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THE PRODUCT REMOVAL PROCESS

A Case Study at Axis Communications

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Preface

This thesis was written at Axis Communications AB, in Lund, and it marks the end of our education at the Faculty of Engineering at Lund University.

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Abstract

Faster development of new products and shorter product life cycles increases the frequency of product removals. Despite its increasing presence, product removal tends to be neglected both in theory and in practice. When the product removal process is overlooked, it might induce customer dissatisfaction and unnecessary costs.

The product removal process is the implementation of the product elimination decision. It usually involves the planning of *when* and *how* a product should be removed from the market, and the execution of these plans. Since this important topic has been neglected, it needs to be examined further. The study uses a single case company, Axis Communications, as the empirical basis for research. Axis' products have a relatively short life time. Hence, the process of product removal is quite present. Personal at Axis describe that they experience increased difficulties in balancing supply and demand at the end of a product's life cycle. The purpose of this study is to add on to the body of knowledge regarding the product removal process and to help Axis improve its process.

The study includes a review of literature regarding product removal and process management. The two are linked together to create a theoretical framework. This framework is used to assess the empirical findings. The empirical data collection consisted mainly of semi-structured interviews and observations at Axis. Pattern matching and content analysis were used to investigate the found main issues, and to generate improvement proposals.

Three main gaps in current literature were found: (1) measurement and evaluation of the process, (2) the sales function's part in the process, and (3) the influence of overall strategy on the process. The empirical study and analysis revealed the main problems at the case company. These problems were divided into the categories: communication, responsibility & overall goals, customer interface, tasks & tools, measurement, demand, and external disruption. To solve, or reduce the impact of, the found problems, eight improvement proposals were developed. The four most important improvement proposals are:

- Determine overall strategy and goals
- Appoint a process owner
- Increase cross-functional integration
- Introduce performance measurements

A theoretical model of the process was also developed through combining the findings in literature with the empirical findings.

This study raises the awareness of the topic of product removal and connects it to process management. From the results it could be concluded that product removal hasn't been treated as a process. It is clear that key concepts from process management have been overlooked by both academics and practitioners. The product removal process is a cross-functional process and it must be managed according to the principles of process management. A product removal must, to be successful, be as well planned and thought out as the company's plans for launching a new product.

Contents

1 Introduction

In today's rapidly changing world, new product development has become a critical factor for the survival and competitiveness of companies (De Grosbois, et al., 2010). A lot of managerial focus is put on new product development and product launch. However, with new products constantly being developed there must also occur removal of old products that are being replaced. Companies selling advanced products usually have a thorough and complex supply chain and it may seem obvious that a product removal require the same amount of effort and focus from management as a product launch. Unfortunately, this is seldom the case. Many companies lack a sophisticated process to handle a product's removal process (Hise, 1975; Muir & Reynolds, 2011). This statement is in contrast to the fact that a substantial share of the total costs in a product's life cycle belongs to the last phase (Cheung, 2015). The product removal process can also be connected to customer satisfaction. There have been research indicating that removing a product may result in severe economic and psychological costs to customers, thereby seriously decreasing customer satisfaction and loyalty (Homburg, et al., 2009). The product removal process, if handled improperly, may also lead to scrapping of excess materials, entailing an undesired environmental impact. Hence, the product removal process is important in several aspects.

Balancing supply and demand is most challenging in the beginning and in the end of a product's life cycle. Therefore it is of high importance to have control not only of the product development and launch, but also of the product removal process. Axis has a product portfolio consisting of (amongst others) high-tech network cameras. These types of products have a relatively short life time. Hence, the process of product removal is quite present. Personal at Axis describe that they experience increased difficulties in balancing supply and demand when in the process of removing products.

1.1 Product Removal

Every company that sells products must at some point remove a product from their portfolio. There are several reasons and purposes why companies decide to remove a product. Some are listed below:

- The product is no longer living up to expected margins (not profitable enough).

- The product is to be replaced by a successor and the product is expected to no longer be attractive to customers.

- The company's product portfolio consists of too many products and it needs to be "cleaned up" through removal of products.

The decision to remove a product is typically made by management. This decision is part of a process that is usually referred to as the *product elimination process*. The elimination process consists of two main parts, namely the "decision-reaching process" and the "decision-implementation process", and it is the latter part which has been largely overlooked by both academic scholars and practitioners (Avlonitis, 1983). In this study, the "decision-implementation process" will be named the *product removal process*. Now, before getting into more details about the product removal process we have to sort out some definitions. The process of removing a product from the market has been called several different names (e.g.

product elimination, product deletion, and product removal). To avoid confusion and make it easier for the reader, some typical concepts are explained below:

- *Product life cycle* represents the unit sales curve for a product, extending from the time it is first placed on the market until it is removed (Rink & Swan, 1979).

- The *product elimination* refers to the whole process in which a product is removed. It typically involves several stages, including identification of weak products, a decision whether to remove the product or not (termed the *product elimination decision*), and the implementation of the elimination decision (the product removal process) (Avlonitis & Argouslidis, 2012).

- The *product removal process* is what this study focuses on. This is a process concerning removing a product from the portfolio. It does not involve any identification of weak products, nor any activities leading up to *why* the product should be removed. It starts when a product elimination decision has been made (Avlonitis & Argouslidis, 2012).

Product Removal Process

| Phase 1: Introduction | Phase 2: Maturity | Phase 3: Decline |

Product Elimination Process
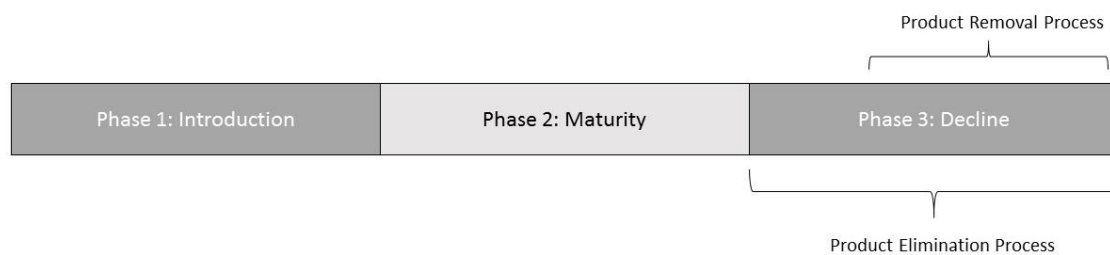
Figure 1: The Product Life Cycle divided into three phases. Note that the phases are disproportional.

The product removal process can, hence, be seen as a part of the product elimination process. The main difference between the two is that the product elimination process may involve process steps that leads up to the decision whether to remove or not (e.g. identification of weak products), while the product removal process does not involve any such activities.

The product removal process ranges over different functions in a company. The process is initiated when a product elimination decision has been taken and the information is then spread throughout the different functions, and also outside the company when appropriate. The information of a product removal is important to most functions in a company. E.g. for Marketing and Sales this means a product will no longer be available for sale and the interface to customers has to be customized to show this change. For Operations this means that this product will no longer be produced. The product removal process is of a cross-functional nature and it has a quite clear trigger in the form of the elimination decision.

1.2 Axis Communications

Axis Communications is a non-manufacturing company selling network products. The company was founded in 1984 and has always been in the business of developing products

related to network integration. In 1996, Axis launched the world's first network camera and this turned into an industry changer by transforming the video surveillance industry from an analog business into a modern network structure. Axis has since then been a world leader in digital network cameras and surveillance systems. Axis has its own internal research and development where all products are developed. The manufacturing of the products is performed by electronic manufacturing services (EMSs) and other suppliers. Axis has only some final assembly and testing at its configuration and logistics centers (CLCs).

1.2.1 Axis' products

The company has a range of products related to the surveillance and security sector. This includes digital network cameras, video signal encoders and decoders, and other security applications such as network door stations. The cameras, which will be the main focus of this study, are divided into four product families. These four families are fixed box cameras, fixed dome cameras, thermal cameras and pan tilt zoom cameras. Axis product portfolio varies from simple fixed box cameras to more advanced cameras with sophisticated features, such as thermal cameras with pan tilt zoom.
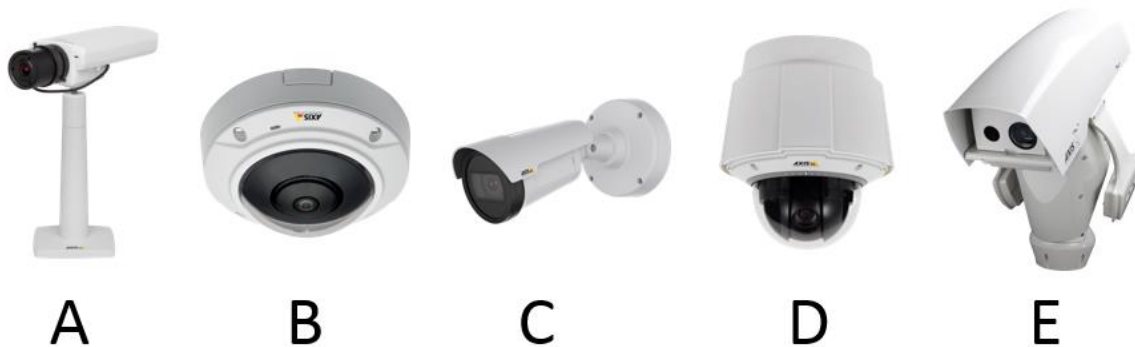
Figure 2: Examples from Axis' product portfolio. Fixed box (A), fixed dome (B), thermal camera (C), pan tilt zoom (D), thermal camera with pan tilt zoom (E)

1.3 Problem formulation

Axis perceives that its current product removal process has room for improvement. The process is of a cross-functional nature and it is uncertain whether the different functions at Axis has an understanding for each other in this particular matter. They describe that they have defined processes within the functions but that they are not linked together. This implies that there might be large potential for improvement within this area. Axis would like to make this process more effective and/or efficient but do not know how.

As described above, the product removal process is generally not something that is highly ranked in companies' prioritizing lists. According to Avlonitis et al. (2000), this important topic is not only being overseen by practitioners, but has also been neglected in theory. There have been studies and writings about product removal but most of this literature focus on the decision of whether to remove a product or not and not the removal process itself (e.g. Muir & Reynolds, 2011; Avlonitis & Argouslidis, 2012). This implies that there may be gaps in the theory of product removal and that it may exist areas within this topic where the body of knowledge can be extended.

The problem at Axis can be divided into two parts. These two parts can be related to two fundamental expressions in process management: effectiveness and efficiency. The first part is considering the operational approach in which products are removed. Axis is not certain whether their approach is the right one for their business. This part is a problem related to effectiveness – "doing the right things" (Drucker, 2006) and it raises the question whether there are more appropriate approaches for the product removal processes. The second part is considering the actual execution of the process. From what Axis describes it is clear that the execution of the process is not handled in a well-functioning way. They cannot directly describe why this is and it will be a part of the study to find out. This part is a problem related to efficiency – "doing things right" (Drucker, 2006).

The two sub-problems require research in different disciplines. The problem of choosing the operational approach is rooted in the theory of product removal. The problem of executing the process has its roots in the theory of process management.

1.4 Purpose

The aim of this study is to add on to the body of knowledge regarding the product removal process and to help Axis improve their process.

1.5 Research Questions

1. *What are current gaps in literature regarding the product removal process?*

2. *What are the main problems with the product removal process at Axis and how can they be categorized and prioritized?*

3. *How can the product removal process at Axis be improved?*

1.6 Focus & Delimitation

The empirical focus of this study will be on the product removal process within Axis. The process will be limited to the boundaries of Axis, hence, no effort will be made to evaluate processes at other tiers in the supply chain. As described above, the product removal process starts once the decision to remove a product has been taken, and the emphasis will be put on this process. However, the boundary between the product elimination process and the product removal process can be fuzzy since they go hand in hand. No effort will be put on how Axis decides which products to remove, but the reason behind an elimination decision may still be of interest for this study.

