 Outline

The theory regarding IT related customer support is explained in chapter 2. Different models describe the context of customer support. Furthermore the different support lines are discussed as well. The way IT related customer support is provided within De Lage Landen is described in chapter 3. This description gives the most common support processes within the IT Department of De Lage Landen. Next to that it focuses in more detail on the Front Office Service Line. The research methodology is given in chapter 4 together with a short explanation of the Goal-Question-Metric paradigm. Furthermore the metrics are given as defined according to this paradigm. The analyses of these metrics are discussed in chapter 5 together with the analysis of a questionnaire. Improvements have been defined based on some of the outcomes of these analyses. These are given in chapter 6. The analyses focused on De Lage Landen. The results however are validated within some other companies as well. Two insurance companies and one bank have been visited in order to generalize the results. This is described in chapter 7. Finally the conclusions and recommendations are given in chapter 8.

2 IT related Customer Support

Customer support is often provided by means of a service desk. This is the single point of contact for the customers. Other processes and activities are important as well to provide the desired service level. However these are less visible for the customer. The complete context of customer support is explained in section 2.1. The different support lines are described in more detail in section 2.2.

2.1 Customer Support Context

The Corrective Maintenance Maturity Model (CM^3) [9] describes the organizational roadmap as depicted in Figure 4. It gives the most common constellation of support organizations today. Front-end support (also referenced as upfront maintenance) is delivered towards the customer. The requests that cannot be solved directly by front-end support will be passed to back-end support.

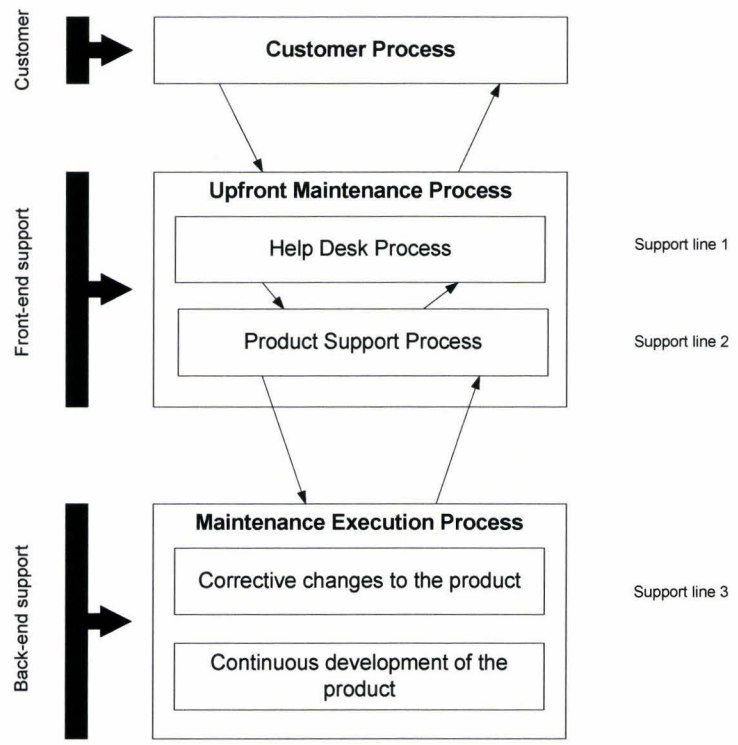


Figure 4: CM^3 Roadmap

The same processes are described in the Software Maintenance Maturity Model (SM^{mm}) [1]. Again upfront maintenance is in place while back-end support is referenced as application software maintenance. This model describes the support context in a broader perspective since software development, computer operations and suppliers are mentioned as well. This model presents a complete customer support context diagram.

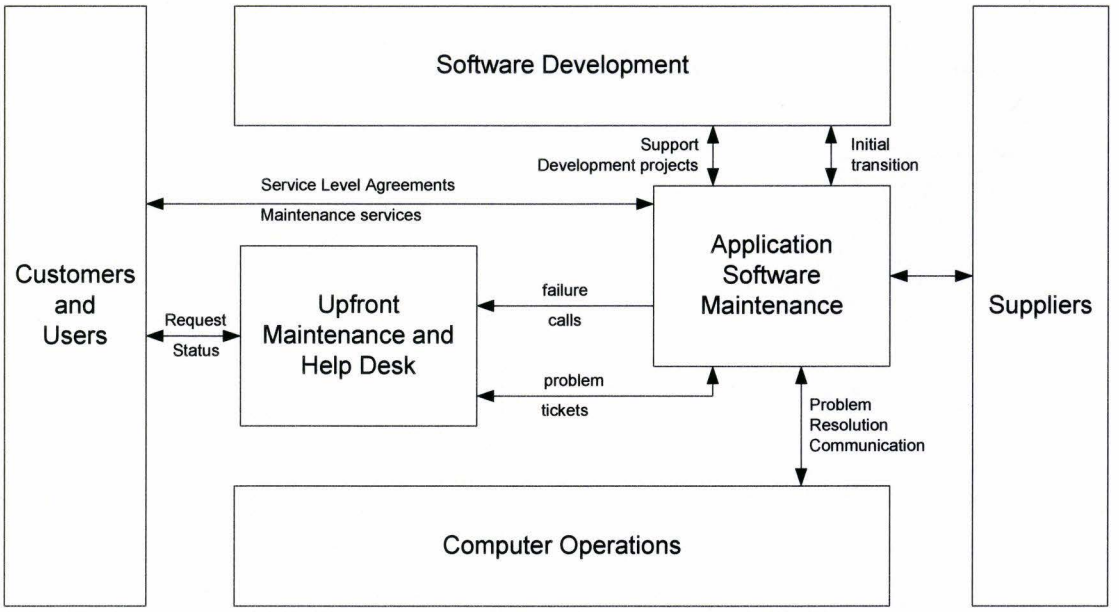


Figure 5: Software Maintenance context diagram

2.2 *Different support lines*

The different support lines are depicted in Figure 4. The 1st line support is provided by a service/help desk. They act as a central reference and interface for the customer to log and track any issues that arise. [7]. Customers can contact the service desk via different communication channels like i.e. telephone and email. Especially calls submitted via telephone require some extra attention. Call centre processes have to be in place to ensure a proper handling of incoming telephone calls.

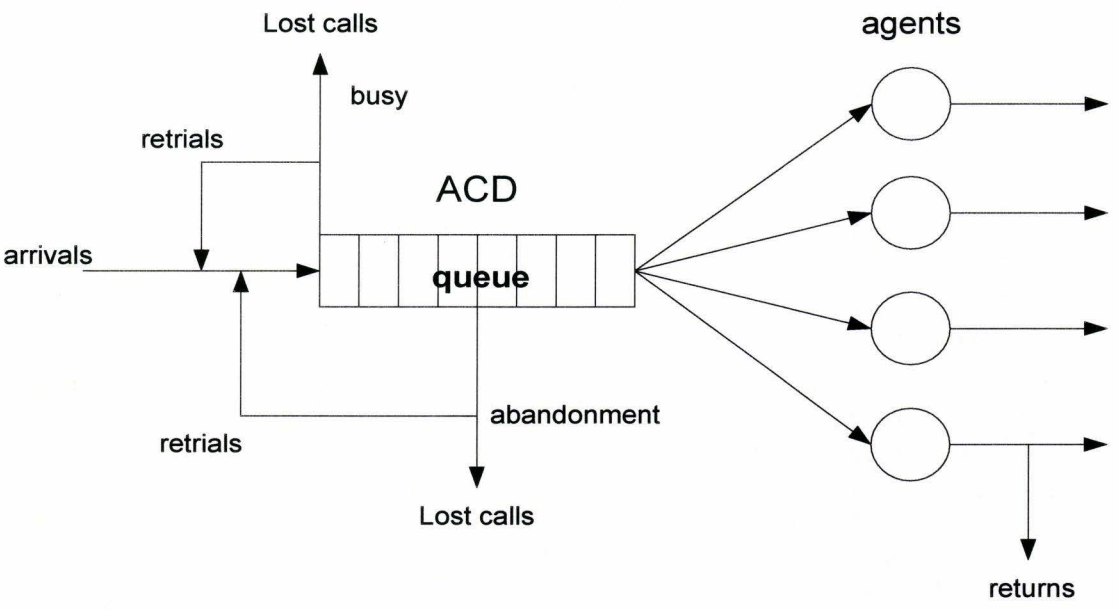


Figure 6: Representation of a simple call center process

Figure 6 gives a representation of a simple call centre process [10]. Calls can either be handled by an agent or lost because of multiple causes.

The 2nd line support is provided by support engineers that are more competent with respect to the supported products [9].

The 3rd line support is provided by experts. Within the software domain 3rd line support is often referenced as software maintenance. According to the IEEE standard for software maintenance [6] the definition of software maintenance is: *"Modification of a software product after delivery to correct faults, to improve performance or other attributes, or to adapt the product to a modified environment."* The figure below gives an overview of the maintenance categories as mentioned in the definition above.

	Correction	**Enhancement**
Proactive	Preventive Maintenance	Perfective Maintenance
Reactive	Corrective Maintenance	Adaptive Maintenance

Figure 7: Software maintenance categories

The 3rd line support mainly focuses on corrective maintenance. The same IEEE standard [6] defines corrective maintenance as follows:
"Reactive modification of a software product performed after delivery to correct discovered faults".

Customer support requires all three support lines. This does not necessarily mean that every support line is represented by a separate group of people. Kajko Matsson [9] describes different service desk constellations. The constellation has influence on delivered support [8, 9]. A service desk can i.e. act as a call center where agents only register and track calls (1st line support). It can act as a skilled service desk where simple issues are resolved by the service desk agents as well (1st and 2nd line support). And it can act as an expert service desk where specialists handle all calls themselves (1st, 2nd and 3rd line support).

3 IT related customer support within De Lage Landen

Customer support is provided in several areas. External customers of De Lage Landen are supported in their processes by i.e. sales support. But sales support is not always a service provider, quite often they are customer as well. The staff department IT Europe is a service provider towards i.e. sales support. Moreover, it is a service provider for all departments within De Lage Landen. The most important support processes for IT Europe are described in section 3.1. Since this study focuses on the Front Office Service Line, the support processes for this Service Line are explained in section 3.2.

3.1 The IT Europe customer support processes.

Two main processes to serve the customers are in place within the IT Europe department of De Lage Landen. The first one is the Incident and Problem Management process that focuses on several different service requests, like:

- Incidents
- Requests for information
- Standard changes

The second one is the Change Management process that focuses on changing existing or implementing new functionality. Two different kind of changes are distinguished in this process:

- Small changes (changes that will take less than 20 days to implement)
- Large changes (changes that will take 20 days or more to implement)

Customers can contact a service desk for any incidents, requests for information and standard changes. For small and large changes they cannot, because these will be handled completely different. Only requests entered via the service desk are in scope of this thesis.

The IT Europe department of De Lage Landen is organized in a matrix structure. (Appendix II). Four service lines exist within this department that are all supported in their daily business by other entities, like i.e. processes, professional services, architecture and IT Utilities. Every service line has its own service desk and maintenance activities to offer 1st, 2nd and 3rd line support. Of all different support-line constellations described by Kajko Mattson [9], the one as depicted in Figure 8 is the best reflection of how support via the service desks is organized.

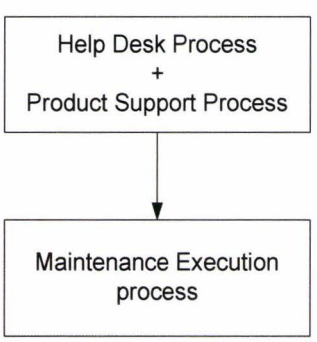


Figure 8: The support-line constellation within De Lage Landen

The service desk (also referenced as help desk) provides 1st and 2nd line support while 3rd line support is provided by a separate team of software or infrastructural experts.

The customer support activities can and will differ between the four service lines within IT Europe. The Front Office service line will be described in depth only. The other service lines do have similarities on high level, but will differ in detail.

3.2 The Front Office customer support processes

The Front Office Service Line supports sales and credit related activities. Custom made applications are in place to support the customers in their daily work. The customer support process as applicable for the Front Office Service Line is depicted in Figure 9. It is represented by a flowchart. A flowchart is commonly used for a graphical representation of a process. This technique is used to describe all the IT related processes within De Lage Landen as well. The status descriptions are added in order to explain the workflow. All process steps are identified with numbers and are explained in Table 3.

Table 3: The process steps of the customer support process

ID	Executer	Activity	Description
1	Customer	Request for service	A customer that has a service request can contact a service desk to get supported. This service desk can be contacted using the following media: ❑ Telephone ❑ Email ❑ Intranet ❑ Fax
2	Customer Support Specialist	Register	The service request will be handled by a Customer Support specialist. All necessary information will be registered in a tool called HP Openview. The customer will receive an automatic email with the unique identification number of his or her request.
3	Customer Support Specialist	Categorize & Prioritize	Every service request (also referenced as service call) will be categorized. The following categories are applicable: ❑ Incident ❑ Standard Change ❑ RFI (Request for information) Next to that every service call gets a priority. The different priorities will be redefined and these are not described in detail
4	Customer Support Specialist	Question	Question whether a service call is an incident or a standard change? **Yes**: process step [5]: *Investigate & Diagnose* **No:** Process step [14]: Verify *standard change*
5	Customer Support Specialist /Developer	Investigate & Diagnose	The incident has to be investigated to find out what happened and how the incident or problem can be resolved. Both the 2nd and the 3rd support line can perform this activity, depending on the incident. *Note: The Customer Support Specialists (2nd support line) will always perform an initial investigation. They will involve the developer(s) whenever necessary. In this situation they will delegate the execution.*
6	Customer Support Specialist	Question	Question whether the Investigation & Diagnose

ID	Executer	Activity	Description
	/Developer		could be performed successfully or whether extra information is necessary? **Yes**: process step [7]: *Contact Customer* **No:** Process step [14]: *Resolve & Recover*
7	Customer Support Specialist /Developer	Contact customer	Extra information from the customer is needed and therefore he or she will be contacted. Email as well as telephone will be used to contact the customer
8	Customer Support Specialist /Developer/ Operation Specialist	Resolve & Recover	It is clear what caused the incident or problem. A solution has to be implemented, a workaround has to be communicated or a system recovery has to be executed. *Note: Only a system recovery has to be performed by an operation Specialist (System Administrator)*
9	Developer	Question	Question whether the software has to be changed in order to resolve the incident or problem? **Yes**: process step [10]: *Deliver software patch* **No:** Process step [14]: *Confirm (by customer)*
10	Developer	Deliver Software patch	A software patch has to be delivered in order to resolve the incident or problem. *Note: This process step encompasses another process regarding deployment. This process isn't described in detail. It is about the flow a patch follows until it is installed successfully on the production environment (via the acceptance environment)*
11	Developer	Question	Question whether the software patch is installed successfully? **Yes**: process step [12]: *Confirm by customer* **No:** Process step [10]: *Deliver software patch*
12	Customer	Confirm	The customer has to confirm whether the resolution is conform expectations and whether the problem he or she experienced is really solved.
13	Customer Support Specialist /Developer	Question	Question whether the customer confirmed that his or her problem is solved. **Yes**: process step [18]: *Close & Inform* **No:** Process step [8]: *Resolve & Recover*
14	Customer Support Specialist	Verify request	The request is verified in order to find out whether all necessary information is available.
15	Customer Support Specialist	Question	Question whether the request is clear or whether more information is needed from the customer **Yes**: process step [16]: *Implement* **No:** Process step [17]: *Contact Customer*
16	Customer Support Specialist	Implement/ handle	Implement or handle the request.
17	Customer Support Specialist	Contact customer	Extra information from the customer is needed and therefore he or she will be contacted. Email as well as telephone will be used to contact the customer
18	Customer Support Specialist	Close & Inform	The customer will be informed about the fact his or her request is handled. Afterward the service call will be closed. *Note: The customer is not always informed as it is possible that he or she is already contacted to confirm the solution, workaround or system recovery.*

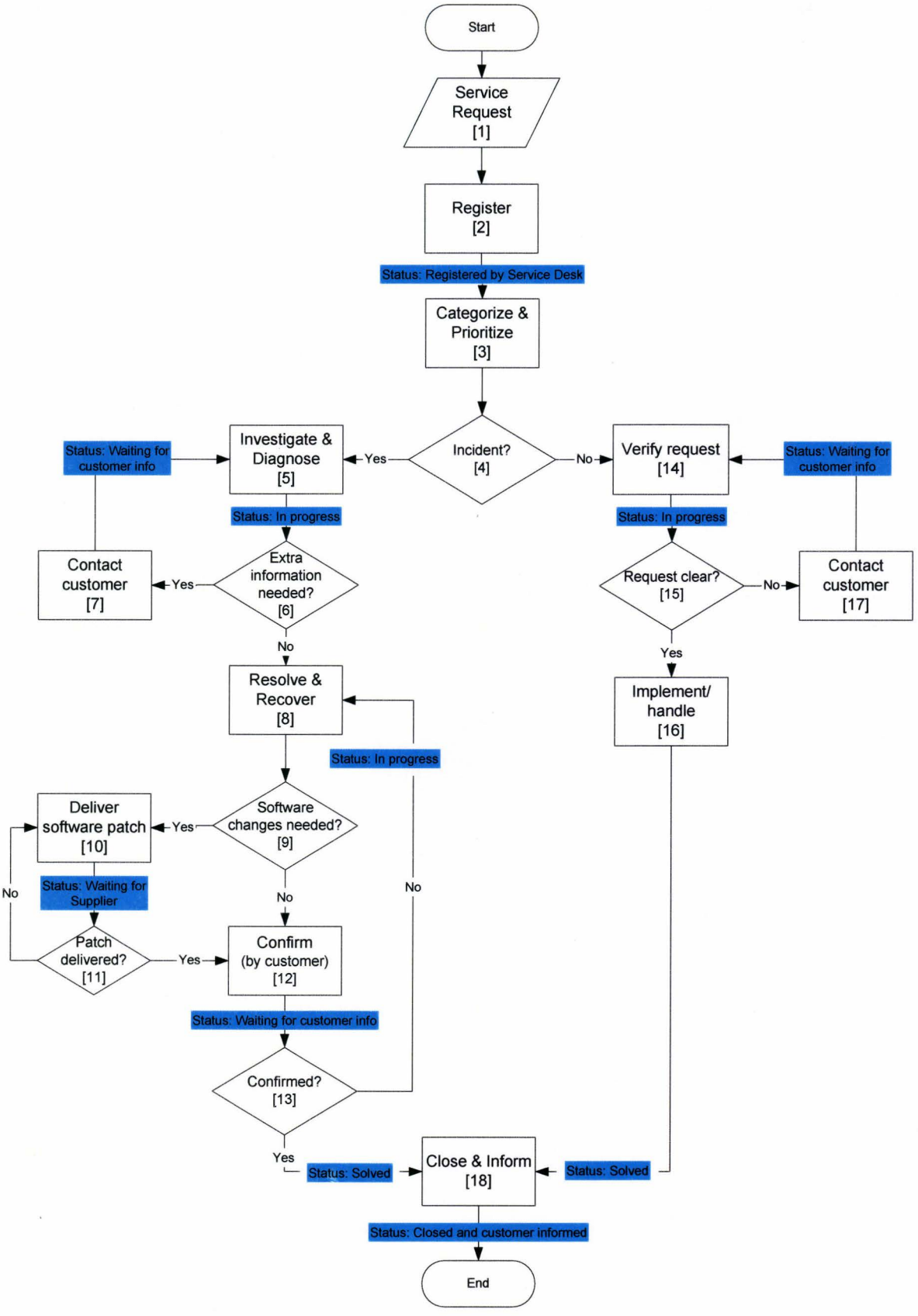


Figure 9: Customer support process

4 Research methodology

The research model is described in section 4.1. Afterwards the Goal-Question-Metric paradigm is explained. This paradigm was used to define a set of metrics that has to give better insights.

4.1 Research Model

A quick scan was performed to get a high level view of the situation. The research model as depicted in Figure 10 is based on the outcomes of this quick scan.

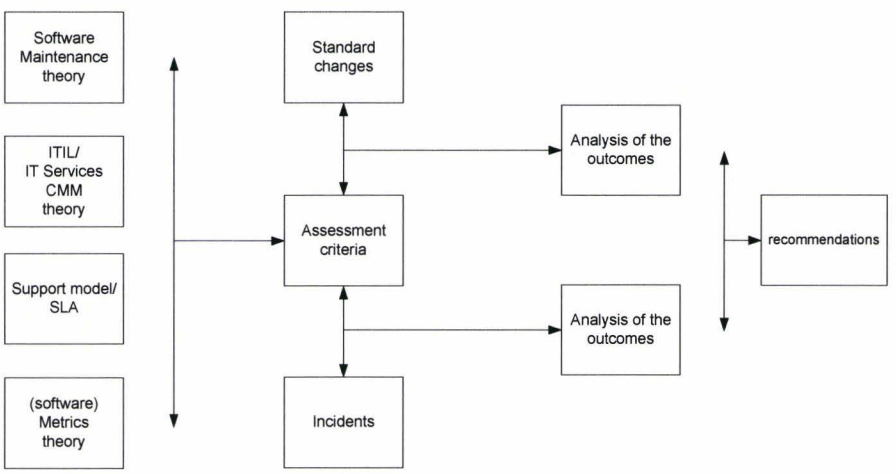


Figure 10: Research model [16]

The agreements made regarding the required service levels, the model used to deliver this service and scientific literature will result in assessment criteria. These criteria will be used to analyse two types of service calls, standard changes and incidents. Comparing the outcomes of the analyses will result in recommendations to improve the process of handling service requests.

The next step was to gather more detailed data (metrics) about the two different categories of service calls mentioned in the research model. One of the pitfalls in metrics programs is to start measuring what is the most convenient or easy to measure [5]. This can result in a situation where the results are not always related to the research objectives. A goal oriented approach named the Goal-Question-Metric (GQM) paradigm [3] was used to prevent such a situation.

4.2 The Goal-Question-Metric paradigm

The GQM paradigm represents a systematic approach for tailoring and integrating goals to models of the software processes, products and quality perspectives of interest, based upon the specific needs of an organization [3]. This approach provides a framework involving the following steps [5]:

- List the major goals of the development or maintenance project
- Derive from each goals the questions that must be answered to determine if the goals are being met
- Decide what must be measured in order to be able to answer the questions adequately

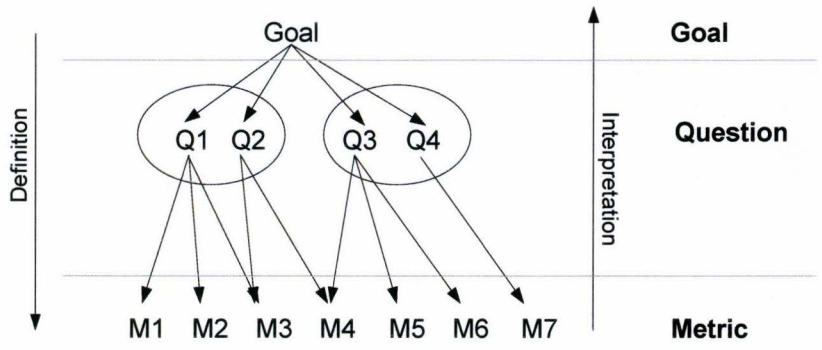


Figure 11: The Goal Question Metric paradigm

Figure 11 shows a graphical representation of the GQM-paradigm. A more detailed description of this paradigm is given by Rini van Solingen and Egon Berghout [15].

A first set of metrics was discussed with the stakeholders and it seemed to be a very extensive one. This brings along the risk that a lot of effort is put in gathering data while the relevance is not really clear for all of it. Therefore it was agreed upon to define only a limited set of questions and metrics of which the relevance is clear. These metrics are described in Table 4.

Table 4: Defined metrics

Goal		Question		Metrics	
G1	A better understanding of the nature of all service calls	Q1.1	What kind of service calls can be distinguished?	M1.1.1	Average number of standard changes
				M1.1.2	Standard deviation of this average
				M1.1.3	Classes of standard changes
				M1.1.4	Average number of incidents
				M1.1.5	Standard deviation of this average
				M1.1.6	Classes of Incidents
G2	Insights in factors that influence the call handling process	Q2.1	Does a relation exist between the number of hours spent to resolve a service call and the throughput time?	M2.1.1	Effort spent per service call.
				M2.1.2	Throughput times per service call.
		Q2.2	Has the channel via which service calls are submitted any influence on the throughput time?	M2.2.1	Possible input channels
				M2.2.2	Throughput time per service call per channel
		Q2.3	Does a relation exists between the input channel used to submit requests to the service desk and the country the requestor is working in?	M2.3.1	Serviced countries.
				M2.3.2	Categories per country
				M2.3.3	Input channels per country.

5 Measurement results

This chapter starts with a description of the results of the quick scan. Afterwards the analyses of the metrics are described in section 5.2. Every question is represented by a separate sub section that describes the analyses and ends with a discussion part. Finally the user experiences that have been captured by means of a questionnaire are described in section 5.3.

5.1 Quick scan

A quick scan has been performed to get a first insight in the situation. This quick scan was based on data that was registered as from the 1st of October 2004 until the 31st of March 2005. The results of this quick scan are shown in Table 5.

Table 5: Basic figures regarding service calls

Month	Registered service calls			
	# calls	# days	avg./day	Std
October	283	21	13.48	7.49
November	213	22	9.68	3.51
December	241	23	10.48	5.04
January	270	21	12.86	5.29
February	249	20	12.45	6.74
March	265	23	11.52	4.39
Total	**1521**	**130**	**11.70**	**5.79**

These results show differences between the number of calls that are registered each month. Next to that, the standard deviation shows that the dispersion is considerable. That is, the number of registered service calls can differ one day or the other. Figure 12 shows that differences exist on a weekly basis as well.

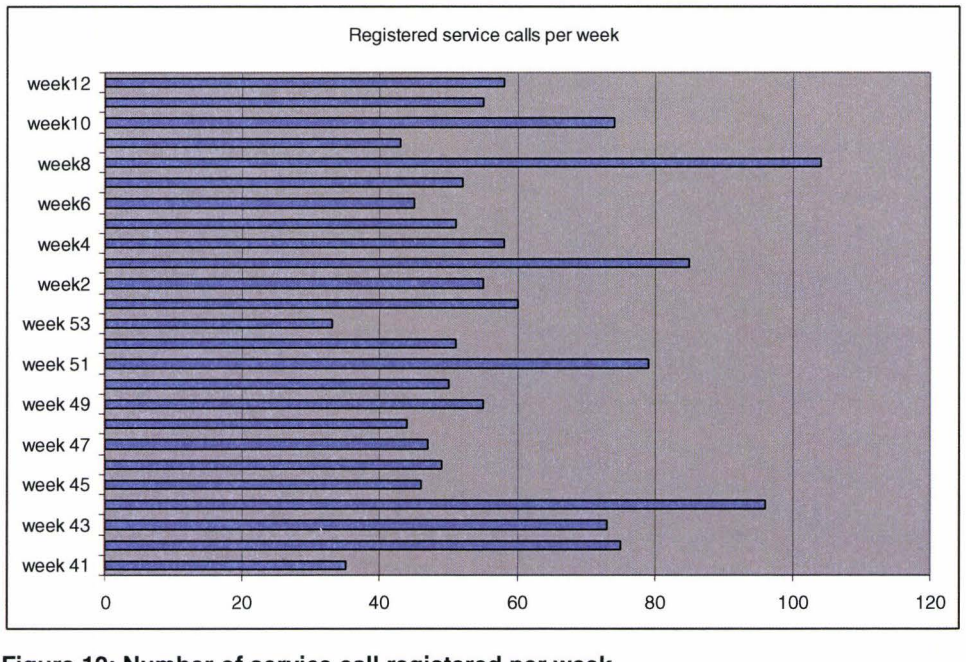


Figure 12: Number of service call registered per week

All service calls are categorized with one of the categories as described in Table 6. Unfortunately the categorisation was not always applied correctly. In order to get a reliable picture of the situation all service calls had to be verified manually. The verification of 1521 service calls would take too much time. Therefore only the service calls registered in February 2005 have been categorized once again.

Table 6 : Overview of all categories

Category	Description
Incident	Currently no distinction is made between problems and incidents. Every service call categorized as 'incident' means a process disturbance.
Request for change	A request to implement new functionality or to change existing functionality.
Request for information	System related questions.
Standard change	Standard work requests that can be implemented by the Customer Support Specialists themselves

The distribution of the service calls amongst these categories is depicted in Figure 13.

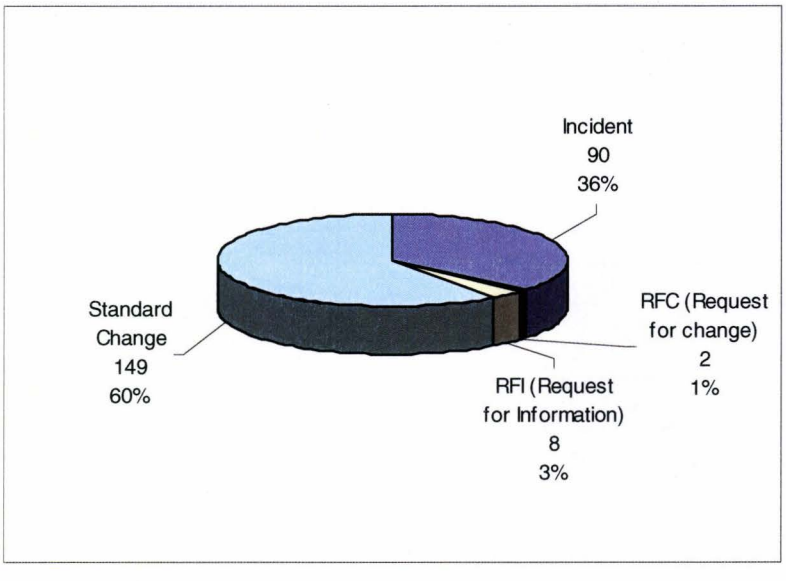


Figure 13: Categorisation of the service calls registered in February 2005

Two categories contain together more than 95% of all registered service calls. These are standard changes and incidents. For this reason, the metrics as defined in the previous chapter will focus on these two categories.

5.2 Analysis

Not all metrics as defined in Table 4 can be extracted directly out of the application used to register service calls (HP OpenView Service Desk). For this reason data is exported to Excel for further analysis. Some data could only be gathered by looking manually in every single service call which makes this exercise very time consuming. Therefore the analysis as described in this chapter is based on information gathered in the months February, July and September 2005. The assumption is made that the service calls registered in these months are representative for all calls registered in 2005. This assumption is subjected to the fact that seasonal influences as well as the delivery of changes will not distort the data set. First of all seasonal influences are available, but on a monthly basis. These influences are caused by the fact that customers have targets to meet at the end of every month. As a consequence the

Front Office systems are used more heavily at the end of each month. Possible effects of these peak moments are covered because data is gathered for complete months only. Other seasonal influences like the summer holiday period could have impact as well. The number of incoming service requests in July was almost the same as in February. In September this number decreased just a little. Therefore it is assumed that the summer holiday period did influenced the data in July and September. Secondly the delivery of changes can also have impact on the incoming service requests. Changes are delivered constantly throughout the year and thus also in these three months. Therefore the effects of the delivery of changes are covered as well. Based on these assumptions all three data sets are combined and considered as one data set.

The questions that will be answered in the coming sub sections are visualized by Structured Analysis and Design Technique (SADT) diagrams. Process blocks have inputs on the left, outputs on the right and controls at the top (Figure 14).