The study will cover the removal process for cameras only. It will not cover the process for other products, accessories or spare parts.

There is a strong relation between new product development and the elimination process. However, there will be no attempts to improve the new product development process since there have been statements from the company saying that it will not be changed.

The study will aim to provide suggestions on solutions to the problems that are described. The implementation of these suggestions will be left to Axis to conduct.

1.7 Approach & Method

The approach to the study was inductive. This means that empirical data was collected and substantive theory was developed from it. The research was conducted as a qualitative single-case study, starting off with a literature review. The literature review is structured through the use of different methods. The literature review ends with an analysis of the reviewed content, where new concepts and ideas are brought up.

The data collection consisted of interviews, focus groups, archival record reviews and observations. Protocols for how to perform interviews and focus groups have been developed to create structure and ensure rich documentation. Analysis methods such as pattern matching, explanation building and logic model creating are used to draw valid conclusions from the collected data. The quality of the study was tested with four design tests: construct validity, internal validity, external validity and reliability.

2 Methodology

This chapter describes general research methodology and different research methods, and explains why certain methods are more suitable than others for this project. This chapter also describes different data gathering- and analysis methods. The purpose with this chapter is to ensure that a scientific approach was used, and to strengthen the validity and reliability of the project.

2.1 Research Approach

The choices of scientific research approach and method lay the foundation for the research project and is therefore of uttermost importance. However, it is not an easy task. As described by the American social psychologist Joseph E. McGrath (1981) there is no "one true method" or set of methodological choices that will guarantee success. McGrath goes on discussing how difficult it is to perform research and that it is almost impossible to do "good" research. Despite his darksome view on the matter, it only further supports the importance of the theoretical ground for the research process.

2.1.1 Induction and Deduction

Firstly, there is the issue with determining the relationship between theory and empirics. According to Ghauri & Grønnhaug (2002) induction and deduction are the two ways of establishing what is true or false and to draw conclusions. Through induction general conclusions are drawn from empirical observations. Through deduction conclusions are drawn from logical reasoning.

Höst, et al. (2006) provide a similar definition of inductive and deductive research. Inductive research is when conclusions are drawn from empirics. Substantive theory is then built on analysis of these conclusions. Deductive research is when conclusions are drawn from previous research and logical reasoning. Its goal is to build or add on to existing formal theory.

The terms substantive and formal theory have been described by Gasson (2009).

"A substantive theory is a model that provides a "working theory" of action for a specific context. A substantive theory is considered transferable, rather than generalizable, in the sense that the elements of the context can be transferred to contexts of action with similar characteristics to the context under study. This contrasts with formal theory, which is based upon validated, generalizable conclusions…"

She further elaborates on when a substantive theory is generated: "A substantive theory is generated when the researcher can define core categories in the data and important patterns of relationships."

Golicic et al. (2005) discusses previous research describing how the formal theory should be applicable to phenomena, people and places in a broader perspective, i.e. how it should be generalizable. The formal theory should also be capable of generating predictive statements.

2.1.2 Qualitative and Quantitative Research

At the broadest level of research design, there is the decision between quantitative and qualitative research (Brewerton & Millward, 2001). They relate these expressions as to "what type of evidence is required".

Qualitative research means that data is collected by "soft" techniques such as interviews and observations. This type of research indicates a more thorough and in-depth analysis of the observed phenomenon. However, it lacks the broader and more generalizable perspective of quantitative research. Qualitative research can be connected to the inductive approach.

Quantitative research means that data is collected by "hard" techniques such as surveys and archival reviews. It can span over a wider area of research targets and is more used to confirm statements or hypotheses already developed. This can be related to the deductive approach.

2.1.3 Chosen Approach

The previous descriptions of the approaches resulted in a simplified structure that can be seen in *Figure 3*.
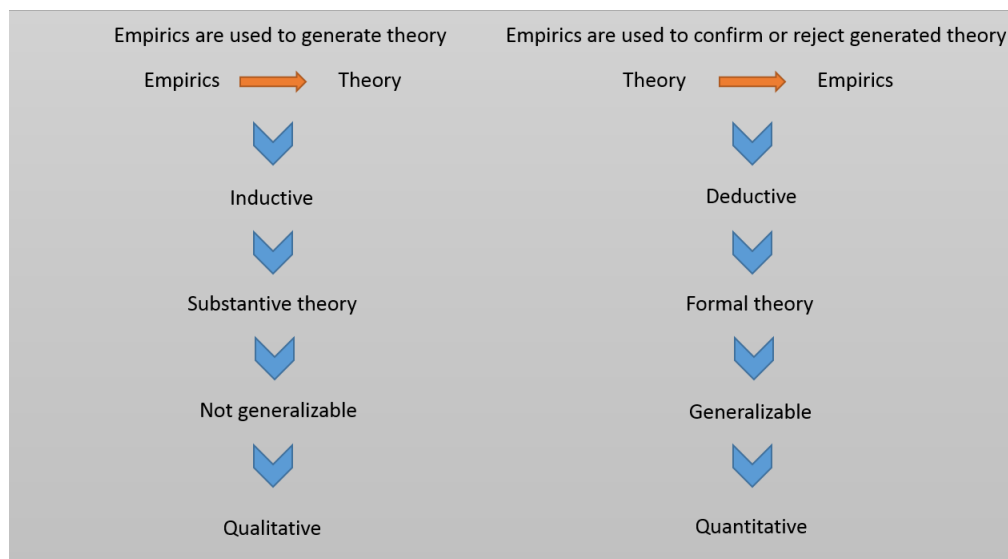
Figure 3: Simplified structure to the research approach decision

The issues related to the product removal process have arisen from observations at Axis, which could be considered as empirics. Continuation of these observations will build on to the empirics, which will be used to develop theory**.** This indicates that the study will be performed inductively. The specificity of the problem and its connection to a specified unit of analysis (the company) might hinder a generalizable theory. This means that a potential theory would be in some kind of substantive form. This is also in line with the previous description of an inductive study. The problem will furthermore be examined with a qualitative approach since the nature of the phenomenon is not statistical or "number heavy". However, in some cases quantitative evidence may have to be collected to strengthen arising queries. This points towards using an inductive, qualitative approach with both qualitative and quantitative data collection techniques.

2.2 Research Method

Research methodology does not in detail describe how research should be made but it provides the basic work flow for the study. It sets up the framework and principles for how to proceed, but does not provide detailed guidelines on how to conduct the study. Before a research study begins, a suitable research method should be chosen.

2.2.1 Research Methods

There are different research methods to choose from and the following is a short description of five common methods that are relevant when doing a master thesis within applied sciences (Höst, et al., 2006; Yin, 2014):

- *Survey*s provide a compilation and description of the current state to the studied object or phenomenon. A survey usually intends to describe a broad question. This is a quantitative research method where data is gathered from a large population of sources. A survey is suitable when the researcher wants to answer questions like, "How much?" or "How many?"

- *Case studies* are in depth studies in one or several cases with the purpose to explore and investigate a contemporary phenomenon (Yin, 2014).

- *Action research* is a closely observed and documented study of an activity with the intention to solve a problem. The study begins with an observation to identify or clarify a problem. The next step is to develop a solution to this problem and finally to implement this solution.

- *Experiments* are usually conducted to compare two or more alternatives. This type of research require control of behavioral events. A few parameters are kept constant while one is manipulated. By testing and evaluating different options a conclusion can be drawn.

- *Archival analysis* is a method where the researcher seeks answers in documentations and statistics (e.g. economic modeling, or a statistical analysis in an epidemiological study). Like a survey, this is a quantitative research method.

2.2.2 Chosen Method

"A study with the purpose to in depth describe a phenomenon or object should use a case study" (Höst, et al., 2006).

Surveys and archival analysis are both quantitative research methods that seek answers in data from a large amount of sources. The nature of the research questions to this study require a more in-depth and flexible method. Hence, a survey or an archival analysis is not suitable for this study. However, just because these two are excluded as research methods, does not mean that a survey or archival record review can be used as techniques for gathering data (see 2.3 Data Collection).

An experimental method require control of behavioral events (Yin, 2014) and since that would be extremely difficult for this study, an experiment is not the right method to go with.

The most suitable method for this research is a case study. Action research can be described as a form of case study (Höst, et al., 2006), but the lack of time and resources delimits the opportunity to implement a solution. This study will have more focus on how to identify key issues and to suggest possible solutions, not to implement them.

2.2.1 Case Study Research

Case studies are used to study contemporary events, especially when the event is difficult to distinguish from its environment (Yin, 2014). Case studies can be made in an organization to understand how a certain task is performed. A case study describes a specific case that is chosen for a specific purpose, and there is no statement that claims that the conclusion from this case is generalizable. On the other hand, if two cases have similar conditions, the probability of two similar conclusion will be higher. If a series of case studies is conducted the probability of getting to a general pattern will increase. However, there will still not be any "evidence" or statistical significant result, because the cases would not be selected through random selection, like in a survey.

Case studies could on the other hand provide in depth knowledge, which surveys cannot. The design of a case study is flexible – you can change questions and the focus during the study – and collected data is mainly qualitative. In a qualitative study, observations and interviews should be held with as many different persons/roles/documents as possible. This will let the researcher see different variations on the studied phenomenon.

2.3 Data Collection

In a case study, the following techniques are often used to gather data:

- Observations

- Interviews

- Archival record reviews

This section will explain these three data collection techniques – how they are executed, how they can differ and how they have been used in this study.

2.3.1 Observations

Observation is an activity in which the researcher studies an event and takes notes of what happens. There are two broad types of observational activity: *participating* and *non-participating*.

A participant observer studies an event alongside the target participants in the field. The participating observer has the benefit of, if done right, earn the trust of and becoming an accepted member of the observed community (Höst, et al., 2006; Brewerton & Millward, 2001). However, there is a risk of that the researcher gets too involved and loses distance to the studied object (Höst, et al., 2006). The observation process is unstructured without preconceived ideas or codes (Brewerton & Millward, 2001).

The non-participant observer does not participate in the observed situation, but instead observes in the background from a distance. The observation process may be guided by a checklist or a set of analytical codes (Brewerton & Millward, 2001). The non-participating

observer is more structured but risk getting too much distance to the observed object (Höst, et al., 2006; Brewerton & Millward, 2001).

It may seem insufficient to divide observation activities in just two categories. Those who are studied may have varying degrees of awareness that they are being observed. In addition, the observer may have varying degrees of interaction in the situation. *Table 1* summarize the four different observation activities that occurs when combining these two factors (Rosengren & Arvidson, 2002).

Table 1: Four categories of observational activities

Interaction	Awareness of being observed	
	High	*Low*
High	Observational participant	Full participation
Low	Participant observer	Full observer

- An *observational participant* is highly integrated in the observed group. The group is also highly aware of the observer. The data is collected by notes and the observer writes them down in a journal.
- A *full participation* observer is also integrated in the observed group but this type of observer tries to give away as little as possible that she/he is an observer.
- The *participant observer* is present in the situation, without being a real part of it. No actions are done to hide the fact that an observation is going on. The data is gathered through open methods, such as interviews and the observed group could be asked to "think loud" and explain to the observer how they act and why.
- The *full observer* does not take part in the group and, ideally, is totally invisible. The data collection is entirely hidden, i.e. the data is gathered through video surveillance and/or recorded audio.

2.3.2 Chosen Observation Activity

The most suitable observation activity for this study was the participant observer. This study was conducted at Axis, at their request, in their facilities and with Axis personnel as the main source of information. In other words, the observed group was highly aware of the presence of this study and they knew that they were observed. The observation occurred in parallel with other data gatherings, such as interviews. The observation has been mainly unstructured where spontaneous observations may have been in both formal situations, such as meetings, and informal situations, such as lunch breaks.

2.3.3 Interviews

Interviews can be used as the main mechanism for data collection and can be combined with other approaches such as questionnaires or observations (Brewerton & Millward, 2001). They are however open to a number of biases and shortcomings, but these can be remedied through quantification and objectification. Quantification means collecting data from several sources (interviewees) to get different angles and perspectives and thereby reducing bias. Objectification refers to the interviewer staying objective in the design of questions and execution of the interviews.

According to Alvesson (2011) there are mainly four subjects that describe interviews: *structure, size, communication media* and *category*.

2.3.3.1 Structure

The structure of the interview is concerned with how the interview is controlled and what level of involvement is expected of the interviewee(s). In several methodological studies the interview structure is divided into three types: *structured, unstructured* and *semi-structured* (e.g. Höst, et al., 2006; Brewerton & Millward, 2001; Alvesson, 2011; Ghauri & Grønnhaug, 2002; Voss, et al., 2002).

Structured interviews are strictly controlled by a beforehand created protocol stating questions and in which order they are to be asked. There could even be fixed response options for the questions. The interview should follow this protocol neatly without exploring or probing into other areas of interest. This structure ensures quick data coding, easy quantification of data and consequent comparability of responses. However, the structure constrain interviewees from thinking outside the given framework and does not allow for much discussion.

Unstructured interviews target broad themes where the interviewees are encouraged to lead the interview in order to end up in undiscovered areas of interest. There is no strict protocol and the interviewees are free to partly define and develop the relevant sub-themes or issues. This structure aims toward obtaining rich, prominent data from each individual, but lacks instead ease of comparability and quantification.

Semi-structured interviews are a blend of the two aforementioned structures. The interview protocol is fixed to some extent, preferably in the beginning and end, but also leaves room for exploration and discovery. It hence carries advantages and disadvantages of both structures.

2.3.3.2 Size

The size issue involves the choice of how many interviewees to use. It usually stands between using a single interviewee or a group of interviewees. Within the area of group interviews different versions can be used, e.g. brainstorming, focus groups. Brainstorming is an unstructured, open way of interviewing and is closer to observation. (Alvesson, 2011; Voss, et al., 2002) Focus groups are discussion-based interviews where qualitative data is generated through a staged setup, with a moderator controlling the discussion (Brewerton & Millward, 2001). The method can be used as a primary research technique, but it could also be used as a supplement to generate hypotheses or construct development. It is useful in exploring people's opinions, attitudes, beliefs and values of things (Brewerton & Millward, 2001).

2.3.3.3 Communication media

There are several forms of communication media: telephone, mail, face-to-face. When performing in-depth interviews, face-to-face is the favorable form.

2.3.3.4 Category

Alvesson (2011) gives example of how the interview design can be affected when different categories of people (children/elderly, men/women etc.) are subjects of the interview. There might be some relevance to consider this when interviewing people within different managerial or hierarchical levels. The specificity of the questions to be asked may differ between management levels. At the higher levels of management the problem has to be

tackled in a broader sense to find potential sources to the problem. When more specificity has been achieved in terms of location within the organization, the questions to lower level managers can be adapted.

2.3.3.5 Who to interview

When choosing interviewees there are two attributes to look for: quality and representativeness. Quality refers to the information obtained in the interview to be rich and insightful. Representativeness refers to the variation among the interviewees and aims to obtaining information from different angles. This also helps in reducing bias. (Alvesson, 2011)

Questions to ask when choosing interviewees could then be:

- Does this person have enough knowledge to contribute with rich and insightful information?
- How can this person contribute with a different angle or approach to the observed problem?

It is generally preferable to find a balance between representativeness and quality in order to get broad representation and "much-to-offer" interviews (Alvesson, 2011). Snowball sampling, i.e. asking interviewees to suggest people for future interviews is also a good idea.

2.3.4 Interview Protocol

The interview protocol is the piece of material that guides the interviewer through the interview process with beforehand determined guidelines.

An interview protocol is more than just a set of questions to be asked. It should also describe how the execution of the interview shall proceed, what should be done before and after the interview, and how the collected data should be analyzed. (Jacob & Furgerson, 2012)

The interview questions should be compared with the research problem and the scientific research questions to ensure the consistency between the interview and the purpose of the study. It is also preferred to create a draft of the protocol to be used in a pilot study. The pilot study involves showing the research problem and the protocol to a few respondents to see if there is an understanding of what data is searched for. Once the protocol has been adjusted to fit the responses in the pilot study and consistency has been assured the final draft can be assembled. (Ghauri & Grønnhaug, 2002)

The protocol should also be a subject of change. It is important to, after, or between interviews, revise whether the interview successfully acquired the desired information. The precision of the following interviews could be improved by asking questions like: what works and what does not, how can introductions, questions, tactics etc. be improved? The subjects of specification and broadness of the studied theme is of high importance here. (Alvesson, 2011)

 "*The most decisive and demanding work effort is to categorize, interpret and creatively use the interview material.*" (Alvesson, 2011) The analysis of data collected through interviews will be discussed in section *2.4 Data Analysis*.

2.3.5 Interview Strategy

In this study, mainly semi-structured interviews were conducted. The first interview consisted of a focus group in order to get a first, wider perception of the process and to generate ideas on where to start looking for issues. Past this, mainly single-interviewee interviews were conducted. The communication media was face-to-face in all but one interview. Some consideration to categories of interviewees was taken when designing the protocols for different interviews. The protocol that stood as basis for all interviews and was adjusted for each interview can be found in *Appendix 1*.

2.3.6 Archival Record Reviews

When executing a case study, archival records may be relevant for the researcher. Examples of archival records include: public use files; service records; organizational records (such as budget or personnel records); and survey data produced by others. These and other archival records can be used together with other sources of information in producing a case study (Yin, 2014).

It is important to consider the original purpose of the documentation. To exemplify: a commercial flyer may not give the same picture of a company as internal documentation would do (Höst, et al., 2006). It is also important to focus on relevant data and not get "lost in documentation". A researcher must always consider what type of information that is needed to answer the research question and not waste time on unnecessary data collection.

2.4 Data Analysis

Collected data have to be processed in order for it to have meaning. Data analysis could be referred to as turning data into information from which conclusions can be drawn. In this section, some techniques for coding, categorizing and analyzing data will be described. These techniques were all used in this study to generate conclusions.

2.4.1 Documentation and Coding

Ideally, documentation of interview material, transcription of tapes, noting of insights and ideas should be done as soon as possible after their occurrence (Voss, et al., 2002).

There is a three step coding scheme developed by Strauss and Corbin (2008).

- O*pen coding*: data are fragmented or taken apart. Concepts are then identified and developed from this break down. The concepts give rise to categories.
- *Axial coding:* consists of putting together data in new ways. The purpose is to regroup and link categories to each other.
- *Selective coding:* consists of selecting a core category and determining its relationship to the other categories of interest.

2.4.2 Content Analysis

Content analysis can be used to analyze any type of data that can be reduced to textual form. The technique comprises of two components: mechanical and interpretative. The mechanical component involves "physically" organizing and dividing data into categories and the interpretative component involves determining which categories are meaningful and actually relevant for the studied questions. The mechanical component can be compared to open coding previously described. The researcher will have to work with both components

alternately to develop a thorough analysis. There are three types of content analysis: qualitative, quantitative and structural. (Brewerton & Millward, 2001)

2.4.2.1 Qualitative Content Analysis

The emphasis of qualitative content analysis is on meaning rather than on quantification. The technique uses a grid with coding on one axis and focus group identifier on the other, see *Table 2* for an example. The targeted data is then located in the grid to visualize particular themes or meaningful quotations. Coding could be derived from the research questions and the protocol that has been used. Focus group identifier is the target of the data collection method (e.g. interviewees). (Brewerton & Millward, 2001)

Table 2: Example of a grid for qualitative content analysis

| **Code/category** | **Focus group ID** | | | |
	Interviewee 1	*Focus group 1*	*Interviewee 2*	*Observation 1*
x				
x				
x				
x				
x				
x				
x				

2.4.2.2 Quantitative Content Analysis

This method offers to use the qualitative data to create numerical data. It is often used to register the frequency of appearance, ranking or rating of certain themes or words. A theme is a statement or proposition about something and can be identified by the presence or absence of specific words. This is more a type of data conversion than it is an analytical tool. The numerical information can then in turn be quantitatively analyzed. (Brewerton & Millward, 2001)

A coding frame will have to be generated, just as with the qualitative method. This consists of a set of categories into which instances will be allocated. The categories can be created substantively, i.e. from the material (look at the material, see which categories can be made from it) or theoretically determined (determine categories from theory and use them to divide the material). When the framework has been settled the data is then quantified, often in the form of frequency of appearance of the different categories. (Brewerton & Millward, 2001)

2.4.2.3 Structural Content Analysis

The structural content analysis involves an establishment of relationships between the categories in the coding frame. Hence, the method has to consider both qualitative and quantitative content analysis as foundation. Rules for how to set up relationships between qualitative and quantitative categories will also have to be defined. (Brewerton & Millward, 2001)

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2.4.3 Pattern Matching

Pattern matching logic compares an empirically based pattern with a predicted one made before collecting the data. If the empirical and predicted pattern seem to be matching, this can help strengthening the internal validity. (Yin, 2014)

2.4.4 Explanation Building

Explanation building is a special type of pattern matching. The goal is to analyze the data through creating an explanation of the case. The idea is that a theoretical statement (broad at first) is made in an explanatory matter as a starting point, much like a hypothesis. This statement is then compared to the data and refined in an iterative process. The series could look something like below (Yin, 2014):

- Making initial statement or explanation
- Comparing the data to the statement or explanation
- Revising the statement or explanation
- Comparing other details of the case against the revision
- Repeating this process as many times as is needed

2.4.5 Logic Models, Dynamic Case Matrices and Causal Networks

Logic models describe and operationalize complex chains of occurences or events over an extended period of time. The relationships between the events are of a cause-and-effect type, where the first variable (event) is independent of any other. The remaining events in the model are dependent in a hierarchical structure where a dependent variable at an earlier stage becomes the independent variable for the next. The technique can be related to pattern matching as theoretically predicted events are matched against empirically observed ones. (Yin, 2014)
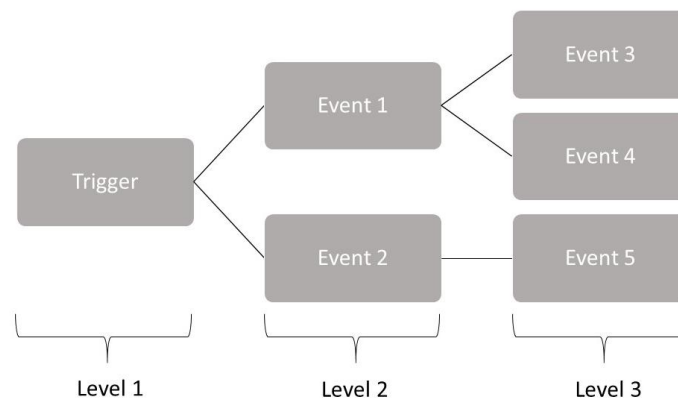
Figure 4: Example of a logic model

Figure 4 shows an example of a hierarchical logic model, where the dependency is described with levels. Here, level 1 is the independent trigger of the observed chain, on which all subsequent levels are dependent. In level 2 both events are dependent on level 1. In level 3, event 3 and 4 are dependent on event 1, but not event 2. Only event 5 is dependent on event 2.