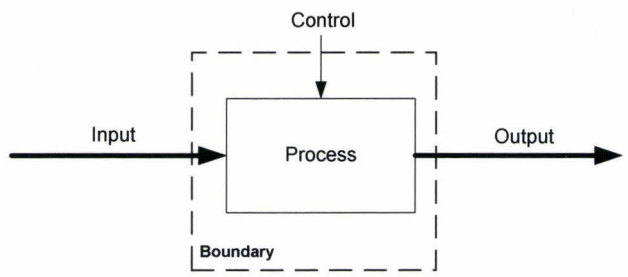


Figure 14: SADT diagram

5.2.1 Analysis of incoming service calls

Q 1.1	*What kind of service calls can be distinguished?*

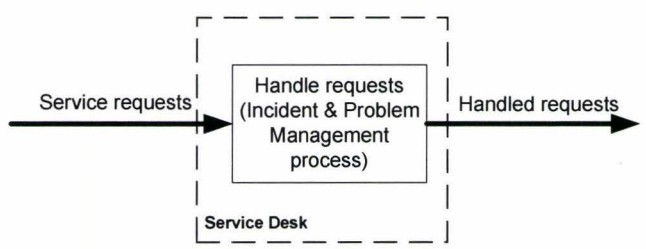


Figure 15: Visualization of question 1.1

The question that will be answered focuses on the service requests as process input (Figure 15).

In total 740 service calls have been registered in the months February, July and September 2005. The average number per day and the standard deviation are given in the table below.

Table 7: Basic information regarding the registered service calls

Number of registered service calls	Average/day	Standard deviation	Minimum	Maximum
740	11.75	6.31	2	36

The standard deviation indicates a considerable spread between days. This is confirmed by a minimum of 2 calls a day and a maximum of 36.
All these service calls have been categorized according to the categories as mentioned in Table 6. The distribution of these service calls amongst the different categories is depicted in Figure 16. This figure is quite similar to the figure of February only (Figure 13).

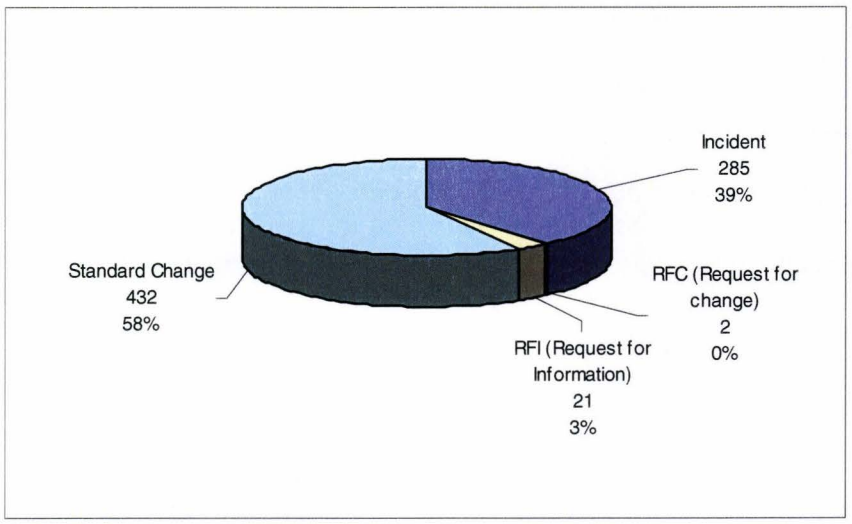


Figure 16: Categorisation of service calls

Standard Changes

The number of registered standard changes together with the average and standard deviation are given in Table 8.

Table 8: Basic figures regarding standard changes

Month	number	avg./day	standard deviation
February	146	7.3	6.21
July	147	7	6.49
September	139	6.32	4.24
Total	**432**	**6.86**	**5.62**

These standard changes have been classified. The classes are explained in Table 9.

Table 9: Description of the classes of standard changes

Class	Description
Authorisations	Requests to change authorisations for existing user accounts.
Deployment	Requests to implement software changes on the production environment.
ITP	Requests regarding documents users can print.
Other	Requests that can not be allocated to the other classes.
SecureID cards	Requests for new SecureID cards to enable external users to enter some systems within De Lage Landen network.
Unit data	Requests to change unit data settings. These settings will determine a specific configuration.
Unit structure	Requests to create new units or to modify existing ones. Units are structured in a hierarchical way and represent business units, vendors and dealers.
User accounts	Requests to create or to delete user accounts.

Per class the absolute numbers as well as the percentages are determined. The results of this analysis are depicted in Table 10. A graphical representation can be found in Appendix III.

Table 10: Different classes of standard changes

Class	Month						Total	
	February 2005		July 2005		September 2005			
	#	%	#	%	#	%	#	%
Authorisations	25	17	28	19	20	14	**73**	**17**
Deployment	0	0	0	0	33	24	**33**	**8**
ITP	12	8	3	2	2	1	**17**	**4**
Other	1	1	6	4	4	3	**11**	**3**
SecureID cards	27	18	29	20	23	17	**79**	**18**
Unit data	4	3	3	2	1	1	**8**	**2**
Unit structure	12	8	25	17	13	9	**50**	**12**
User accounts	65	45	53	36	43	31	**161**	**36**
Total	**146**	**100**	**147**	**100**	**139**	**100**	**432**	**100**

Incidents

The same analysis is performed for the incidents as well. The number of registered incidents, the average per day and the standard deviation are given in Table 11. The classes of incidents are explained in Table 12 while the distribution of incidents amongst these classes is given in Table 13. Appendix IV shows the graphical representation.

Table 11: Basic figures regarding incidents

Month	number	avg./day	standard deviation
February	93	4.65	2.06
July	100	4.76	2.53
September	92	4.18	2.48
Total	**285**	**4.52**	**3.35**

Table 12: Description of the classes of incidents

Class	Description
Functional error	Errors that are caused by incorrect or missing functional requirements. These errors will normally result in 'Request for Changes' (RFC's) that are handled in a different process.
Other	Requests that can not be allocated to the other classes.
Technical error	Errors that are caused by software faults. Software changes will be necessary to solve these problems.
User error	Errors that are caused by users that used the system incorrectly.

Table 13: Different classes of incidents

Class	Month						Total	
	February 2005		July 2005		September 2005			
	#	%	#	%	#	%	#	%
Functional error	3	3	1	1	0	0	**4**	**1**
Other	4	4	7	7	3	3	**14**	**5**
Technical error	55	60	53	53	52	57	**160**	**56**
User error	31	33	39	39	37	40	**107**	**38**
Total	93	100	100	100	92	100	**285**	**100**

Discussion

Almost 60% of all service requests are standard changes. These changes find their origin in the needs of the customer and are exogenous in nature. The only exception is the deployment class. The deliveries of all software changes (deployment) are registered by the service desk Front Office as from the 1st of August 2005. Since the delivery of software changes bring along some routine actions these are categorized as standard changes. User accounts are mostly requests with 36%. External users that are using the systems from outside the De Lage Landen offices need a SecureID card for authentication purposes. A request for a SecureID card will often result in a request for new user account. Half of the user account requests are meant for external users because SecureID cards represent 18% of all standard changes.

Almost 40% of all service requests are incidents. These are submitted because the customer experiences disturbances in their operational processes. These requests are endogenous in nature. IT Europe can i.e. decrease the incoming incidents by improving the quality of several IT related processes. Technical errors represent 56% of all incidents. Software changes are needed to resolve these incidents. User errors are caused by users themselves. Sometimes these incidents can be resolved by just explaining the situation. In other cases the user cannot resolve the situation i.e. because a contract is frozen. Additional activities are necessary to resolve these incidents.

5.2.2 Analysis of effort and throughput time

Q 2.1	*Does a relation exist between the number of hours spent to resolve a service call and the throughput time?*

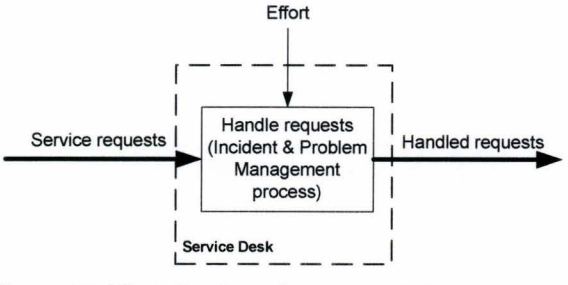
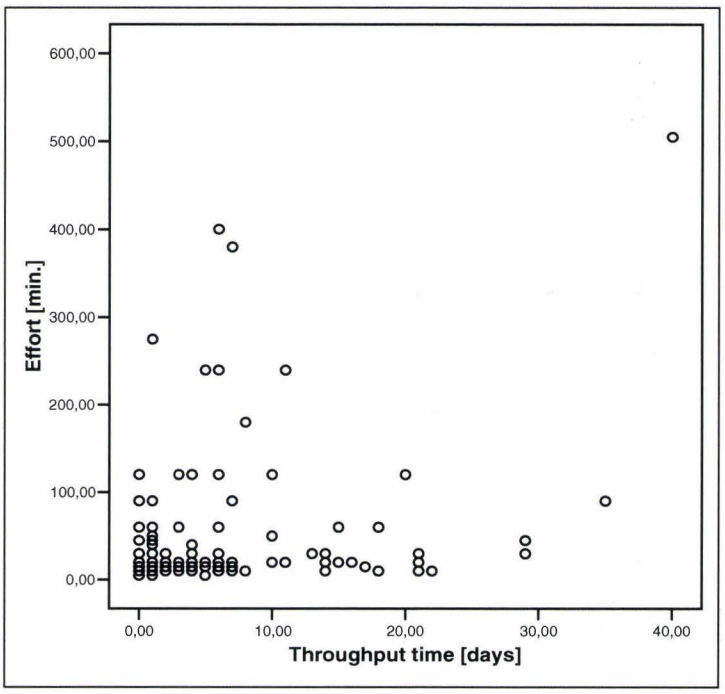


Figure 17: Visualization of question 2.1

The question whether effort and throughput time are correlated is visualised by Figure 17.

The effort needed to resolve a service call is measured in September 2005 only. Measuring effort brings along some extra administrative tasks for the people involved. The effort was determined for 75% of all service calls registered in this month.

It is important to know whether the throughput time and the effort are correlated. To determine the correlation between the throughput time and the effort the Spearman's rank correlation coefficient is calculated.



Correlation = 0.226

Significance = 0.002

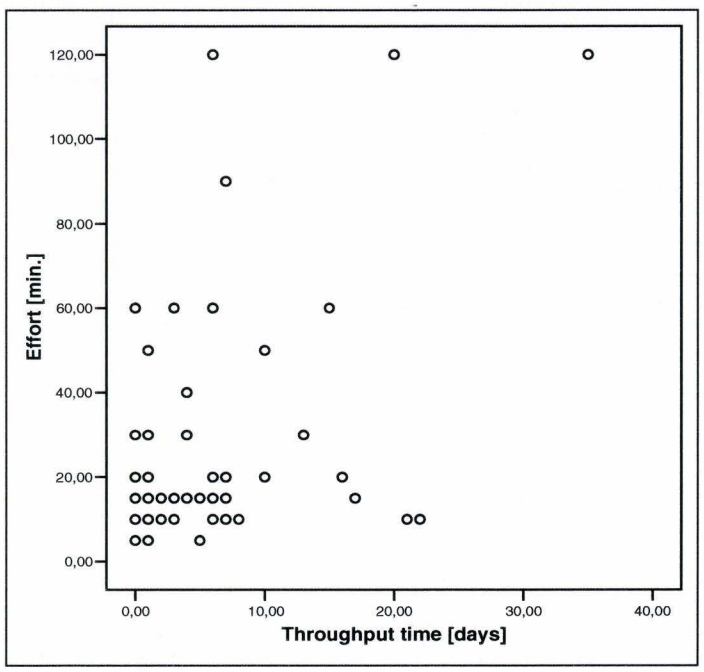
N = 180

Figure 18: The correlation between throughput time and effort

The correlation is significant at the 99% confidence level since the P-value is 0.002. The correlation coefficient of 0.226 indicates a relation between effort and throughput time. This relation is not a linear one-to-one relation. The scatter plot of Figure 18 confirms this. This analysis doesn't make a distinction between standard changes and incidents. Because the nature of standard changes is completely different from the nature of incidents, the same question is raised again for standard changes and for incidents separately.

Standard changes

Figure 19 shows the correlation between the throughput time and effort for standard changes only. The number of dots in the scatter plot is a lot smaller than the size of the data set (N = 120). This means that a specific combination of throughput time and effort occurs multiple times within this data set. The fact that some combinations of throughput time and effort occur multiple times can be explained by the nature of the standard changes. These changes can be seen as routine actions which makes the effort deterministic. Creating a new user account i.e. will normally take the same effort independent of the account that will be created. Next to that, most of the standard changes are closed within a few days. As a consequence, there is a considerable chance that a combination of throughput time and effort occurs several times. The correlation of 0.256 indicates that the effort needed to handle a standard change is related to the throughput time.



Correlation = 0.256

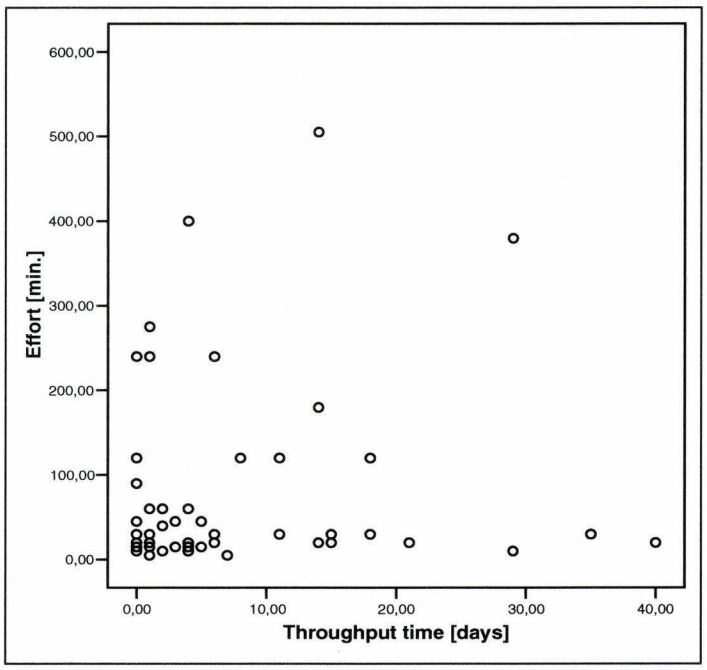
Significance = 0.004

N = 120

Figure 19: Correlation between throughput time and effort (standard changes)

Incidents

Regarding incidents, the P-value of the correlation is 0.821. This means the correlation is statistically not significant. The correlation coefficient of 0.03 is close to zero which indicates independency of both variables.



Correlation = 0.030

Significance = 0.821

N = 60

Figure 20: Correlation between throughput time and effort (incidents)

Discussion

A correlation exists between effort and throughput time for standard changes. The service desk employees explained that they sometimes handle a standard change immediately because they know it will only take a few minutes. Service calls are

handled in incorrect order in such a situation. Starvation can occur for the more time consuming requests when this happens a lot during a considerable workload. Figure 21 gives a graphical representation of this explanation.

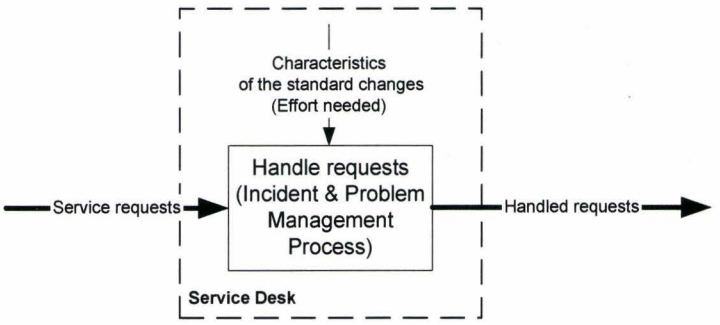


Figure 21: The influence of effort on request handling

The effort and throughput time are not correlated for incidents. It is more difficult for service desk employees to find out whether an incident can be resolved quickly.

5.2.3 Analysis of input channels and throughput times

Q 2.2	*Has the channel via which service calls are submitted any influence on the throughput time?*

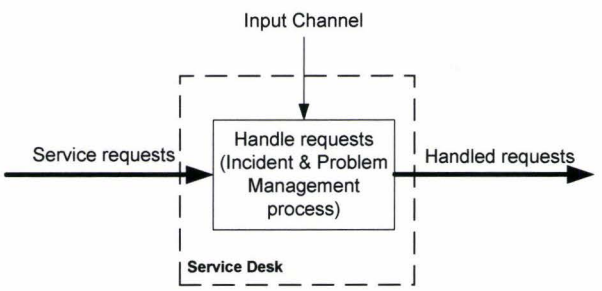


Figure 22: Visualization of question 2.2

The question whether the input channel will influence the throughput time is represented graphically in Figure 22.

Customers can contact the service desk via different input channels. An overview of these channels together with a short explanation is given in Table 14.

Table 14: Input channels

Input channel	Description
Email	The front office service desk has its own email account. This account can be used to register a service request (service call). There are no requirements at all regarding the format and content of the emails.
Fax	The fax can only be used for one specific class of standard changes, namely the SecureID cards. For security reasons a signature is required for every single SecureID card.
Intranet	Forms are available on the intranet of De Lage Landen which can be used to register a service request. All fields are pre-defined so the format is more standardized then i.e. emails.
Telephone	The service desk has its own telephone number. Telephone calls are handled by the customer support officers.

To get an idea of the distribution of all incoming service calls amongst the input channels, the absolute numbers as well as the relative numbers per input channel are given in Table 15. A graphical representation of these numbers is given in Appendix V.

Table 15: Service calls per input channel

Input channel	Service calls	
	#	%
Email	351	47
Telephone	119	16
Intranet	192	26
Fax	78	11

The throughput time of all calls is determined. That is, the time elapsed between the moment a call is registered and the moment a call is closed. Both moments are stored and can easily be extracted from HP Openview Service Desk. The expectation that most of the calls are resolved within a few of days is confirmed by Figure 23 and Figure 24. After 5 days almost 60% of all service calls have been closed.

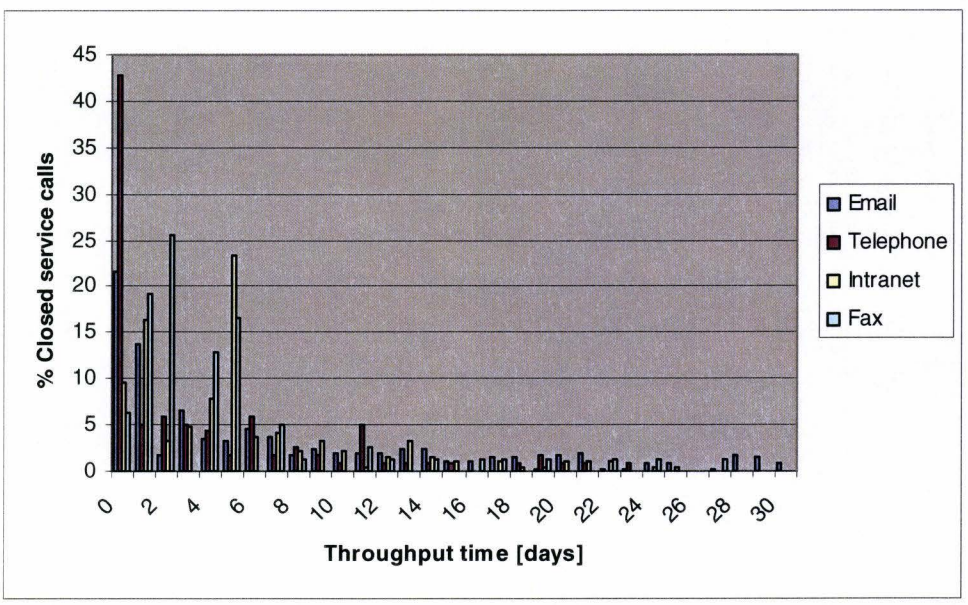


Figure 23: Throughput times per input channel (in percentages of service calls per channel)

Another representation is in cumulative percentages instead of percentages as depicted in Figure 24. Both figures indicate differences between the input channels in terms of throughput times.

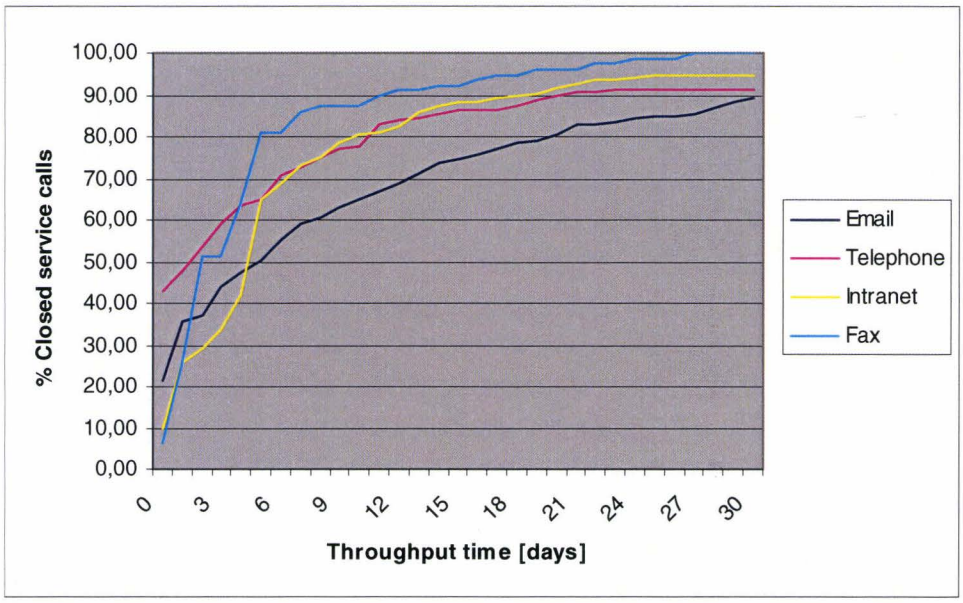


Figure 24: Throughput times per input channel (in cumulative percentages of service calls per channel)

A statistical analysis has been performed to verify whether the throughput times do differ per input channel. The expectation is that the data is distributed according to a negative exponential distribution. Therefore the non parametric Kruskal-Wallis test, which compares medians, will be used for a statistical analysis [11].

Table 16: Results of the Kruskal-Wallis test

Input channel	Sample size	Average rank
Email	329	371.29
Telephone	112	288.30
Intranet	181	362.76
Fax	78	323.68
P-value = 0.00097		

Since the P-value is less than 0.01, there is a significant difference between the medians taking into account a 99% confidence interval. This means that the input channel used to submit service calls does influence the throughput time. A graphical representation of the differences is given by the Box-and-Whisker plots in Appendix VI.

Standard changes

The usage of the different input channels to submit standard changes is depicted in Table 17. A graphical representation is given in Appendix V. Most of these requests are submitted via email or via intranet while only 6% is submitted by telephone. Requests submitted by fax are all requests for new SecureID cards. Other requests cannot be submitted via this channel.

Table 17: Standard changes per input channel

Input channel	Service calls	
	#	%
Email	175	41
Telephone	27	6
Intranet	152	35
Fax	78	18

The throughput times of the standard changes are given in Figure 25. Comparing this figure with Figure 24 shows that the difference between input channels is even bigger. The Kruskal-Wallis test confirms this because the P-value in Table 18 is less than the one in Table 16.

Table 18: Results of the Kruskal-Wallis test (standard changes)

Input channel	Sample size	Average rank
Email	162	207.735
Telephone	25	208.205
Intranet	148	221.399
Fax	78	113.240
P-value = 0.000460454		

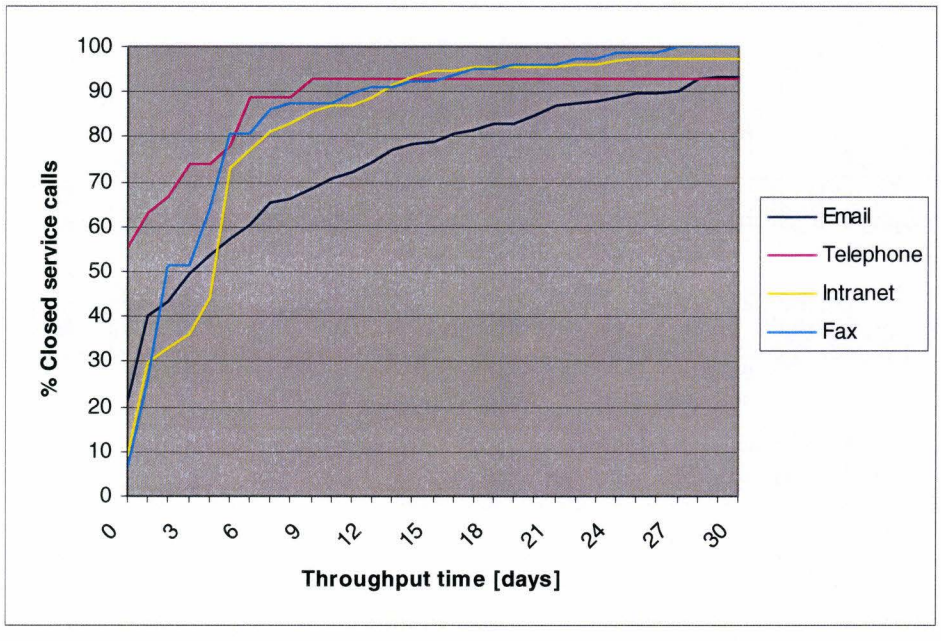


Figure 25: Throughput times of standard changes per input channel.

Again the Box-and-Whisker plots in Appendix VI give more information about the differences in medians.

Incidents

The same analysis is repeated for all service calls categorized as incidents. The distribution of the submitted incidents amongst the input channels is given in Table 19.

Table 19: Incidents per input channel

Input channel	Service calls	
	#	%
Email	161	56
Telephone	85	30
Intranet	39	14

Also Figure 26 shows that differences between input channels exist in terms of throughput time. The results of the Kruskal-Wallis test (Table 20) show that the P-value of the analysis performed on the incidents is smaller than the one for standard changes. So the differences between input channels are bigger for incidents than for

small changes. In both cases the differences are significant. The Box-and-Whisker plots can be found in Appendix VI.

Table 20: Results of the Kruskal-Wallis test (incidents)

Input channel	Sample size	Average rank
Email	133	125.214
Telephone	76	151.232
Intranet	28	96.250
P-value = 0.000334385		

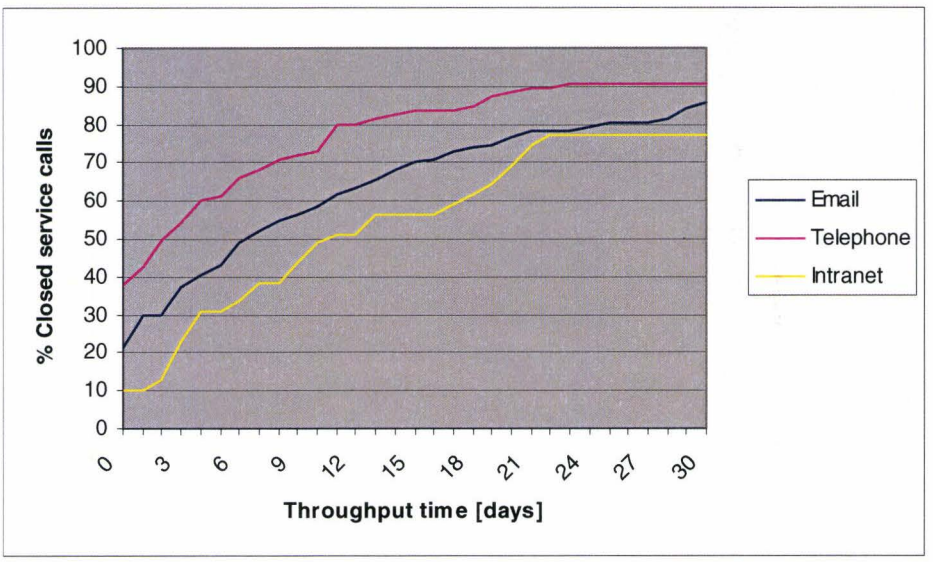


Figure 26: Throughput times of incidents per input channel

Discussion

The input channels are used differently for standard changes and incidents. For both requests email is mostly used. Regarding standard changes 41% is submitted by email against 56% in case of incidents. Looking at the Intranet as input channel one can see that this channel is used more often for standard changes. This can be explained by the fact that some forms on the intranet can only be used for a specific request like i.e. a new user account. These requests are categorized as standard changes. Finally the telephone is only used for 6% of the standard changes while it is used for 30% of all incidents. Apparently customers tend to pick up the telephone more easily when they experience disturbances. This result is a faster call handling because the telephone is the best performing input channel.

The throughput times of standard changes as well as incidents differ per input channel. Almost 60% of all standard changes submitted by telephone are handled within 1 day. For email this percentage is around 20% while for the other channels it is less than 10%. Figure 25 shows that changes submitted by intranet and fax are sometimes bundled and handled within one day. Figure 26 shows that the throughput times for incidents are handled more equally over time. Incidents vary more in nature and therefore can not be bundled easily.

The telephone shows the best performance in terms of throughput times for both incidents and standard changes. This can influence the media choice when the customer finds out. A feedback loop can arise that makes it more difficult to control the output of the incident and problem management process (Figure 27).

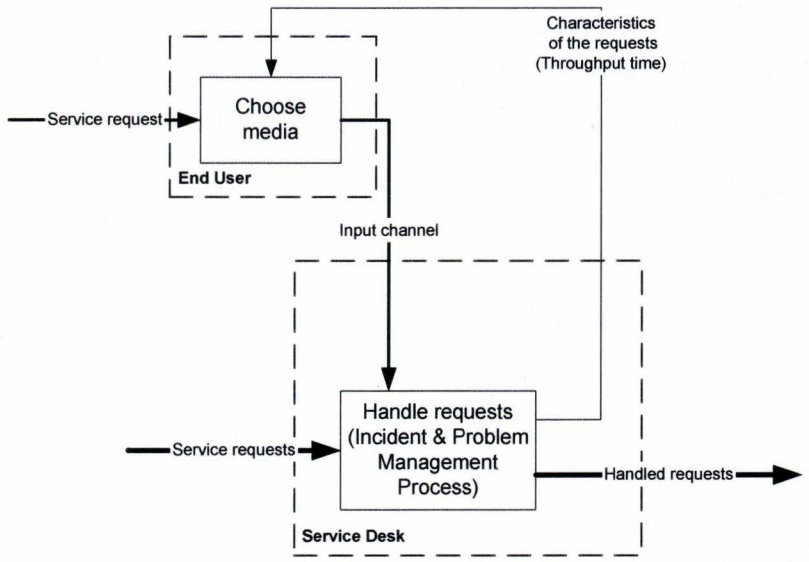


Figure 27: Possible feedback loop

The telephone is only used for 16% of all requests. This means customers do not recognize a better performance for requests submitted by telephone or that other factors influence their media choice as well. The fact that the telephone is used more often in case of incidents indicates that other factors like i.e. the type of request do influence the media choice as well.

5.2.4 Analysis of input channel and country

Q 2.3	*Does a relation exists between the input channel used to submit requests to the service desk and the country the requestor is working in?*

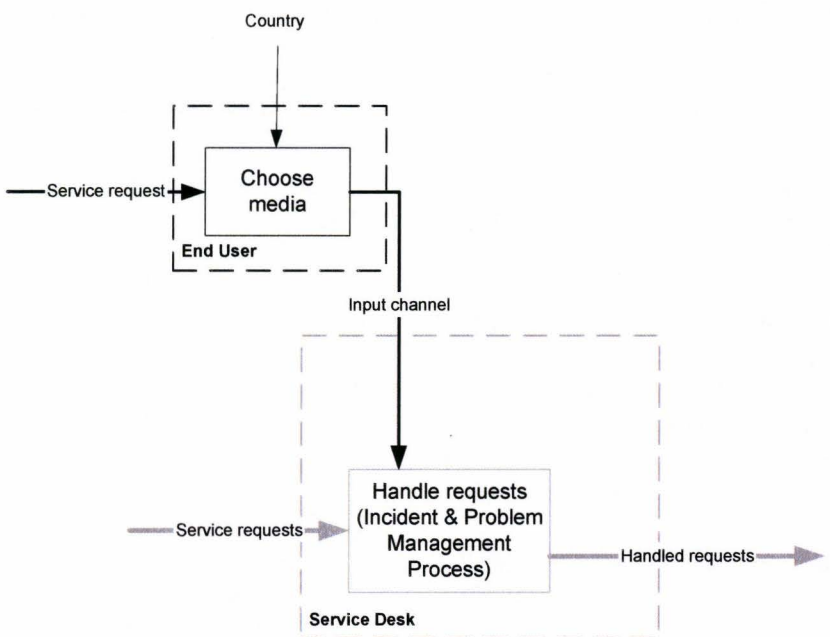


Figure 28: Visualization of question 2.3

The question whether a relation exists between input channel and country is focused on the media choice of the customer as depicted in Figure 28.