A special type of logic model that can be used when looking at a business process is called a process map. In order to properly understand the process in focus, a visual model should be

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created. A process map is a diagram that shows tasks and activities performed in a business process, their interdependence, inputs and outputs and in which chronological order they occur. It should show which activities are predecessors and successors. (Damij & Damij, 2014)

The process model should reflect the attributes of the real process as accurately as possible in order to make valid analyses and conclusions. Different techniques for modeling exist, e.g. flow charts, spaghetti diagrams, value stream maps and data flow diagrams (Meran, et al., 2013; Damij & Damij, 2014).

Many of these techniques are quite similar, but a mapping technique that is especially useful on mid-level activities in processes that reach over several functions is the swim-lane flowchart map (Meran, et al., 2013) shown in *Figure 5*. This type of map shows in which area (e.g. function, team, department) each activity is performed by illustrating horizontal "swim lanes".
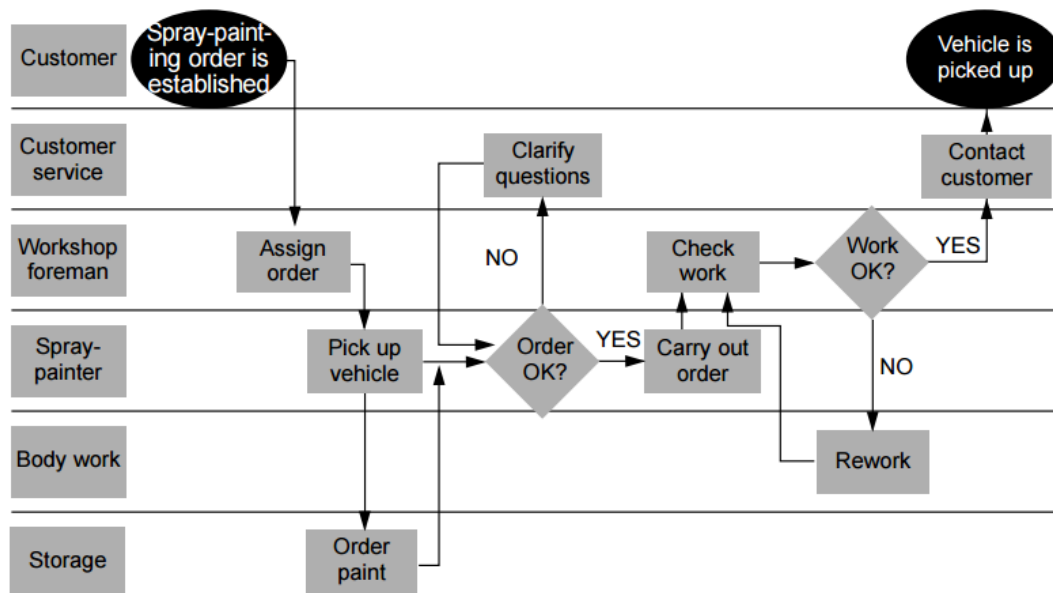
Figure 5: Swim-lane flowchart map (Meran, et al., 2013)

Two concepts similar to the logic models are *case dynamics matrices* and *causal networks*. The case dynamics matrix displays a set of forces for change and traces the consequential processes and outcomes. The causal network is a display of the most important variables in the field of study and their independencies and dependencies. It shows variables and what is cause and effect. (Voss, et al., 2002)

2.5 Case Study Design Tests
To prove the validity of a case study some tests have been developed. Four tests have specifically been established to test the quality of any empirical research. These four tests are *construct validity, internal validity, external validity* and *reliability*. (Yin, 2014)

2.5.1 Construct Validity
Construct validity is achieved through identifying and establishing correct operational measures for the concepts being studied. This can be done through using multiple sources of evidence, also referred to as *triangulation*. (Yin, 2014)

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2.5.2 Internal Validity

Internal validity is considered when an investigator is trying to explain how and why event x led to event y. If the investigator determines the relationship without knowing that some third factor z may also be involved, the research has failed to avoid a threat to the internal validity. This is also related to how inferences are made and how thorough the investigation is. Using appropriate analysis methods can reduce the threats to internal validity. (Yin, 2014)

2.5.3 External Validity

External validity is concerned with the generalizability of the study outside the immediate studied area (i.e. the company) (Yin, 2014). Developing a generalizable theory from a single-case study might be difficult. The inability to determine whether the theory actually applies to similar situations hinders the confirmation of external validity.

2.5.4 Reliability

Reliability is concerned with whether the study can be conducted with the same procedures by another researcher and gain the same findings and conclusions. The goal is to minimize the errors and biases. In order to make sure that the procedures of the study can be followed and, theoretically, repeated, they have to be clearly documented. The use of a study protocol and a data base can act as good documentation. (Yin, 2014)

2.5.5 Measures Taken to Achieve Validity

In order to confirm the quality of this study, some measures were taken to pass the four design tests. In *Table 3*, the tactics for dealing with the design tests, and the measures taken are described briefly.

Table 3: Design Tests, adopted from Yin (2014)

TEST	Case Study Tactic	Achieved through
Construct validity	Use multiple sources of evidence	Using different methods of data collection
	Establish chain of evidence	Having traceable steps from research questions to conclusions in the form of clear methodology and documentation
	Have key informants review draft case study report	Reviews from supervisors at the company
Internal validity	Use different, acknowledged forms of data analysis	Using pattern matching, explanation building and logic models
External validity	Use theory	Developing theory for the studied phenomenon
Reliability	Use case study protocol	Creating and using a thorough case study- and interview protocol
	Develop case study database	Saving all obtained material

2.6 Literature Review: A Six Step Approach

Literature reviews are considered essential when doing research (Seuring, et al., 2005; Brewerton & Millward, 2001; Höst, et al., 2006). They act as a record of evidence and material that has already been gathered (Brewerton & Millward, 2001). They help to generate ideas for research and summarize existing research by identifying patterns, themes and issues (Seuring, et al., 2005). Well performed literature reviews lessens the risk of overlooking already made findings and helps reaching the goal, which is to add on to the foundation of existing knowledge (Höst, et al., 2006). The following section stood as a guideline for how the literature review in this study was conducted.

The literature review should be approached systematically, starting with a broad perspective and narrowing down as the focus of interest becomes clearer (Brewerton & Millward, 2001).

Rowley & Slack (2004) describe five steps in a literature review:

1. **Finding and scanning documents** provides a familiarity with the broad spectrum of documents and may give insights into key themes that need to be included in the literature review. Some techniques of finding documents and gathering information are listed below.

   - *Brief search*: retrieves a few documents crudely and quickly to get a starting point.
   - *Citation pearl growing*: starts from one or a few documents and uses any suitable terms in those documents to retrieve other documents.
   - *Building blocks*: takes the concepts in search statement and extends them by using synonyms and related terms.
   - *Successive fractions*: search within an already retrieved set of documents to eliminate less relevant or useful documents.

2. **Making notes** leads to a distillation of key themes and messages. Sources of ideas should be noted so that citation to these can be used later on.

3. **Structuring the review** is concerned with identifying the key themes in the review and starting to organize concepts and documents in accordance with the key themes. A general framework could consist of four structural blocks.

   - *Basic definitions* – what is?
   - *Reasons for interest in the subject* – why is this important?
   - *Already made research* – what is there already on this topic?
   - *Summary of research opportunities and objectives*

   Another tool to facilitate the creation of a conceptual framework is mind mapping or concept mapping. This is referred to as a picture of the territory under study, and represents the concepts in that area and the relationships between them. Concepts are typically represented by labeled circles or boxes, and relationships are represented by lines or arrows. The relationships can also be explained with additional description attached to the lines or arrows. *Figure 6* shows an example of such a concept map.
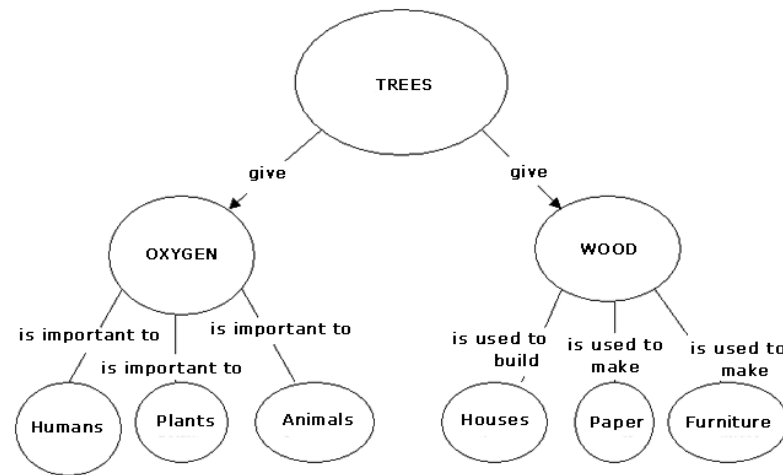
Figure 6: Example of a simple hierarchical concept map (Birbili, 2006)

4. **Writing the literature review** can commence once a broad structure has been resolved. The literature review should integrate in a coherent account with three different types of material.

   4.1 A distillation and understanding of key concepts

   4.2 Quotations should be used sparingly for special impact.

   4.3 A distillation of positions, research findings or theories from other authors, but written in own words.

5. **Building the bibliography.** The authors have some propositions on how to create the bibliography, but since this is done digitally, there is no need to dig into this topic.

   In addition to these five steps, a sixth is now introduced.

6. **Literature and theoretical analysis.** When the literature review is in its final stage an analysis of its impact on the study can be done. This is supposed to stand as a bridge between the literature review and the empirical research and can be compared to the first step in explanation building described in section 2.4.4 Explanation Building. The analysis should include own thoughts and even theories that has arisen from the literature review. It could be stated what is to be expected of the empirical study now that theory has been laid out. Examples of questions to this analysis could be:
   - What problems are to be expected?
   - How can these problems be identified and categorized?
   - What could be their barriers and drivers?
   - What type of framework could be useful in the empirical analysis?

This sixth step has some similarities with "operationalization", where the research questions are translated into testable and or measurable form, and hypotheses regarding expected results are created (Brewerton & Millward, 2001).

3 Literature Review & Theoretical Framework

This chapter treats the theory related to this study and will serve as a theoretical framework to the empirical study at Axis. The first sections presents the relevant theory found in previous literature. Then, an analysis follows with findings and thoughts developed during the literature review.

3.1 Introduction and Guideline for the Literature Review

This literature review focuses on product removal. The product removal process is a part of the product elimination process – the two processes go hand in hand. Hence, most of the literature regarding product removal has been found in the literature of product elimination.

The six step approach, described in 2.6, was followed to create this literature review. Step one involved scanning previous literature. Articles written between 1960 and today were scanned to get an overview of the previous written literature. Key words such as: product elimination, -deletion, -removal, and –discontinuation were used to search for relevant articles. The technique "*citation pearl growing*", described in 2.6 was also used to increase the search span. All relevant articles were saved, and comments and notes were made to each article, as described in step two.