Around Europe several different countries are serviced by the Front Office Service Desk:

- Belgium
- France
- Germany
- Ireland
- Netherlands
- Spain
- United Kingdom

The country where the requestor is working in has been determined for all service calls. The results are presented in Figure 29.

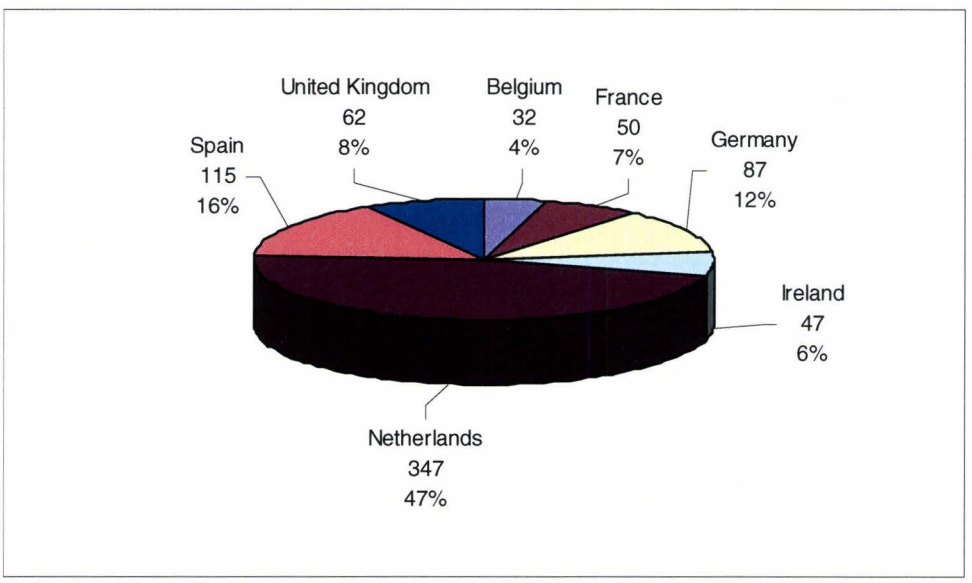


Figure 29: Registered service calls per country

The table below shows the absolute and relative numbers of the usage of input channels per country. This table shows that the input channels are not equally used across the countries in Europe. Appendix VII gives a graphical representation by means of a radar graph.

Table 21: Usage of the input channels per country

Country	Email		Fax		Intranet		Telephone	
	#	%	#	%	#	%	#	%
Belgium	12	38	1	3	11	34	8	25
France	29	58	1	2	16	32	4	8
Germany	40	46	18	21	19	22	10	11
Ireland	24	51	10	21	9	19	4	9
Netherlands	147	43	36	11	75	22	81	24
Spain	47	40	12	11	49	43	7	6
United Kingdom	44	71	0	0	13	21	5	8

A comparison between the countries has to be made regarding the nature of the submitted service calls. That is, a comparison of the categories of the service calls.

Again the focus will be on two categories, namely the standard changes and the incidents. The comparison of categories between the countries is based upon relative numbers because the number of service calls registered per country differs considerably. The numbers are presented in Table 22. A graphical representation is given in Appendix VII.

Table 22: Categorization per country

Country	Incidents	Requests for Information	Standard Changes
	%	%	%
Belgium	66	3	31
France	48	4	48
Germany	24	2	74
Ireland	53	0	47
Netherlands	40	3	57
Spain	16	1	83
United Kingdom	60	6	34

Differences exist in the nature of service calls submitted to the service desk. In Spain i.e. 83% of all calls are standard changes and only 16% are incidents while in Belgium it's almost the other way around. 31% are standard changes and 66% are incidents.

Standard changes

The number of standard changes submitted per country differs considerably. Because the data sets for some countries are just little, data sets of all countries except the one of the Netherlands are combined and named "Other".

Table 23: Relation between country and Input channel (Standard changes)

		Input Channel				Total
		Email	Fax	Intranet	Telephone	
Country	Netherlands	86	36	52	21	194
	Other	89	42	100	6	236
Total		175	78	152	27	432

The hypothesis that input channel and country are independent variables is verified by the chi-square test. The fact that the P-value is less than 0.01 means the hypothesis can be rejected at a 99% confidence level. This means that the variables country and input channel are related to each other.

Table 24: Results of the cross tab analysis (Standard changes)

	Value	Df	Significance
Chi-Square	20.111	3	0.000

Incidents

The same analysis performed for the standard changes is repeated for the incidents as well. The fax is not mentioned in the contingency table below because incidents can not be submitted by fax.

Table 25: Relation between country and input channel (Incidents

		Input Channel			Total
		Email	Intranet	Telephone	
Country	Netherlands	61	22	56	133
	Other	100	17	29	146
Total		161	39	85	285

Again the hypothesis can be rejected at a 99% confidence level which means both variables are related.

Table 26: Results of the cross tab analysis (Incidents)

	Value	df	Significance.
Chi-Square	18.504	2	0.000

Discussion

Differences exist in the usage of the input channels across Europe. Because the sample size is quite small for some countries it is not possible to perform a reliable analysis taking into account every single country. For this reason the Netherlands is analysed against all other countries. A difference in usage of input channels does exits between the Netherlands and the other countries in Europe. This outcome could be explained by differences in language. All service desk employees do speak English, but not mother tongue. The same is true for people working in other countries, except for the United Kingdom and Ireland. Some employees do not even speak English business fluent in i.e. France and Spain. This makes communication difficult, especially via telephone.

5.3 User Experiences

The previous analyses are purely based on numbers. Experiences users have are not taken into account. For this reason a short questionnaire has been distributed amongst customers in order to find out whether their experiences are conform the outcomes of the quantitative analysis. This questionnaire focused on the metrics that are visible for the customer: Those are metrics regarding the questions:

- Has the channel via which service calls are submitted any influence on the throughput time?
- Does a relation exists between the input channel used to submit requests to the service desk and the country the requestor is working in?

The questionnaire contains 8 questions and has been sent to 69 customers around Europe of whom 29 responded directly and 5 responded after a reminder. The questionnaire together with the outcomes can be found in Appendix VIII. The table below gives an overview of the respondents per country.

Table 27: Respondents per country

	BE	FR	GE	IE	NL	ES	GB
# respondents	4	4	6	1	11	6	2

Q 2.2	*Has the channel via which service calls are submitted any influence on the throughput time?*

The analysis of the previous paragraph revealed a relation between throughput time and input channel. The question is whether the customers do experience this relation as well. 50% of all respondents stated that they experience differences in the way their call is handled based on the input channel used. Of these 50% everybody says that calls submitted by telephone results in the fastest call handling and thus have the shortest throughput times. According to the quantitative analysis, most of the calls submitted by telephone have indeed shorter throughput times. The other 50% of the respondents do not experience differences.

Q 2.3	*Does a relation exists between the input channel used to submit requests to the service desk and the country the requestor is working in?*

The questionnaire also asked for preferences with regard to input channels. In order to find out whether a relation exist between these preferences and the countries the respondents are working in, a cross tab analysis is performed. Because of the small number of respondents per country, the Netherlands is tested against the other countries in Europe. It is expected that preferences for input channels differ per country, because a relation between input channel and country exists as well.

Table 28: Relation between preferences for input channels and country

		Preference for Input Channel				Total
		Email	Intranet	Telephone	No preference	
Country	Netherlands	0	0	10	1	11
	Other	13	4	6	0	23
Total		13	4	16	1	34

The results of this analysis are presented in the table below.

Table 29: Results of the cross tab analysis

	Value	df	Significance.
Chi-Square	16.866	3	0.001

The significance of 0.001 indicates a relation between both variables, which is conform expectations. Referring to the literature, Rowe and Struck [14] investigated the influence of some cultural values like i.e. innovation, reactivity and entrepreneurship on the media choice. They concluded that the media choice is indeed associated with different cultural values. Language is also a cultural value. The assumption that language is also associated with the media choice can explain the preference for an input channel. Future research has to verify this assumption.

The type of request has also influence on the media choice. Most of the respondents (76.5%) confirmed that the type of request has influence on the input channel that will be chosen. The fact that the nature of the different types of service calls is different could explain this result. The Media Richness Theory (MRT) [4l] describes that richness of communication media differs in the extent of the following characteristics:

- Provide variety in language
- Transmit multiple cues
- Provide immediate feedback

- Provide personal focus

Rich media can reduce uncertainty and equivocality of tasks. Where uncertainty is caused by the lack of information and equivocality is caused by the lack of understanding. Media of higher richness (telephone) can be effective for processing messages with high uncertainty and high equivocality, like i.e. complex incidents. Media of lower richness (email, intranet) can be effective for processing well understood messages and standard data like i.e. standard changes.

So the choice for the most appropriate input channel will be based on several factors.

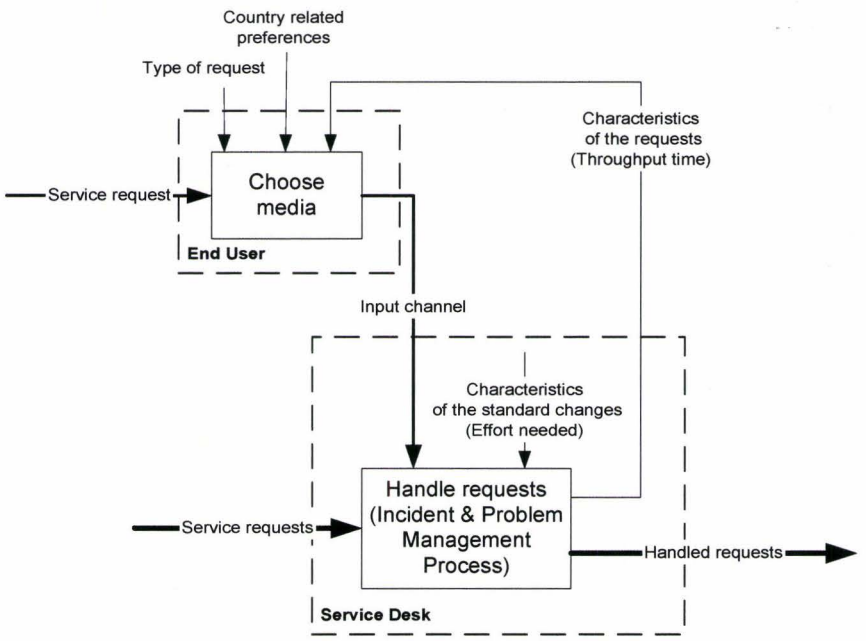


Figure 30: Factors of that influence the media choice

The research within the context of this master thesis focused on the factors as mentioned in Figure 30. This figure gives a final visualization of factors that will influence the incident and problem management process directly or indirectly. The service requests are already taken into account, but the other factors not.

The media choice that will be made by the customer will influence the call handling process. Therefore the media choice has to be taken into account within the call handling process. When the service desk analyses the media choice they can define actions to influence this choice. Preferences i.e. can be influenced by making a specific input channel more easy to use. Giving an input channel priority above others can influence the media choice as well. The media choice has to be influenced in such a way that telephone usage decreases. The telephone is used for 16% of the requests. Decreasing this percentage even more will enable service desk employees to perform their activities more efficiently. Their activities will less frequently be interrupted by telephone. Asynchronous and structured input channels should be promoted. Intranet is preferable above email because users can be guided in entering the correct information.

6 Customer support improvements & verification

The analyses of the previous chapter revealed that almost 60% of all service requests are standard changes. These requests bring along a lot of routine actions for the service desk employees. When routine actions are required a more automated solution can probably be defined. Standard changes classified as user accounts are mostly requested (Table 10). The efficiency improvements as described in section 6.1 are focused on this class. Section 6.2 describes the expected results these improvements will realize.

6.1 Efficiency improvements

All service requests categorized as standard changes will normally require routine actions. When the correct information is available these standard changes can be implemented without any further interaction between customer and service desk. A structured input channel, like a predefined intranet form or a synchronous input channel like telephone are the best input channels to ensure all necessary information will be available. From a service desk perspective the first one is the most desirable because this channel does not require direct response. It is not necessary to react directly on requests submitted via intranet. Furthermore the service desk employees can plan their activities better without being disturbed by the telephone all the time.

The customer has to provide the correct information anyhow independent of the input channel used. This information is stored in the application for registering service requests and has to be entered again when implementing the request. The process steps needed to implement a standard change are depicted in Figure 31. The numbers refer to the customer support process in Figure 9.

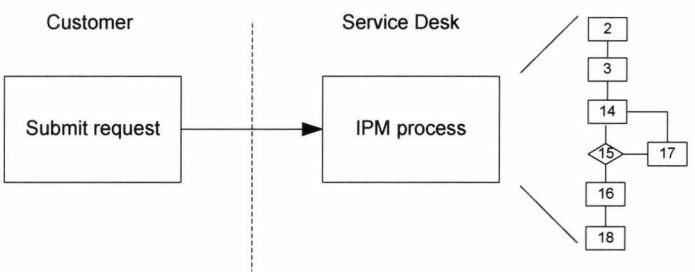


Figure 31: Handling of standard changes

To ensure the information is only entered one time instead of multiple times new functionality has been developed. At first this functionality focuses on adding new user accounts because this class is the most requested standard change. However the concept can be applied for other classes of standard changes as well. This functionality is available for the service specialists (super users) and their delegates.

A request for a new user account can now be entered directly into the system because of this new functionality. The entered information will be validated and when everything is entered correctly the request is stored. The service desk employees can see all requests and if necessary they can see every detail. They will validate the request again and when everything is correct they can approve the request. The request will be implemented automatically afterwards.

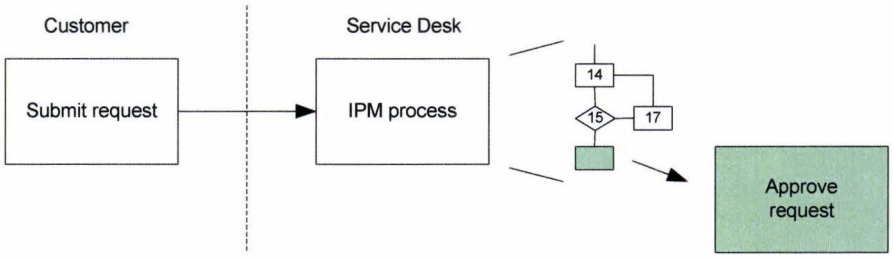


Figure 32: Improved handling of standard changes

This approach will save several process steps as shown in Figure 32. This will result in a more efficient handling of standard changes.

6.2 Expected results

The efficiency improvement for requests regarding user accounts requires fewer activities of the service desk employees. However they still have to perform some activities. The question is what this improvement will realize in terms of incoming service requests and in terms of effort. First of all Table 10 shows that 161 requests regarding user accounts were submitted in the month February, July and September 2005. This is 37% of all incoming standard changes. Business developments like more focus on the dealer market will probably lead to more user account requests in the future than submitted in 2005. To be on the safe side a decrease of 37% will be taken into account. This is a decrease of 22% of all incoming requests.

Next to a decrease in incoming requests the improvement will save effort as fewer activities are required. Requests do not have to be registered anymore and the implementation is automated. An estimation of the savings in terms of time is made based on the effort measured in September. Measurements of effort showed that the average time to create a user account is almost 14 minutes. The test of the new functionality showed that the service desk employees will need only 1 or 2 minutes to verify and approve the requests. This means that more than 10 minutes will be saved per request that is entered correctly. To be on the safe side a saving of 10 minutes will be taken into account. In the period of three months this will result in 161 * 10 = 1610 minutes = 26.83 hrs. This is almost 9 hours a month. These hours can be spent to other service requests and will probably result in shorter throughput times. No estimations will be given for this effect.

This improvement is implemented and introduced to the customers as from the 13th of March 2006. A verification of the estimated savings in terms of incoming requests and effort is not possible within the context of this study, because the planning does not allow it. However it is important to verify the estimations and to report the realised savings towards management. This will create opportunities for further improvements.

7 The results in a broader perspective

The analyses described in chapter 5 focused on De Lage Landen only. The question rises whether the results of the analyses are specific for De Lage Landen. To answer this question some other companies that provide financial services were visited. Section 7.1 gives a short explanation about how customer support is provided in these companies. Section 7.2 describes which GQM questions can be answered in these companies while the answers are described in section 7.3.

7.1 Customer Support in other companies

Three financial companies were visited in order to find out how customer support is provided and to generalize the results of this study. All three companies have a centralized service desk that provides support in several different areas like i.e. the office environment and the application environment. The service desks are providing 1st line support and in some areas 2nd line support. 3rd line support is always provided by other teams. In other areas like i.e. application support 2nd and 3rd line support is provided by separate teams. Kajko-Mattsson describes some support line constellations [9], but not the variant as applicable for the visited companies. This variant is depicted in Figure 33.

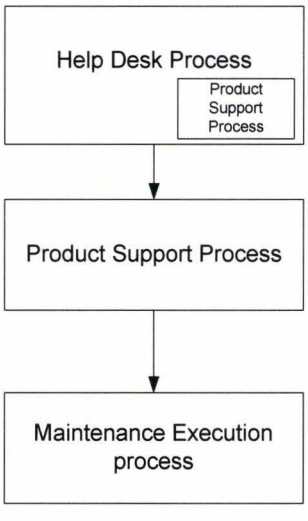


Figure 33: The service desk constellation of the visited companies

Customer support is organized different within these companies compared to De Lage Landen. First of all De Lage Landen has decentralized service desks while the visited companies have a centralized service desk. Secondly the Product Support Process (2nd line support) is not always provided by the service desk within the visited companies while it is within De Lage Landen.

7.2 Measurements in other companies

The metrics as measured within De Lage Landen were not always available in the first place and if they were, the data was not always reliable. As a consequence additional actions were necessary in order to gather the data or to verify the data.

Such additional actions can not be required from the companies that were visited. So the first analysis within these companies focused on the question whether these metrics could be extracted out of the existing systems easily. The results of this analysis are depicted in Table 30.

Table 30: Metrics within other companies

Company	Q1.1	Q2.1	Q2.2	Q2.3
De Lage Landen	✓	✓	✓	✓
Insurance company 1	✓	×	×	*n/a*
Insurance company 2	✓	×	✓	*n/a*
Bank 1	✓	×	×	*n/a*

✓ : ***Metrics available***
× : ***Metrics not available***
n/a : ***Not applicable***

All companies provided data for analysis purposes. This data can be used to answer the questions that are marked with a '✓' in Table 30.

The questions that can be answered will be analysed in the next section.

7.3 Generalization of the results

Q 1.1	*What kind of service calls can be distinguished?*

The nature of the incoming service requests can be determined in every company. Information about these requests is registered and can be used for analyses. The number of incoming service requests of the companies is gathered for January 2006 except for insurance company 2 where the data is based on January 2005. The outcomes are presented in Figure 34. Differences exist between the number of incoming service requests.

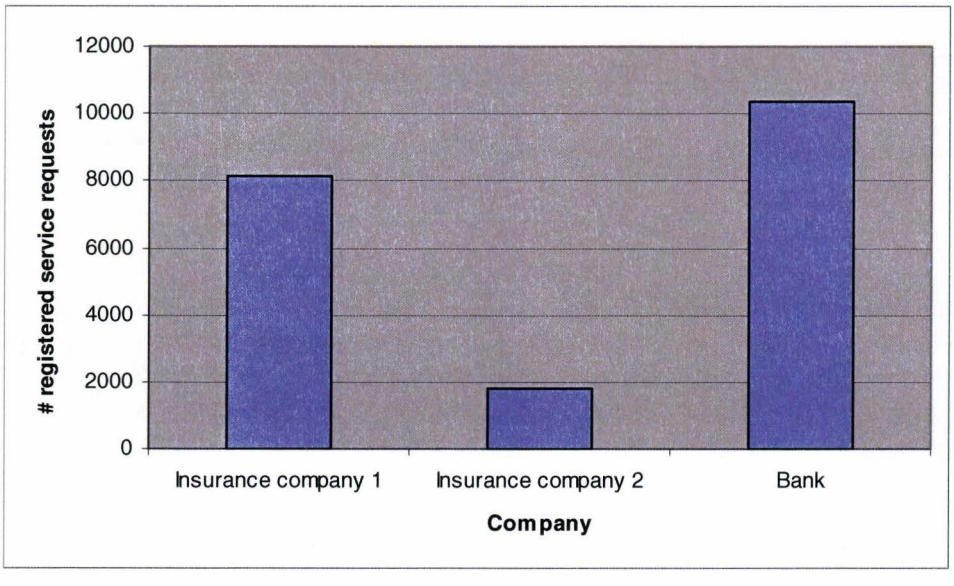


Figure 34: Number of incoming service requests measured in january 2006

The categorization as well as the classification differ from company to company and therefore are not analyzed in detail.

Q 2.1	*Does a relation exist between the number of hours spent to resolve a service call and the throughput time?*

The effort needed to resolve a service request is not captured in any of the visited companies. These metrics are not measured because there was no reason to do so. The time spent per telephone call however is measured in every company, but this information is not sufficient to answer the question raised above.

Q 2.2	*Has the channel via which service calls are submitted any influence on the throughput time?*

The input channel used to submit service requests is only registered within insurance company 2. The bank has the facilities to store the input channel, but until now they never did. Insurance company 1 cannot register the input channel in their system at all.

The distribution of all incoming service request amongst the input channels within insurance company 2 is given in Figure 35. This figure is based on all requests registered in 2005.

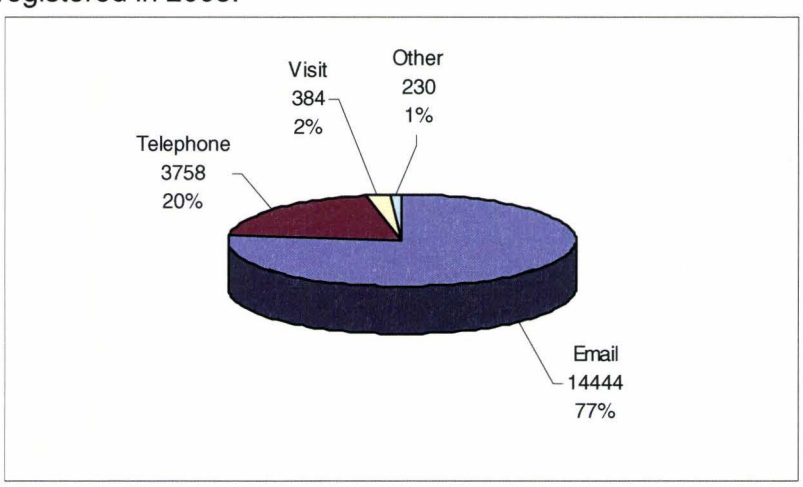


Figure 35: Service calls per input channel (insurance company 2)

The input channel that is used the most is email. 77% of all requests were submitted via this channel. The telephone is used for 20% of all requests. The other channels are used occasionally. Similar percentages for telephone usage are determined within De Lage Landen (16%).

Differences in performance are also measured within this company as depicted in Figure 36. The overall performance is better than within De Lage Landen (Figure 24). The telephone is again a better performing input channel.

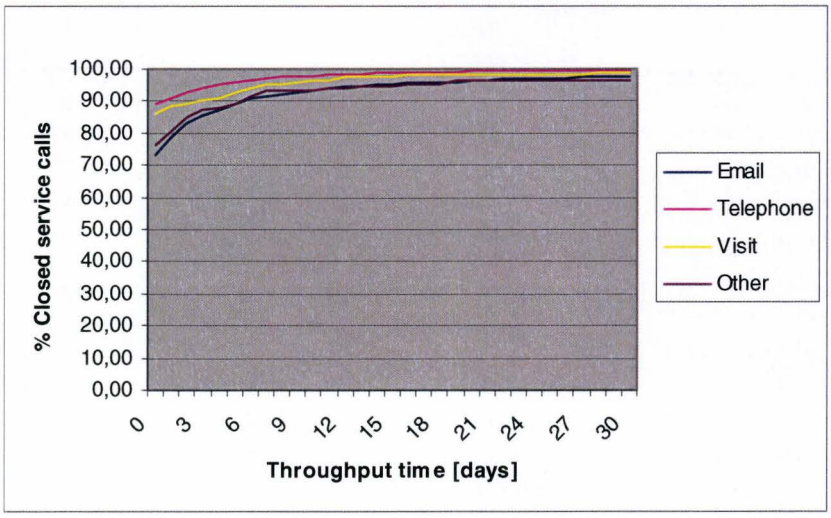


Figure 36: Throughput times per input channel (Axa)

The used input channels can be registered within the visited bank, but until now this has never been done. The number of requests submitted by telephone is known as is the total number of submitted requests. These numbers can be used to determine the percentage of requests that is submitted by telephone. This is almost 95%.

Q 2.3	*Does a relation exists between the input channel used to submit requests to the service desk and the country the requestor is working in?*

The service desks within the visited companies are focused on the Netherlands. A relation between input channel and country is therefore not applicable.

Discussion

The companies that were visited in order to generalize the results have all different systems to register their incoming service requests. No standard system seems to be available within financial companies. All these companies gather and analyze metrics for reporting purposes. These reports are mostly produced in Excel probably because the systems have insufficient reporting possibilities. The content of these reports differs from company to company. No standard reports are available.

The question whether the input channel has influence on throughput time is the only question were a generalization was performed. The other questions were company specific or could not be answered because of multiple reasons. The input channel also influences the throughput time within insurance company 2. The telephone is again the best performing input channel as was the case within De Lage Landen. The overall performance in insurance company 2 is better compared to De Lage Landen. Insurance company 2 handles almost 90% of all requests the same day. This percentage is around 40% at De Lage Landen. The nature of the requests will differ because insurance company 2 has a centralized service desk. This could explain these differences. Requests in the office environment are normally less complex in nature.

The telephone is only used for 16% of all requests within De Lange Landen and for 20% within insurance company 2. The opposite is true for the visited Bank where 95% of the requests are submitted by telephone. As a consequence the service desk environment is a call centre environment. Other requirements are applicable regarding i.e. availability in such an environment.

8 Conclusions & recommendations

The major findings of this study are described in section 8.1. Recommendations are given in section 8.2 and this chapter ends with some suggestions for future research.

8.1 Major Findings

The conclusions that are described below are based on the results of the analyses performed in the context of this master thesis. The objectives as defined in chapter 1 are processed within this description.

- **A metrics program can provide better insights:**
  Defining and executing a metrics program provides a better understanding and can result in valuable insights. The metrics program performed in the context of this master thesis focused on the incoming service requests and on other aspects that can influence the incident and problem management process. The incident and problem management process itself is considered as a black box (Figure 37).

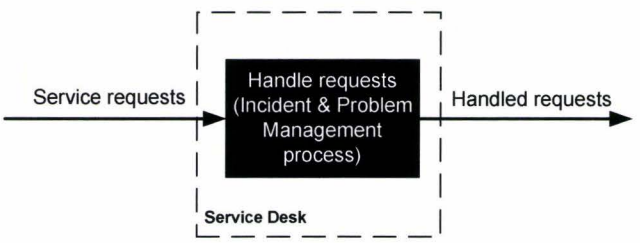


Figure 37: Incident & Problem Management as a black box

The analyses performed in chapter 5 showed that not only the incoming service requests will determine the process output. Other factors like input channel and effort are of influence as well (Figure 38).

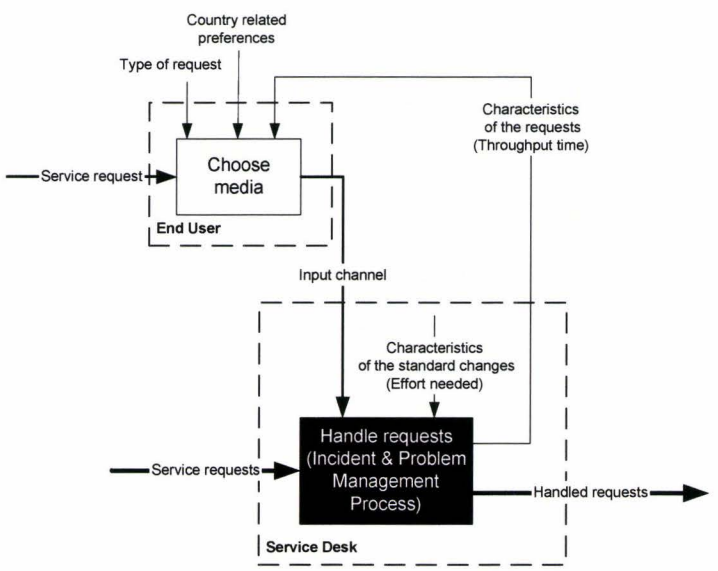


Figure 38 : The incident & problem management process with multiple inputs

- **The media choice of the customer is based on multiple factors:**
  The input channel used to submit a service request is determined by the media choice of the customer. The questionnaire revealed that customers in different countries have different preferences for input channels. This is confirmed by the gathered metrics. Input channels are used differently across Europe (Figure 52). The telephone i.e. is used the most in the Dutch speaking countries. 24% of all requests originating from the Netherlands are submitted by telephone. For Belgium this is 26%. For the other countries it is 11% or less. The questionnaire also revealed that the type of service request will influence the media choice.

- **The input channel used to submit service requests influences the throughput time:**
  The input channel chosen by the customer will influence the outcomes of the incident and problem management process in terms of throughput time. Undesired side effects can occur when the customer finds out that a specific input channel results in a faster call handling and that he or she decides to use this channel more often. Such a 'feedback loop' is presented in Figure 38 and makes it difficult to control the output of the process. The telephone is the best performing input channel while it is used to submit only 16% of the service requests. This justifies the assumption that this feedback loop is not yet present. In particular because the questionnaire revealed that 50% of all respondents experienced the influence of the media choice on call handling. They all stated that submitting requests by telephone results in the fastest call handling. The conclusion that the input channel will influence the throughput time is strengthened by the fact that this is the case in one of the visited insurance companies as well.

- **Improvements can be defined based on gained insights:**
  Almost 60% of all incoming requests are categorized as standard changes and require routine actions. Efficiency improvements have been realized for the most requested standard changes. It concerns requests classified as 'user accounts' and these represent 37% of all standard changes. Probably these improvements will realize a decrease of 22% in incoming requests. Savings in terms of effort will be realized as well because the service desk employees have to perform fewer activities. The estimated savings will be almost 9 hours a month. These estimations have not been verified in practice.

- **Not all results could be generalized:**
  The question whether the results of the analyses are De Lage Landen specific could only be answered partially. Some results are company specific like the analyses regarding the incoming service requests. The results regarding the influence of an input channel on the throughput time could only be verified in one company. The other results could not be generalized because data was not available or because the results were not applicable at all. However the fact that not all results could be generalized did not mean that the visits had no value in terms of insights and better understanding.

8.2 Recommendations

This study showed the value a metrics program can have from a practical point of view. The recommendations as described below can have value not only for De Lage Landen, but for other companies as well.

- **De Lage Landen should continue with metric programs:**
  Metric programs provide valuable insights that can be used to initiate improvements in processes and systems. The results of these improvements should be proven and reported towards management to get management support for other programs. The result can be shared with the staff as well to stimulate people to improve their day-to-day activities based on real life numbers.

- **De Lage Landen should define the requirements they have regarding a support application and determine whether the current system covers these requirements:**
  The customer support environment has to be facilitated by a flexible application that has sufficient reporting possibilities. Some of the metrics measured in the context of this study could not be registered while others that were registered could not easily be used for reporting purposes. This makes a metrics program a time consuming exercise. De Lage Landen should define the requirements they have regarding a support application and determine whether HP Openview Serivce Desk covers these requirements. If not, a new application should be selected. Economies of scale can result in cost savings when other companies in the Rabobank Group will be involved in such a selection. Currently the visited companies that are part of the Rabobank Group are all using different support applications.