These notes were then coded and different key themes arose. Step three involves four blocks. The blocks "basic definitions" and "reasons for interest in the subject" were handled in chapter 1. The other two blocks: "already made research" and "summary of research opportunities and objectives" are handled in this chapter. *Figure 7* shows an overall concept map of the already made research that is handled here. This can be related to "key concepts" described in step 4.1. The literature review begins with a broad perspective, and then it narrows down to the focus of this study, which is the product removal process and its characteristics. Following this is a brief review of literature within the topic of process management.
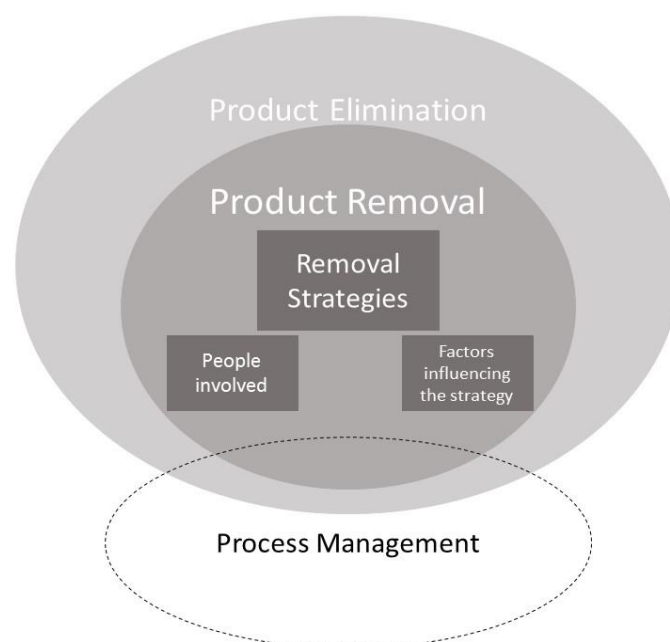
Figure 7: Concept map for the literature review & frame of reference

The review is concluded with a distillation and analysis of the reviewed content and based on this, a new model for the product removal process is presented. This is a combination of step 4.3 and 6 in the approach. This model is based on previous literature, but has been developed further and will be used to compare the case company to literature. The final block, "summary of research opportunities and objectives", is expressed as the gaps in literature that were found during the review.

3.2 Product Elimination Process

The product removal process is a part of the product elimination process. This section will provide a brief summary of the product elimination process and how research within the subject has developed over time.

Product elimination is a tool for effective product line management. This important topic has been given considerably less attention, compared to other product line management research (e.g. new product development) (Avlonitis, et al., 2000; Avlonitis & Argouslidis, 2012). Product elimination was not considered a topic of academic studies until the 1960s. According to Avlonitis & Argouslidis (2012), it was first mentioned in theories of product life cycle, where it was treated as a simple course of action for the end of a product's harvesting period, and in the theories of product portfolio management, where it was referred to as a straightforward option for declining products. However, after an ambitious period of global growth 1950-1960, where companies were highly engaged in line expansion without concern for the rises in costs it became obvious that companies had to change their product policy from expansion to rationalization.

In the 1960s, scholars began to give product elimination attention and address it as a standalone topic. Alexander (1964) was the first author to suggest that product elimination decisions should be made and implemented through a multi-stage process. Other conceptual studies then followed where scholars suggested similar multi-stage processes for taking product elimination decisions (e.g. Browne & Kemp, 1976; Kotler, 1965; McSurely & Wilemon, 1973). Typically, these studies describe a multi-departmental cooperation process that undergoes four sequential stages. The first stage (termed *identification*) aims at identifying weak products that need evaluation. In the second stage (termed *up-program,* or *product analysis*), the identified products are examined to detect the causes of deviation (e.g. Alexander, 1964; Browne & Kemp, 1976) and if these causes are controllable, possible improvement programs could be suggested (e.g. a quality improvement). The reviewed products, whose performance cannot be improved, move into a third stage (termed *down-program* or *product evaluation*). The impact of a product removal is projected on the profitability and sales volume of other items, the financial structure of the firm, the relationship with the employees and the market-related interrelationships (Avlonitis & Argouslidis, 2012). If the projection of a product removal does not suggest any serious negative impacts, then a decision to remove the product can be reached. The final stage, which several authors refer to as the *implementation of the elimination decision*, (termed *product removal*) involves choosing a removal strategy that is in the best interest of the company, and a preparation of a detailed timetable defining when and how to communicate the decision (Kotler, 1965). *Figure 8* is adapted from Avlonitis, et al. (2000), and it shows the four stages included in the product elimination process. The rest of this paper will focus on the last stage, which we call the product removal process.

1. Recognition Stage
(Identification)

Candidates for product elimination are identified

2. Analysis & Revitalization Stage
(Up-program)

Alternative course of action are considered to
restore the viability of the product

3. Evaluation & Decision Formulation stage
(Down-program)
Evaluates consequences of removal and decides
whether a removal is in the best interest of the
company

4. Implementation stage
(Product Removal)

Implementation of the elimination decision for the
product

Figure 8 Product Elimination Process, adopted from (Avlonitis et al, 2000)

3.2 Product Removal Process

"*Once the decision to eliminate a product is made, plans must be drawn for its death and burial with the least disturbance of customer relations and of the other operations of the firm*" (Alexander, 1964)

As explained above, the product removal process is the implementation of a product elimination decision (stage four in *Figure 8*). Previous studies suggest that the implementation of a product removal starts when it has been decided to remove a certain product (e.g. Avlonitis, 1983; Kotler, 1965; McSurely & Wilemon, 1973; Alexander, 1964). Conceptual theories suggest that the first step should be to develop policies and a plan for the removal process (e.g. Alexander, 1964; Kotler, 1965; McSurely & Wilemon, 1973; Browne & Kemp, 1976). For each product, management must investigate the impact on all affected parties (Kotler, 1965), determine who should be responsible for the process, decide on a product removal strategy, and develop a time schedule for the process (McSurely & Wilemon, 1973). The time schedule should involve when, what and how to notify each individual and component related to the product removal (e.g. production, distribution, sales etc.), and when other various actions of the process should be taken (McSurely & Wilemon, 1973; Kotler, 1965).

Avlonitis (1983) made an empirical study of the product removal process within industrial companies in the U.K. The emphasis was put on what tasks were performed, by whom, and in what sequence. His study shows that the process usually starts with the determination of a marketing program that will serve to meet the current demand, such as order backlogs or completion of certain contracts. The marketing program will also include the anticipated demand up to the desired withdrawal date and possibly the unforeseen amount which is likely to be demanded after the withdrawal date by strongly loyal customers. The next step is an inventory control. Both the stock of finished goods and the stock of material are revised. If the stock of finished goods is enough to satisfy the demand determined in the marketing program, further production is called off. If not, an additional batch is manufactured. The scenario is similar for raw material. If the amount is enough to manufacture the remaining amount of products, further purchasing is stopped. If not, the remaining material necessary to complete remaining manufacturing should be purchased. Once the marketing program is adjusted and the date for final production is set, management proceeds to declare the product obsolete. After this declaration, all ongoing orders are completed and new orders and inquiries are to be referred to production control before accepting and quoting. The stock controller then makes sure that excess inventory is scrapped. Once these tasks have been executed, the product's removal has been completed.

3.3 Product Removal Strategies

A big part of the product removal process is to choose the most appropriate removal strategy. Twelve different proposed strategies have been identified within the reviewed literature. However, some of them are very similar to each other. Avlonitis (1983) states that earlier theory mentioned two basic strategies that a company can follow after the product elimination decision: (1) drop immediately and (2) phase out. However, there have been conflicting opinions whether the first is applicable in practice. An empirical study by Mitchell et al. (1997), showed that some companies actually use the strategy "drop immediately", but according to Avlonitis (1983), no company "drop" a product in a "here today, gone tomorrow" sense. Instead, Avlonitis (1983) suggest a modification of the two: "*phase out immediately*" and "*phase out slowly*". Mitchell et al. (1997) suggest other variants of these (e.g. "slow harvesting" and "fast harvesting") but most research refer to some kind of phase out strategy where the "pace" of the phasing out is determined by a many different factors (see section 3.5 Factors Influencing the Choice of Strategy).

In addition to different variants of the phase out strategy, two other strategies have been identified in practice. One of them is the "*license out-*" or "*sell out-*" strategy, which involves the company selling the rights to produce the product to another manufacturer. The other one is the "*keep as premium*" strategy, which means that the product will no longer be produced as a standard, but will, if demanded, be provided as a premium product to a higher price. Appendix 2 summarizes the different strategies that have been identified in previous research, and as can be seen, many of them are similar to each other.

3.4 Who is involved and responsible?

Both theoretical- (e.g. Browne & Kemp, 1976) and empirical studies (e.g. Avlonitis, 1983; Muir & Reynolds, 2011) indicate that a range of departmental opinions have to be considered before the removal of a product is initiated. Several studies suggest that the marketing- and the finance departments are the most frequently involved departments (e.g. Muir & Reynolds,

2011; Avlonitis & Argouslidis, 2012). However, this involvement refers to the product elimination decision and not the product removal process.

McSurely & Wilemon (1973), suggest that after the removal strategy has been selected, an employee responsible for the actual phasing-out should be appointed. This will, according to McSurely & Wilemon (1973) probably be the current product line manager.

The question of responsibility has also been a topic of interest in business process management. Damij & Damij (2014) explains that the cross-functional process requires the creation of a special kind of manager who is responsible for taking care of the process. This manager, or "process owner", should follow the workflow throughout the different functions in order to create tight linkages between the involved parties. Other scholars (e.g. DeToro & McCabe, 1997; Rummler & Brache, 1991; Gardner, 2002) also discuss the role of the process owner and its importance in maintaining and improving business processes.

3.5 Factors Influencing the Choice of Strategy

In his study, Avlonitis (1983) found five major factors that influence the choice of strategy for the product removal.

- **The problem situation that evoked the elimination decision** (the reason for elimination) is one basic factor that influences the removal strategy and timing. If for example a product is to be removed due to governmental regulations, then a "drop immediately" strategy is preferred for obvious reasons.

- **Stock on hand** is a vital factor. The inventories of finished goods, components and raw material are usually revised to determine the length of a phase out.

- **Holdover demand** is especially important to companies operating in oligopsonistic or monopsonistic markets. Expected future orders and holdover demand will influence the timing and date of the removal.

- **Replacement product development** will most likely determine timing for important activities such as the cease of production and when to stop placing orders to suppliers.

- **Effect on customers** is another important factor that influence the choice of strategy. For example, if a product removal will have a large negative effect on the company's customers whilst the company finds that their relationship with its customers is important, the removal strategy will most likely be "phase out slowly".

The following section will summarize what has been written about each of these influencing factors.

3.5.1 Reason for Elimination

Avlonitis (1983) depicts how case histories have shown that the choice of product removal strategy can be correlated to the reason for elimination. For example, if the reason for elimination is declining market potential or a variety reduction policy, then the removal strategy is generally to phase out immediately. If on the other hand the reason is the development of a replacement product, then the strategy is generally phase out slowly.

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Harness & Harness (2006) also found connections between the choice of removal strategy and the problem situation that initiated the removal. They also describe how the 17 problem situations identified by Hart (1988) can be divided into three broad areas of influence: *overall performance of the product, internal influences*, and *external influences*. The overall performance of the product can be related to level of sales and profitability. Internal influences are from within the organization and can be related to management of the product portfolio, e.g. variety reduction policy, new product development, or poor quality and design. External influences are factors outside the organization's control that affect the tradability of the product, e.g. change in interest rates or government policies and regulations. How the different situations have been divided can be seen in *Table 4*.

Table 4: Reasons for removal

Overall Performance	Internal	External
Problems associated with raw materials and parts	Operational problems	Government policies and regulations
Poor sales performance despite a generally viable market	Development of a new product	Third party decisions
Poor profit performance	Company resources required elsewhere	Competitive activity
Poor product quality	Development of an active variety reduction (rationalization) program	Decline in market potential
Poor fit with strategic plans and company capabilities	Rationalization due to mergers and acquisitions	Parent company decisions and policies
Poor fit with company image		

3.5.2 Stock On Hand

McSurely & Wilemon (1973) emphasize that the inventory status is a vital input to the selection of the proper phase-out strategy. Specifically, how much capital is tied up in inventory and at what stage of manufacturing and distribution it is located.