- **De Lage Landen should pay more attention to the media choice of the customer:**
  The media choice of the customer (input channel) will influence the call handling process and therefore it is advisable to take this aspect into account in the process descriptions. The fact that the media choice of a user influences the handling of service requests is not necessarily a problem. It brings along some negatives side effects when the user experiences differences and act upon it. This creates a feedback loop that makes it more difficult to control the process. On the other hand the media choice can be influenced by the customer support organization in order to promote a specific input channel. This will definitely be an asynchronous and structured channel like intranet. No immediate response is necessary and the user can be guided in order to ensure all information will be provided.

- **De Lage Landen should define clear priority mechanisms:**
  A clear priority mechanism will result in an unambiguous order in which the requests have to be handled. It will also decrease the influence that input channels have on throughput times. Specific input channels can even be promoted when input channels are taken into account within these priority mechanisms.

8.3 Future research

The analyses performed in the context of this study revealed some aspects that were not covered. Suggestions for further research are given in this section.

- Input channels are used differently across Europe. Probably language will be the most important explanation of these differences. This assumption should be verified by future research. The company language within De Lage Landen is English, but apparently people do experience problems in communicating in English. Better insights in these differences provide opportunities to improve customer support.

- In the customer support area the media choice and the input channel are not taken into account. Future research has to reveal whether the media choice is taken, or has to be taken into account in other areas as well where workflows are supported by systems. This can have consequences for modelling workflow systems.

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Appendix I De Lage Landen International B.V.

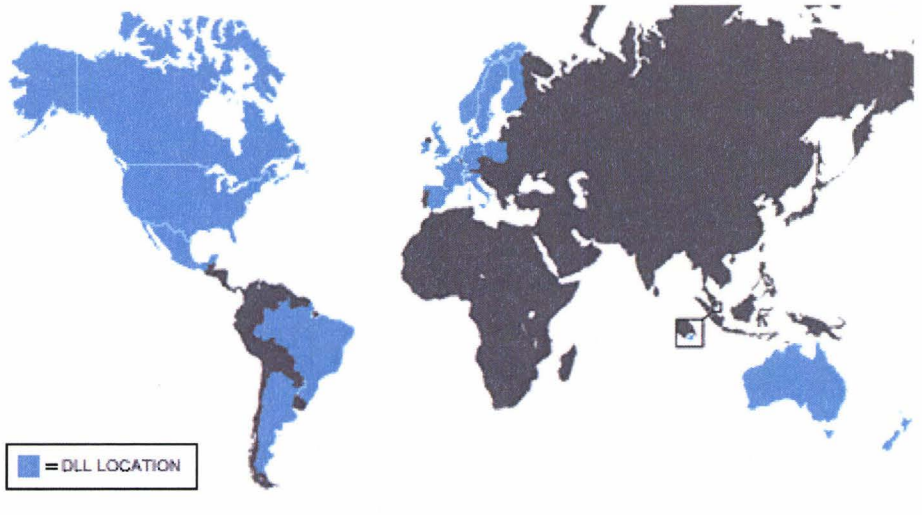
De Lage Landen, a fully owned subsidiary of the Rabobank Group, was founded in Eindhoven, Netherlands in 1969 in response to a growing need among larger agricultural operations for more sophisticated and far reaching financial services. In 1987, De Lage Landen initiated a programme of aggressive European expansion, and began offering services in neighboring European countries. In 1998, De Lage Landen expanded into the Americas in support of a partner in agricultural equipment manufacturing and has been expanding its product line, and broadening its knowledge and partner base ever since. As corporate clients underwent change and growth, they too required broader and more expert advisory services. As the playing field for all customers became increasingly global, so did the demand for banking support in a number of industries.

Development of the De Lage Landen International Network

1969 - Netherlands, Founded
1987 - Belgium
1988 - Germany
1989 - United Kingdom
1990 - France
1991 - Italy
1992 - Ireland
1995 - Spain
1996 - Poland
1997 - Denmark, Finland, Sweden, Switzerland
1998 - Brazil, United States
2000 - Canada
2002 - Mexico, Australia, New Zealand
2004 - Norway

De Lage Landen Today

Today De Lage Landen International is organized into two Divisions (Europe and the Americas), which provide services in more than 20 countries throughout Europe, the Americas, Australia and New Zealand.



Equipped with unparalleled industry experience, the company is currently an international leader in putting partnership into high quality asset financing.
Internationally De Lage Landen focuses on vendor finance programmes and strategically enters into partnerships with manufacturers and distributors of capital equipment. De Lage Landen offers financing products all along the distribution chain thereby increasing the competitive advantage of our business partners. De Lage Landen concentrates on these industries: Food & Agriculture, Healthcare, Office Equipment, Information Technology, Telecommunications and Materials Handling & Construction Equipment.

In the US De Lage Landen offers private label leasing programmes for the Banking industry. In the Dutch home market De Lage Landen offers an array of leasing and trade finance products via local Rabobanks and direct to the market. This product range includes Trade Finance, Equipment Lease, Commercial Finance, Car and Commercial Vehicle Leases, and ICT Lease.

In 2004 De Lage Landen grew its net profit to € 140 million and its balance sheet total to € 15 billion.

Appendix II IT Europe

The IT Europe department of De Lage Landen is organized in a matrix structure. The business is serviced via the service lines:

- Front Office Services
- Back Office Services
- Consolidated Business Services
- End User Device Services

These service lines are supported in their internal processes by:

- Incident & Problem Management
- Change Management
- Quality Assurance
- Information Security Management

Furthermore professional service will be supportive as well in the following areas:

- Training & Education
- Account Management
- Project Management

IT Utilities is responsible for the hardware and infrastructure, while Architecture will be involved in new developments in order to ensure that these developments are conform the architecture used by De Lage Landen.

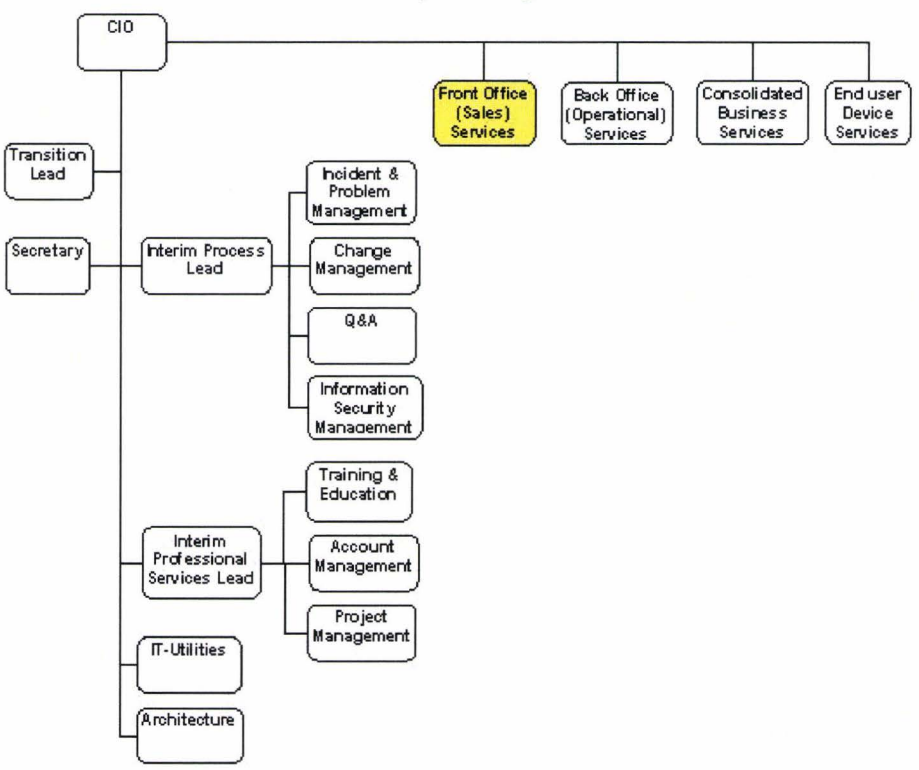


Figure 39 : The organisation chart of IT Europe

Appendix III Classes of standard changes

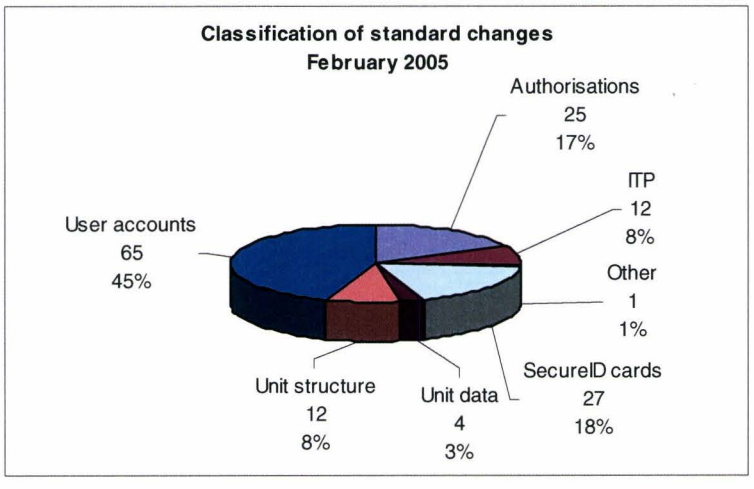


Figure 40: Classes of standard changes (February 2005)

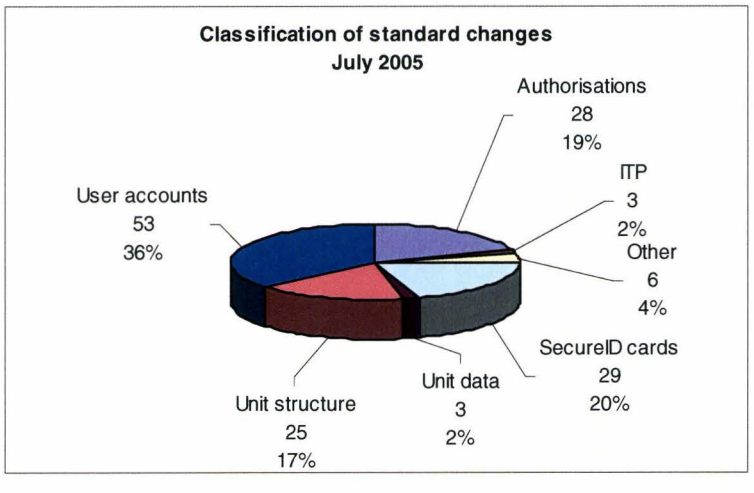


Figure 41: Classes of standard changes (July 2005)

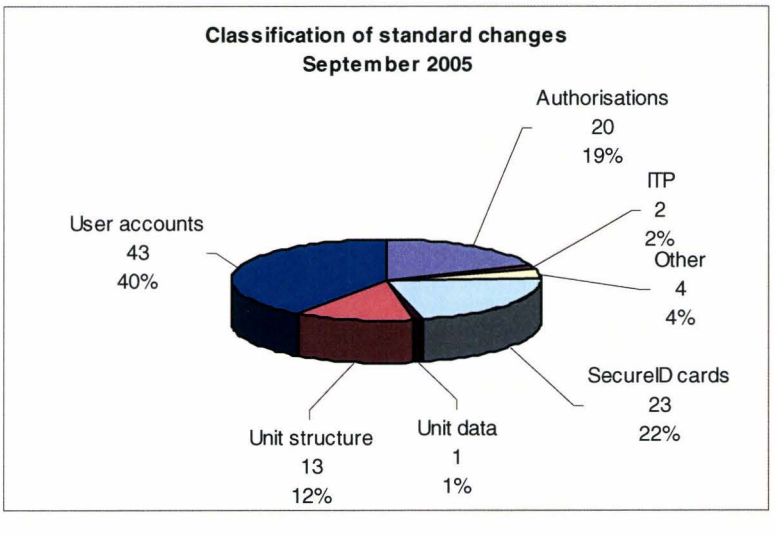


Figure 42: Classes of standard changes (September 2005)

Appendix IV Classes of incidents

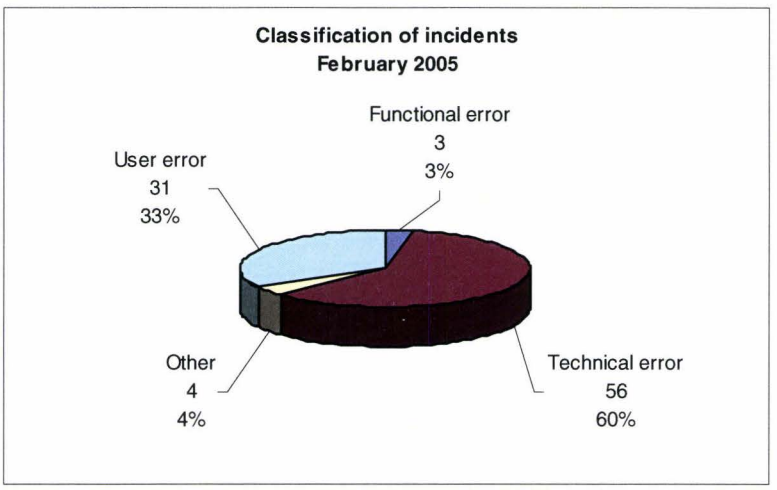


Figure 43: Classes of incidents (February 2005)

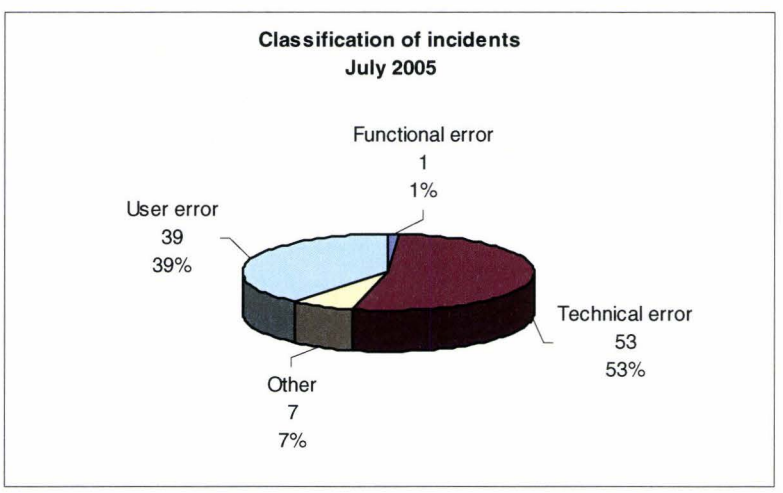


Figure 44: Classes of incidents (July 2005)

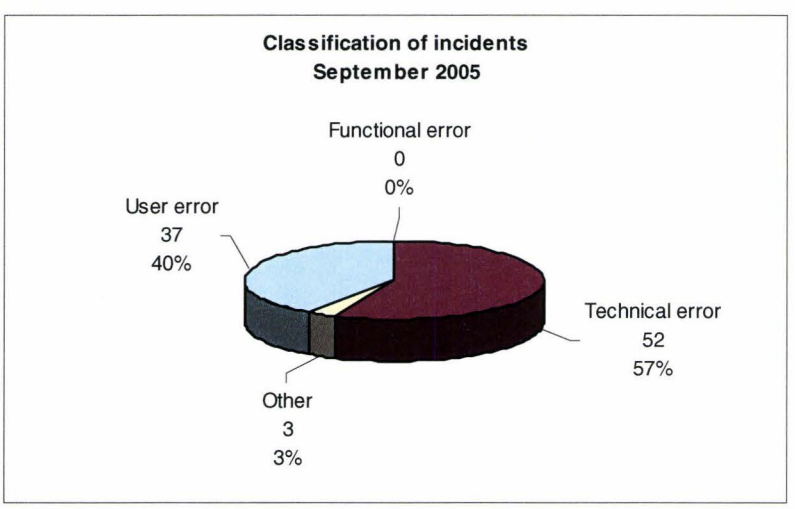


Figure 45: Classes of incidents (September 2005)