In his article, Alexander (1964) mentions the consideration of "stocks" in the removal process. He depicts that it is about downsizing the operation surrounding the product that is to be removed in order to recover the maximum amount of working capital invested in it. Kotler (1965) elaborates on how one factor when determining the "phasing-out plan" is the remaining finished and semi-finished stock in inventory at the company and its distributors.

Avlonitis (1983) found that most companies include their current inventory of raw materials, components, and finished goods in the assessment of when to set the removal date. Hence, the stock on hand significantly affects the timing of the product removal.

3.5.3 Holdover demand

Holdover demand is referred to as the demand that remains after the product has been removed. The problem to anticipate future orders and holdover demand has been found to be an important factor in the determination of the removal date (Avlonitis, 1983). Especially for companies operating in oligopsonistic markets this factor is of primary importance. These

companies tended to extend the time of product availability to their most important and loyal customers (Avlonitis, 1983).

Harness & Harness (2006) describe different financial services' removal strategies that take the holdover demand into consideration. Their strategy "make product a closed issue" ceases sales of the service to new customers but keep providing existing ones. The strategy could also entail removing features from the kept service, launching a new service with the same name, or merging similar services into one.

3.5.4 Replacement Product Development

"If one phases out the old product too late, then the new product may suffer from poor sales due to the late withdrawal of the old product. If one introduces the new product too early, then it may cannibalize the demand for the old product. However, if the new product is launched too late, the novelty of the new product is diminished." (Lim & Tang, 2006)

Lim & Tang describes the difficult dilemma concerning the introduction of a new product simultaneously to a product removal. Having a replacement product ready for launch when it is time for the old product to be removed affects several variables in the business. The demand for the old product may increase in the short-term as customers anticipate its imminent elimination (Saunders & Jobber, 1994). In many cases, the scheduled launch date of the replacement product tends to determine when the eliminated product is to be removed (Avlonitis, 1983). This launch date has also been found to trigger, or be a deciding factor for, other activities such as when to stop procurement, or when to notify sales and customers (Avlonitis, 1983).

When there is in fact a replacement product at hand, the factor of holdover demand becomes less important when deciding the removal date (Avlonitis, 1983). Companies in Avlonitis' study indicate that they change the incoming orders of the old product into orders of the replacement product. Generally, the synchronization of simultaneous product introduction and removal has been found to be the basic aim (Avlonitis, 1983). However, this is a most difficult target due to the complexity of new product development. One common way to approximate this situation is to postpone the removal of the old product, a tactic that may prove to be very costly since it might require upscaling the production that has already been downsized (Avlonitis, 1983).

3.5.5 Effect on Customer

The effect on the customers is an important factor to consider when choosing a product removal strategy. The goal to minimize costs related to the product removal conflicts with the goal of retaining goodwill towards customers. Or as Alexander (1964) describes it: "with the least disturbance of customer relations and of other operations in the firm". These two opposing objectives can be balanced against each other. Emphasis put on each of them has been found to be dependent on three factors (Avlonitis, 1983): (1) the position of the company on the market, (2) the cost entailed by delaying the removal, and (3) the importance of the customers of the eliminated product to the company.

The company's position on the market is dependent on the market economy in which it operates and the strength of the company. Avlonitis (1983) determined that a more competitive market with individual customers (oligopsonistic market) requires a slower phase out, and that more care is taken to inform and educate customers about the removal and the

eventual replacement product. If the company on the other hand is operating in a monopsonistic market and has large power over its customers, more focus should be put on minimizing the costs associated to the process, e.g. using up stock of material and components.

The costs entailed by delaying the removal are engendered by the loss of goodwill (Avlonitis, 1983). The delaying of the removal is actually referred to as a "slower" phase out. This is much related to the first factor discussed, but is more specifically focused on the costs that the loss of goodwill could entail. Avlonitis (1983) observed little concern for this potential loss in his study.

The importance of the customers to the company could consider the individual revenue-share or other key characteristics of the customers. A customer that is vital to the company should be treated with more caution in the removal process and should be noticed enough in advance to be able to switch to a substitute or replacement product (Avlonitis, 1983). There should also be enough time for the sales team to adapt to this change in order to properly inform and educate the important customers.

Homburg et al. (2009) made an empirical research on the effect of product removal on customer relationships. They suggest that customers can be affected by the outcome of the removal process, and by how the removal process is executed. This is referred to as the perceived quality of the outcome and the perceived quality of the removal process. The impact on the customers can come in the form of psychological costs (e.g. loss of trust in the company) and economic costs (e.g. resources spent on search for, and adoption to a substitute product).

Homburg et al. (2009) evaluate business relationships by to which extent the customer felt confident about the company's reliability and flexibility and its fit for long-term relational benefits. They explain that product removals tend to raise customer doubts about engaging in a business relationship with the company. A company's withdrawal of a product typically has serious negative consequences for its customers and for company-customer relationships.

In their study, Homburg et al. (2009) found that the economic costs of the customers tend to be equally driven by perceived quality of process and outcome, whereas a customer's psychological costs are more heavily affected by the perceived quality of the process. They also found that customers' perceived loss of long-term relational benefits (induced by psychological costs) damages a business relationship more severely than a perceived short-term economic loss.

There have also been predictions on how the development of the topic will proceed in the future. Harness & Harness (2006) relate the development of the influence of the customer on product removal to relationship marketing. As relationship marketing has gained in popularity, they propose that it is likely that the customer's influence will have stronger impact on the choice of product removal strategy.

3.6 Success Measurement

To know if the process was successfully executed, the output has to be measured. And to know if the measurement of the output is good for the company, the company need to determine the desired result (i.e. the goal with the process). Harness & Harness (2012)

addresses several measures that can be used to determine whether the process has been successful or not. *Table 5* summarizes these 22 "success measures".

Table 5: Success Measures (Harness & Harness, 2012)

Contribution to product management function	Success Measures	Physical good	Service offerings
Simplification/ concentration of management and sales effort	Less confusing products for sale	*	*
	Concentration of sales effort	*	*
	Concentration of management effort	*	*
	Simplification of management activity	*	*
	Strategic planning enabler	*	*
	Fulfilment of regulatory obligations	*	*
Improved product portfolio performance	Increased product portfolio performance	*	*
	Increased profitability	*	*
	Decrease risk (failure/financial exposure)		*
	Increased sales	*	*
	Improved competitive position	*	*
Customer management related	Customer retention	*	*
	Customer satisfaction	*	*
	Reduced customer confusion	*	*
Improved physical and financial resource management	Longer production runs	*	
	Stock reduction	*	
	More efficient use of stores	*	
	Easier production control	*	
	Higher plant utilization	*	
	Release of resources	*	*
	Improved asset management	*	
	Increase production capacity	*	*
	Improved financial structure	*	

Harness & Harness (2012) emphasize that the product removal process must be structured and based on facts. They discuss how collection of data that highlights the likely impact of product removal on critical stakeholders e.g. suppliers, internal business functions, distributors and customers, is essential. They further elaborate on how the sequence of activities that leads to elimination should be defined, and that success indicators should be woven into this sequence.

In order to gain success, Harness & Harness (2012) also mention that communication strategies should be developed to inform, instruct and reassure customers and sales staff about the removal. Timescales and budgets should also be used, since planning was considered vital to determine the impact of the removal process.

Avlonitis (1983) advise that a product removal process must be executed with the same amount of effort as the execution of new product launch.

"*It appears as though there is no single, right way to dispose of unprofitable or obsolete products; each strategy adopted by a company must, to be successful, be as well planned and thought out as the company's plans for launching a new product*." (Avlonitis, 1983)

3.7 Process Management

The purpose of this section is to get a quick overview of the concept of process management and its different approaches.

Almost every company is divided into organizational units, which are called functional areas or functions. Each functional area is specialized in accomplishing a particular and specialized kind of work. Examples of these functions are Marketing and Sales, Production, Purchasing, Finance and Human Resources. (Damij & Damij, 2014)

When the company is organized into these functional areas, it is called a vertical organization. The work conducted in each function often becomes isolated from the work in other functions. This creates a boundary between functions that end up being "silos" of isolation (Rummler & Brache, 1991).

The work performed in each function is often tightly connected to and needed by work accomplished in other functions. The work started within a specific function is usually continued and completed in another function. (Damij & Damij, 2014)

The isolation between the functions hence becomes a problem. Rummler & Brache (1991) provide the description of a horizontal organization which has a "systems" view of the company. The horizontal view shows how work actually gets done through the visualization of business processes. A business process is a set of activities that takes one or more inputs and creates an output that is of value to the customer (Hammer & Champy, 1995). To see the work performed in a company as processes instead of separate activities is the foundation of process management. Damij & Damij (2014) noted their own definition of a business process, which is illustrated in *Figure 9*. It shows clearly how a business process is of cross-functional nature.
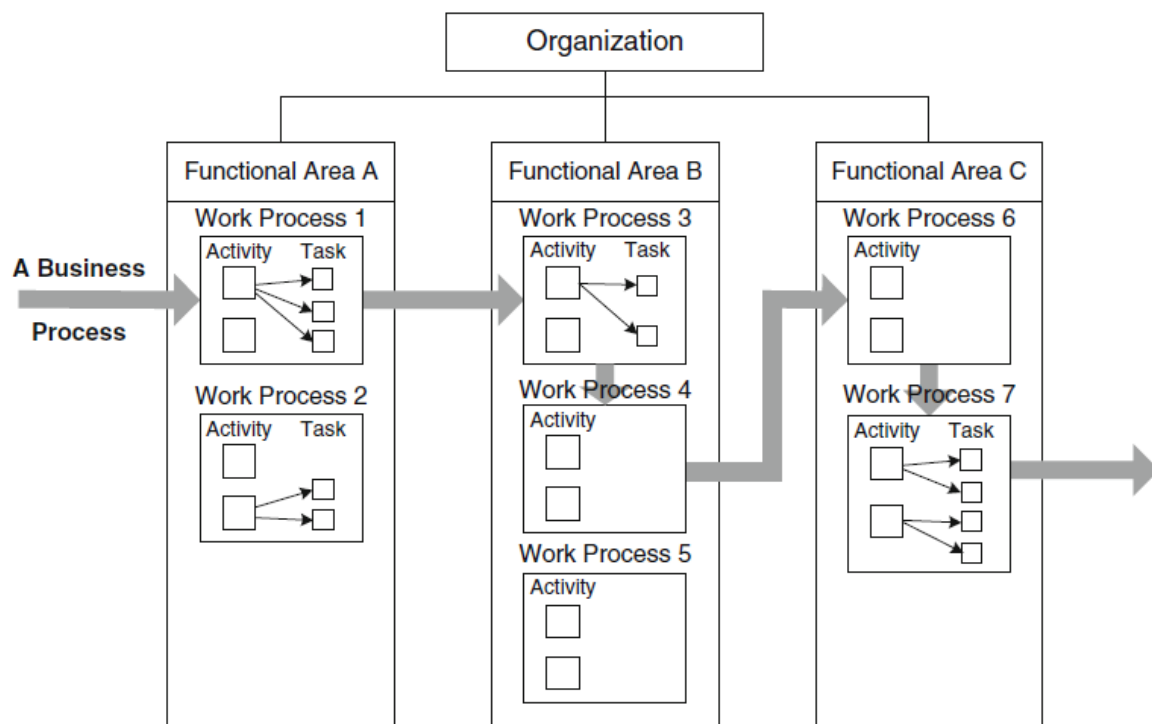
Figure 9: A business process in the vertical organization (Damij & Damij, 2014)

A business process must have an input, an output, and a clear goal which should be aligned with the company's overall goals. The process should have cross-functional measurements and a process owner to ensure that the process is managed (Gardner, 2002).