Appendix V Service calls per input channel

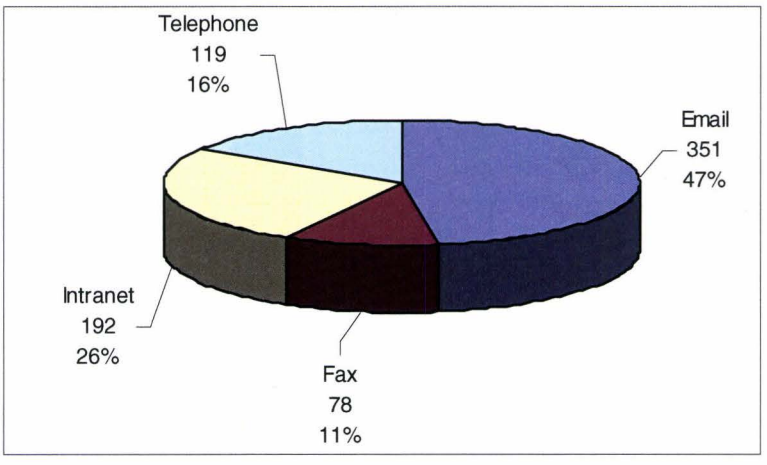


Figure 46: Service calls per input channel (Total)

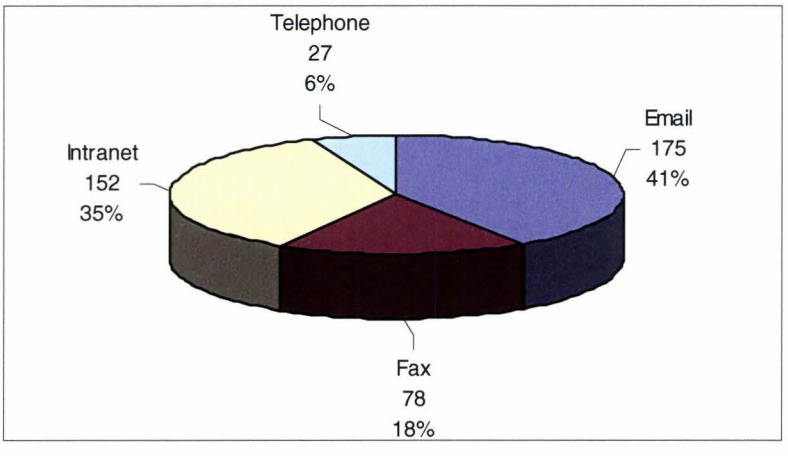


Figure 47: Service calls per input channel (Standard changes)

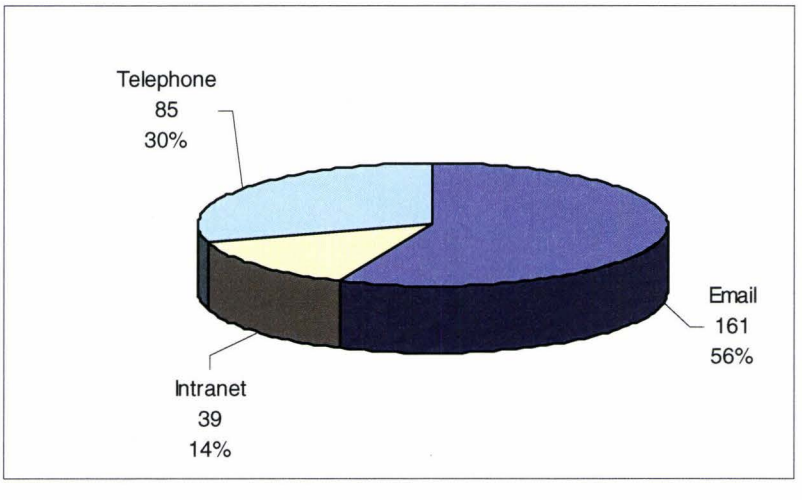


Figure 48: Service calls per input channel (Incidents)

Appendix VI Box-and-Whisker plots

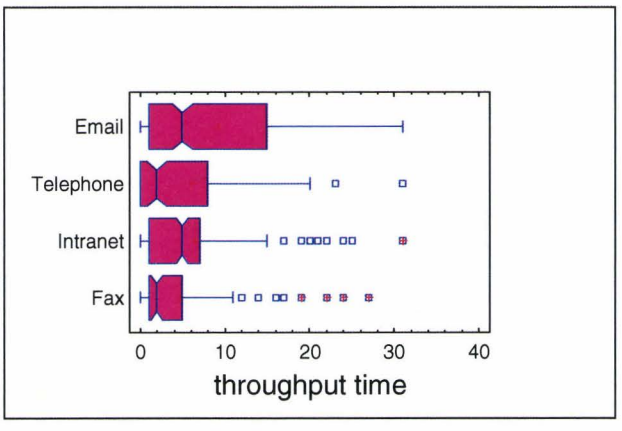


Figure 49: Box-and-Whisker plots per input channel

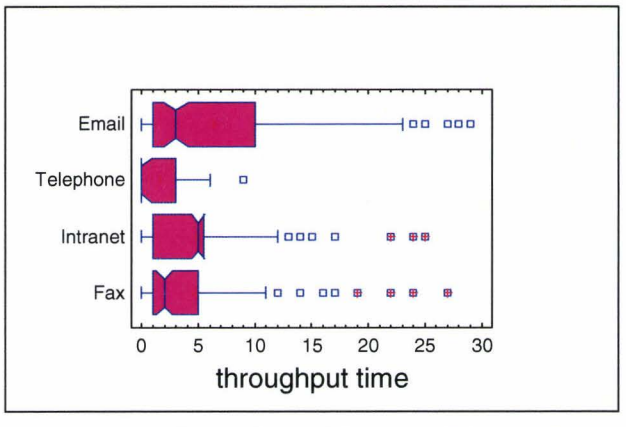


Figure 50: Box-and-Wisker plots per input channel (standard changes)

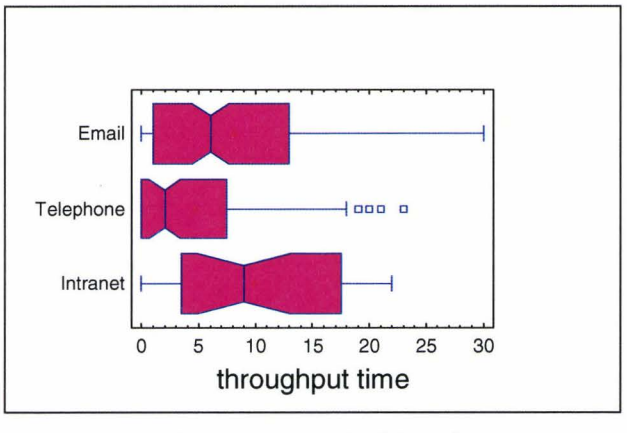


Figure 51: Box-and-Wisker plots per input channel (incidents)

Note: A box plot describes several features of a data set, such as centre, spread departure from symmetry and outliers. [Montgomery and Runger].

Appendix VII Country specific measurements

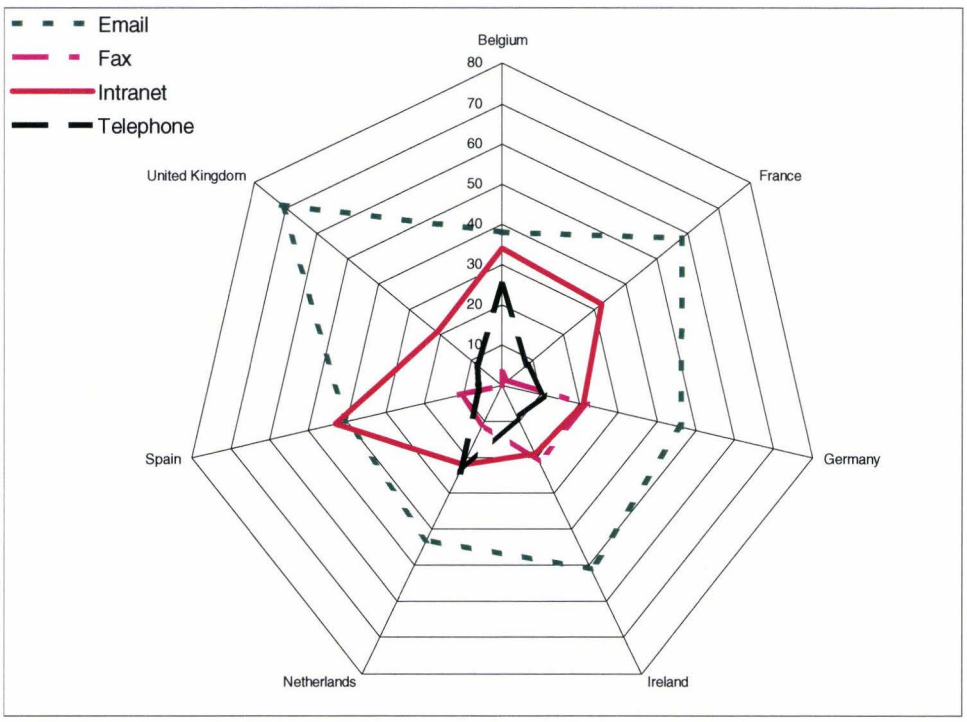


Figure 52: Radar graph of the usage of input channels per country

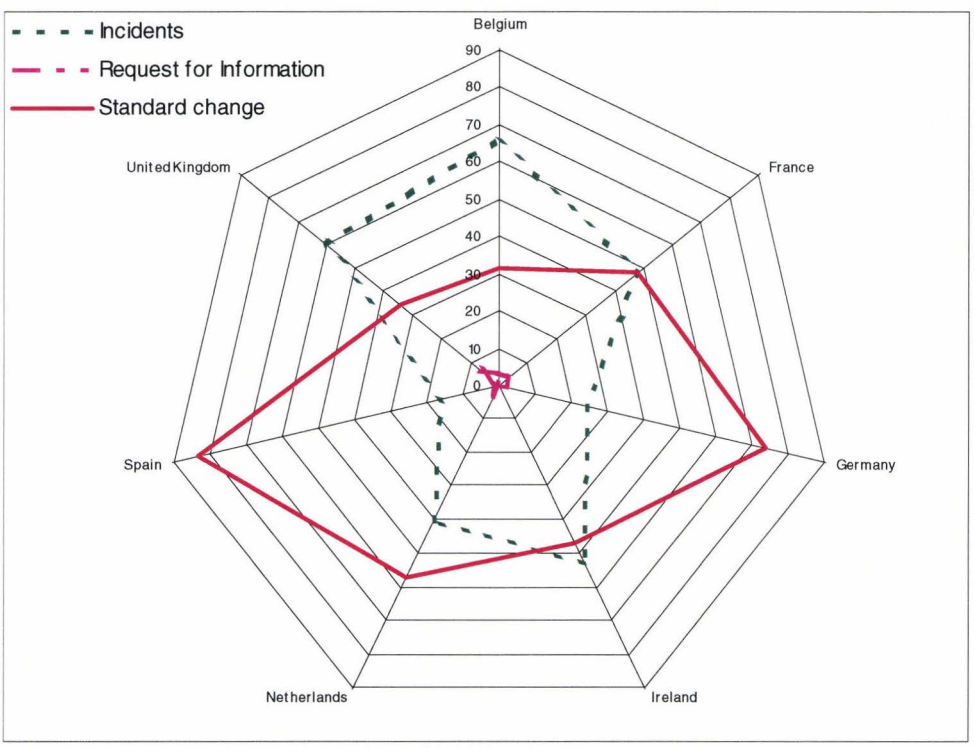


Figure 53: Radar graph of the categorisation per country

Appendix VIII Questionnaire & Answers

1. How many times a week do you contact the Front Office Service Desk?

2 times or less	3 times – 5 times	6 times – 8 times	9 times or more
18	10	4	2

2. Wich input channel do you prefer to contact the Front Office Service Desk?

Email	Intranet	Telephone	No preference
13	4	16	1

3. Why do you prefer a specific input channel?

Easy to use	More easy to explain the situation	Better call handling	Other
11	20	0	2

4. Has the type of request, like i.e. a problem, a change or a question, any influence on the input channel you will choose?

Yes	No
26	8

5. Do you experience any difference in the way your call is handled based on the input channel used?

Yes	No
17	17

6. Which input channel results in the most satisfying call handling?

Email	Intranet	Telephone	No differences
0	1	16	0

7. Which input channel results in the fastest call handling?

Email	Intranet	Telephone	No differences
0	0	17	0

8. Do you have any comments or remarks regarding the way you contact the Front Office Service Desk?

- I find it easier when I have a problem to explain this over the phone that via intranet or e-mail.
- By submitting a change request via Intranet you can only include 1 attachment; you should have the possibility to include more than 1 attachment.
- If I know the call is easy and fast to handle I will use telephone. If there is a database or screenshot necessary I use mail.
- Usually I prefer to create calls via "the source", but I find it easier to set the priority right from my perspective when I'm using the phone.
- If the request is complicated I feel it is better to use a written means of communication. This leaves people time to read carefully, and understand what is being asked (especially if English is not their mother tongue). It also leaves a written trace which they can consult again if unsure of what is expected. If the request is simple, and I expect that the answer is known and no work is required to find the answer, then a phone call may be the best solution.
- It is always very helpful that a person speaking Dutch makes the call. this is definitely the fastest way to receive an answer.

Appendix IX The ITIL structure

Nowadays, IT is incorporated in a lot of business operational processes. The term IT is a comprehensive one, as is the number of IT related activities within a modern company. So IT is inevitable in the work of millions of people all over the world. As a consequence people need to be supported in their processes. A well known framework for IT support is ITIL (Information Technology Infrastructure Library).

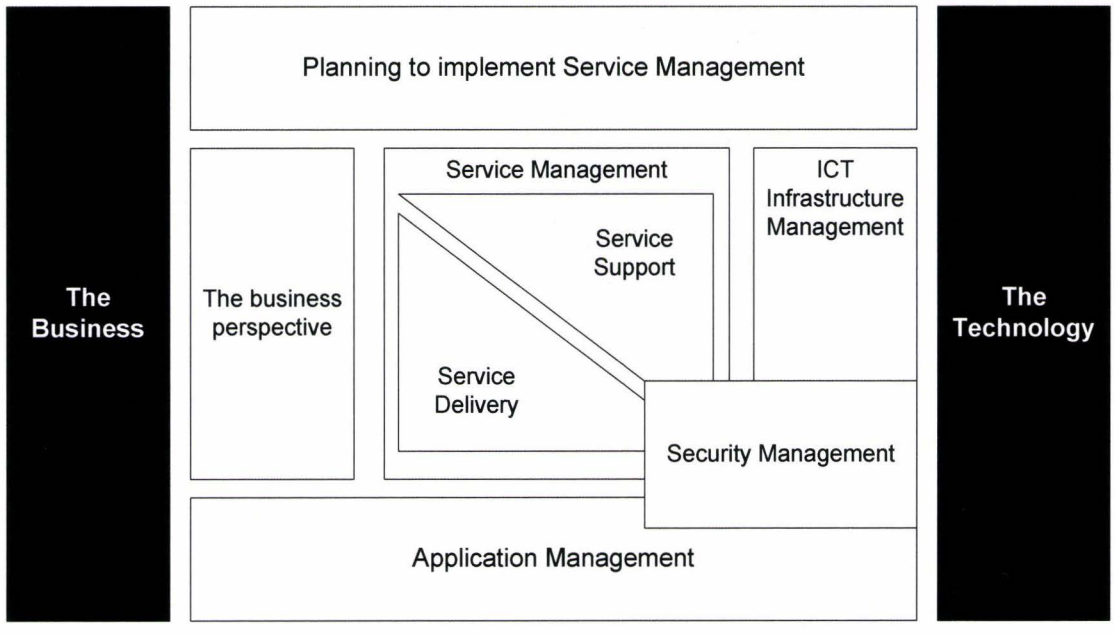


Figure 54: ITIL Structure [2]

The ITIL framework is divided into two main areas [2]:

- Service Support (operational processes)
  - Configuration management
  - Incident management
  - Problem management
  - Change management
  - Release management
  - Service Desk management

- Service Delivery (tactical processes)
  - Availability management
  - Capacity management
  - Financial management
  - Service level management
  - IT service continuity management