The effects of integrating functional parts of the company on organizational performance has been studied for an extensive period of time. Wheelwright (1985) discusses manufacturing companies in the U.S. together with previous literature and consultancy reports. The results shows that cross-functional integration (referred to as "horizontal integration") increases organizational performance. Pagell (2004) also discusses how previous literature and empirical evidence further strengthen the importance of cross-functional integration.

3.7.2 Business Process Approaches

Different types of approaches to how business processes can be handled and improved have been developed. This section will discuss two of them: business process reengineering and business process improvement.

Business process reengineering means that the current or old process is completely scrapped and replaced with a new process (Hammer, 1990). The design of this new process should be founded in the strategic goals of the company. This is the most radical approach and it depends on the reengineering team to be very knowledgeable and experienced in innovative work in order to develop better business processes (Damij & Damij, 2014).

Business process improvement is about turning the existing process into a better one without erasing the fundamentals. This is done through finding ways to increase performance, quality and lowering cost (Damij & Damij, 2014). In order for this to be possible, an identification and analysis of the current process must first be conducted. This analysis includes discovering obstacles and problems that cause the process to not be functioning as expected.

A comparison between business process reengineering (referred to as 'process innovation') and business process improvement was made by Davenport (1993) and he concluded that they do not necessarily replace each other, but could work together sequentially, see *Figure 10*.
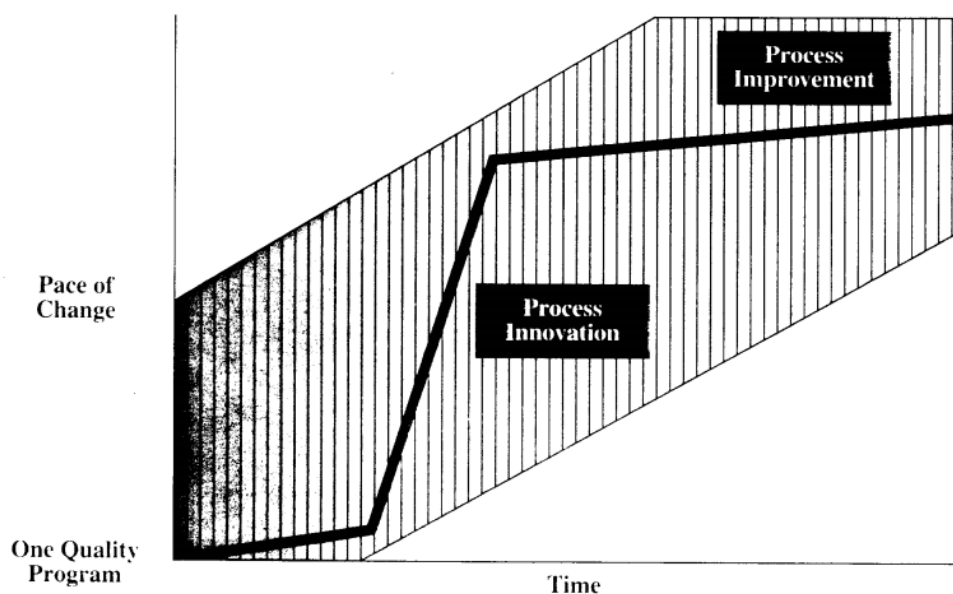
Figure 10: Sequential alternation by Davenport (1993)

Damij & Damij (2014) briefly introduce the different phases of business process improvement first mentioned by Harrington et al. (1997): *documenting, analysis, implementation* and *management*.

Documenting is about collecting information about the process so that it can be described and visualized. Following the process, conducting interviews and deploying surveys are recommended ways to collect this information. Activities and tasks within the process should be defined and documented. In order to avoid misunderstandings and mistakes, the collected information should be presented to the ones involved in the process to gain their approval of its validity. The information should then be presented to management in order to further validate the understanding of the process.

The analysis phase includes synthesizing the collected information in order to draw conclusions on where room for improvement exists. It is important that the employees who are involved with the process are heard out since they are the actual experts of the execution of the process. Their experience may contribute to finding opportunities of improvement.

The implementation phase is when the design of the improved process is created and communicated to the different departments involved. Modifications and improvements can be made in collaboration with department managers in order to make the process fit the real situation better. Once a consensus on the process design has been achieved, an implementation team can be allocated to the task of replacing the old process.

The last phase is called the management phase and consists of keeping the process up to date as the environment changes. Incremental improvement should be part of the process owner's work to maintain the quality of the process. Creating a continuous improvement plan could facilitate this assignment.

3.8 Analysis of the Literature Review

This section is the final step in the literature review and it contains our findings together with thoughts and ideas that arose while creating the literature review. First, our findings on the removal strategies and the factors influencing the choice of strategy will be explained. Second, we will describe the missing pieces in the literature, i.e. the gaps. Last, we will conclude some challenges we expect to face at Axis in the empirical study.

3.8.1 Product Removal Strategies

Many of the different types of removal strategies discovered in the literature had one common theme: time. The strategies often revolved around when, or how fast the removal should occur. Since the time aspect was the only thing that differed many strategies from each other, we decided to put all these together in a single "phase out" strategy, which involves removing the product over a set period of time. This time period is decided upon after the choice of using the phase out strategy has been taken.

Apart from the time aspect there were some extremes that deserve special attention. The "drop immediately" strategy was found to be used only under certain circumstances, e.g. if the product is being removed due to governmental regulations. The "license out" is special in its nature since the product actually stays on the market and it requires a more thorough external analysis than the other strategies. The "keep as premium" strategy is also considered a separate one since the product is not actually completely removed from the portfolio. Based

on this, we conclude that there are a total of four strategies, relevant to this study, which can be applied to a product removal.

1. Phase out
2. Drop immediately
3. License out
4. Keep as premium

The choice of strategy and the pace, timing and scheduling will be dependent on five factors as explained by Avlonitis (1983): (1) Reason for elimination; (2) stock on hand; (3) holdover demand; (4) replacement product development; and (5) effect on customer.

Reason for elimination

The pace of the phase out is not primarily dependent on the reason for elimination. However, if the reason for elimination is external and compulsory (i.e. regulation or prohibition) the drop immediately strategy should be used to avoid legal and reputational consequences.

Stock on hand

As several authors explain, the inventories of raw material, components, and finished products should be investigated when deciding on the pace of the phase out. The aim is to reach zero in the supply and demand equation at the end of the removal.

$$current\ inventories + planned\ procurement\ and\ production \\ - current\ demand - expected\ demand\ until\ end\ of\ removal = 0$$

If a positive result is derived from the equation there will be obsolete material left in stock after the end of the removal, which most likely will induce scrapping. If on the other hand a negative result is derived, this means there will be a stock out, which is also undesired since it lowers customer service level. The amount of stock on hand can directly affect the pace of the removal. The effect is shown in *Figure 11*.
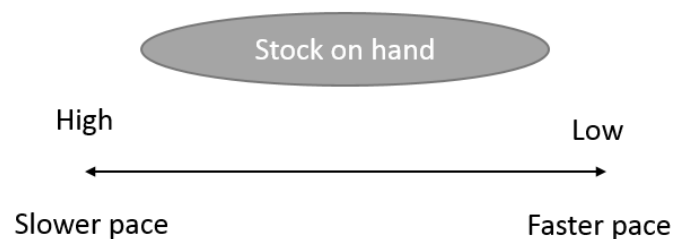
Figure 11: Pace effect of stock on hand

Holdover demand

If holdover demand is expected from important and loyal customers this could lead to lengthening the phase out period or even lead to the keep as premium strategy. If the holdover demand is expected to be very high (compared to regular/current demand) from important customers, and the company cannot continue producing, the license out strategy should be considered.

Replacement product development

Having a replacement product ready should make the phase out period shorter. Consideration should be taken to how the demand patterns change when there is a replacement product at

hand. Possibilities of replacing orders on the removed product with orders on the replacement product should be investigated and used when determining the pace of the phase out. The effect is visualized in *Figure 12*. Having a replacement product that is similar to the removed product might also hinder the license out and keep as premium strategies. The company would not want to compete at the marketplace with its old product (if it could be considered competitive) or see cannibalization within its own portfolio.

Figure 12: Pace effect of replacement product development

Effect on customers

The importance of the customers plays a large role. When doing the evaluation of the product it should be considered if any important customers are buying this particular product. If so, it should be determined how the removal will affect them and the pace of the phase out should be adjusted accordingly. The findings by Avlonitis (1983) can be resolved in a conclusion regarding the relationship between the choice of removal strategy and the company's market position. The stronger the market position of the company, the more focus it should put on minimizing the costs related to the removal process, which will probably lead to a faster phase out. The weaker the market position of the company, the more focus it should put on retaining customer goodwill (i.e. minimizing the effect on customers), and this might lead to a longer phase out period. *Figure 13* illustrates this relationship.

Figure 13: Pace effect of market position

The findings made by Homburg et al. (2009) show that the perceived quality of the removal process is more important to the customer than the actual outcome of the removal. This gives rise to the thought that increasing the efficiency of the process might as well increase effectiveness. The perceived quality of the process from the customer side should be dependent on how well the customers are informed and kept up to date, and how well the company sticks to established statements and time schedules.

Product Characteristics

In addition to these five factors, a sixth has been identified: product characteristics. The empirical study by Avlonitis (1983) showed that most companies within the engineering

industry preferred the "phase out slowly" strategy, whereas similar studies by Rothe (1970) and Eckles (1970) indicated that companies within the consumer goods industry preferred the "immediate drop" strategy. This can be related to the complexity of the product and its function at the customers. If the product is an advanced industrial product that is integrated into other systems it may be more difficult to replace. If on the other hand the product is a commodity, it should have apparent substitutes and the replacement should be easier. Depending on the ease of replacement, customers should be given enough time to either find substitutes, or adapt to the replacement product that the company is offering (if they are). The product characteristics hence affects the pace of the phase out, shown in *Figure 14*, and could in some situations lead to the drop immediately strategy.
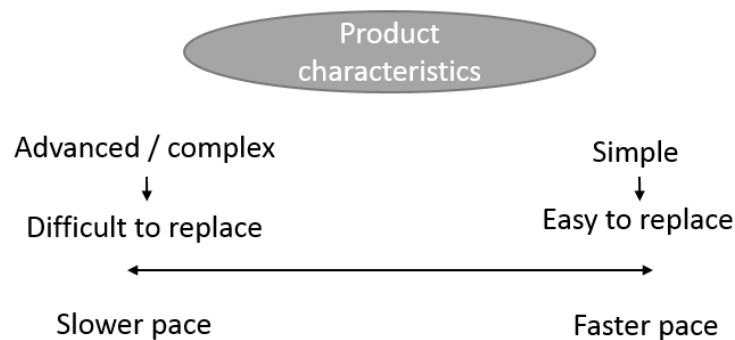
Figure 14: Pace effect of product characteristics

3.8.2 The Product Removal Process

It has been noted that the product removal process is not a fixed procedure in the sense that it is the same for all products. Several authors have described how different factors regarding the company and the product play a role when performing the process. The process is therefore dependent and changeable. "One size fits all" is simply not a viable option when it comes to product removal. The process itself can however be described by a model, with choices and variable activities. Out of all previous written literature, there is only one scholar that has created a model of the product removal process and its different steps. Avlonitis' empirical study (1983) was made at several British industrial companies in the early 1980s. In his study, he introduce a systemized model for the different steps in a product removal process, see Appendix 3. Although his model is over 30 years old, the main content is still relevant today. For example, the model takes into account the stock levels, residual demand and if there is an adequate substitute for the product. However, Avlonitis' model describes the process at an operational level, and the model is very specific on certain details, such as who performs what. This may be true for the companies in Avlonitis' study but it makes it less generalizable for companies today.

Therefore a new theoretical model has been created. This model is inspired by Avlonitis' model, but it lifts it up to a higher level – a tactical level, and takes influences from other authors as well. This "five-step-model" combines relevant and important aspects from previous literature (e.g. Alexander, 1964; Avlonitis, 1983; Hise, 1975; Saunders & Jobber, 1994; Harness & Harness, 2006; McSurely & Wilemon, 1973; Lim & Tang, 2006; Homburg, et al., 2009) with central aspects from process management. As a complement to this model, another requirement has been discovered: there must be a process owner appointed to the

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removal process. The process owner has the main responsibility for the removal process and makes sure that everything runs according to the plan. The process owner should work as a link between the different functions and therefore facilitate the cross-functional integration. She/he is also responsible for the continuous development and improvement of the process.

The model acts as a definition of what the product removal process could look like. This model will be used as a basis for comparison with the empirical study. It will be used to determine if the case company performs the activities that are described in literature. The model will also be a subject of development. Since it is based on literature and theory, it is difficult to determine its applicability. By comparing and combining the model with the empirical findings at the case company, a higher degree of connection to "reality" will be achieved. The model is however quite rough and only includes high level activities. It hence leaves much room for details and more thorough description. The model follows a chronological order but does not specify points in time. The reason for this is that the time schedule is developed during the process and may look very different from company to company.

Figure 15 illustrates the steps that would be included if the phase out strategy is chosen and the steps are described more in detail below. Similar figures for drop immediately and keep as premium can be found in Appendix 4 and Appendix 5 respectively. The process for license out has not been investigated or developed due to the delimitation that this study will look at the process within the boundaries of the company of interest only.
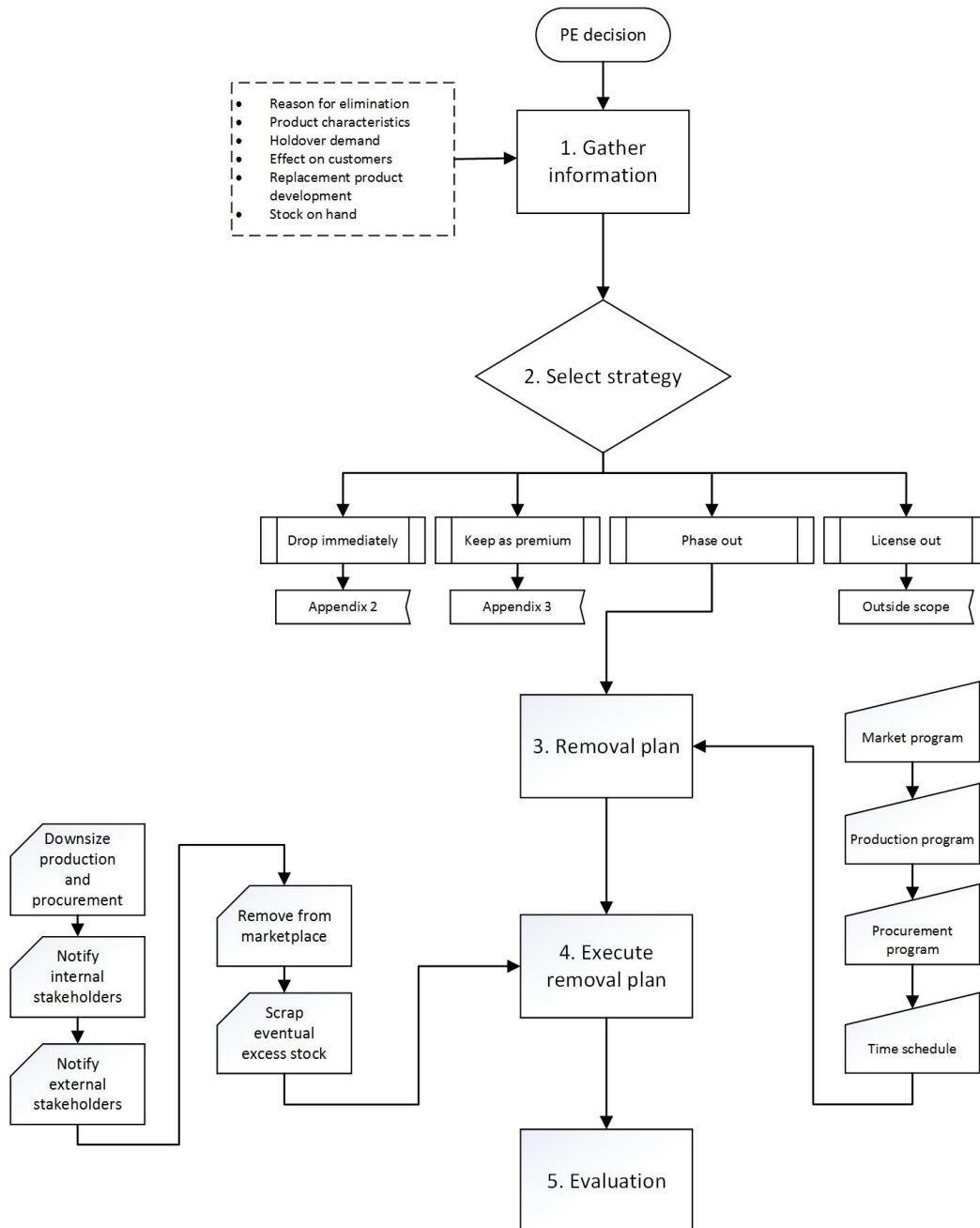
Figure 15: The product removal process with the phase out strategy

Step 1: Gather important information

The first step in the removal process should consist of gathering the information needed to be able to decide on a removal strategy. The information can be categorized into the six influencing factors previously described. It should be the process owners' responsibility to gather all necessary information needed to evaluate the situation. Preferably, the process owner has a checklist of information needed that she/he walks through with the other involved people.

Step 2: Select the appropriate strategy

The information gathered is now used to select the most suitable strategy. This selection will be dependent on information gathered in the first step. A good idea would be to start investigate if any of the "extreme" strategies should be implemented. Is the product being

removed due to regulations? If yes, then choose drop immediately. Is there any gain in selling the production to another manufacturer? Then perhaps the best thing to do is to license out the product. Are there any important customers that would require the product in the future and the company does not want to lose goodwill? Then phase out the product but keep the opportunity to produce the product using the keep as premium strategy. If none of the other three strategies are suitable, then move on with the phase out strategy. The influencing factors will then impact the pace and timing of the removal.

Step 3: Develop a removal plan

Before the selected strategy is executed, a detailed plan should be developed. This plan involves a market program (how many more products to sell), a production program (how many more units to produce), a procurement program (how many more components are needed), and a detailed schedule with important dates (e.g. when to inform who, date of removal etc.). These programs will be adjusted to each specific product and situation. The adjustment of these programs is dependent on the information gathered in the first step and other sources of data (e.g. demand forecasts). Involved and affected parties should be informed of the plan to open up for suggestions or oppositions, after which the plan can be revised.

This step will be executed in a varying scale of carefulness depending on which strategy is chosen. If for example the chosen strategy is to drop immediately there will be no focus on any market-, production-, or procurement program.

Step 4: Execute the plan

After the plan has been approved by involved parties, it is executed. If the strategy is to drop immediately, production and procurement stops immediately. Otherwise, production produce the remaining units necessary to reach the market program. Procurement place orders on the last components needed to produce the last batch. Then, notification of the removal is sent out to internal stakeholders and thereafter external stakeholders. If the strategy is not to keep as premium, the product is removed from the market place and eventual stock is scrapped.

Step 5: Evaluation

A last step of the removal process should be to evaluate if the process was successful. This highly important step has been neglected by previous scholars. It clearly seems that there is not a right way to execute the removal process and it is difficult to know beforehand e.g. when to inform different stakeholders and which phase out pace is the most suitable. Without a clear receipt on how to configure the removal process, companies will have to improve this process over time. To improve, one has to know what to improve, and to know what to improve, one has to measure (Drucker, 2006). By measuring how a product's removal process was executed and following it up with an evaluation, companies can strive to continuously improve their product removal processes. Ideas and suggestions for how to evaluate the process and its outcome can be adopted from the study of success measures by Harness & Harness (2012) described in *3.6 Success Measurement*.

Other than these success measures, literature does not seem to have covered the topic of measurement of the removal process. Since there have been discussions on cost and customer service level, these could be areas to begin with. The most obvious cost related to the process

is the cost for scrapping excess material. Service level is often measured by if the promised lead time to customer is followed.

3.8.3 The Gap in Literature

It appears as there is no single, right way or "best practice" to the product removal process. This is understandable as every company differs and each situation is different in terms of product characteristics and market situation. However, there are some areas that would be interesting for future researchers to look at. One area that certainly would be interesting for practitioners to look at is if there exist any success factors related to the removal process, or for that matter, any pitfalls to watch out for. Another interesting area would then be how to measure the success (i.e. if there are any KPI's related to the removal process). If the last step of the process should be the evaluation step, companies must know what to measure and how to evaluate the process. To improve something there has to be some way to measure the improvement. Previous literature mention costs and service and the goal could be to achieve the appropriate balance between the two. There is always a tradeoff here. Downsizing the operations around the product that is to be removed minimizes the risk of having excess materials and equipment. However, a downsizing of the surrounding operations means that the service level of the product that is to be eliminated is reduced – a conflicting objective according to Alexander (1964). The costs related to the removal process could be measured to create a comprehension of its impact. If one would create KPIs out of this, the most significant costs would have to be discovered. In the same manner, customer service can, if not be measured by, be related to service level. This leads on to another interesting, yet uncharted territory. It is important that the balance of costs and service matches the product and supply chain strategy of the company (Fisher, 1997). A company should have a clear overall strategy and this strategy may differ between being purely cost efficient (focusing on optimizing costs), or being responsive (focusing on customer service). Previous research in product removal does not separate the two and it would be very interesting to know whether the choice of removal strategy would differ depending on a company's overall strategy.

One of the biggest gap in literature is the absence of the sales function's part in the process. As it is now, there is a relatively high agreement of how Operations should operate during a removal process. All steps in the implementation involve some part of the Operations function, such as purchasing or production, but there are not any descriptions on how Sales should act during the removal process. This seems odd since Sales almost certainly has the closest relationship and contact with the customers. The sales function may have a great influence on the customers and thereby may have the power to influence the demand. Since much of the product removal process is about downsizing production and sell off remaining stock, it seems important that Sales tries to sell accordingly. To make this run smoothly it seems logical that Sales must be informed about the removal plan and updated on relevant data such as stock levels.

3.8.4 Expected Challenges

The first issue recognized in literature was the lack of interest in the subject from both researchers and practitioners. It was expected that the concept of product removal would not be as elaborate as new product development at Axis. Therefore it was expected that it would be difficult to find interest in the subject and to make employees take part in the study.

As denoted, the customers are more affected by how the process plays out than the actual outcome of it. Intuitively, it was expected to find impactful areas of improvement connected to how the interface towards customers was designed. Presumably, this mostly involves the Sales and Marketing functions.

The concept of timing showed significance for the removal process. The timing factor refers to when the product is to be removed and when affected parties are to be informed of the removal. It also considers when certain activities related to the downsizing of the operations should take place. These timing parameters were expected to be of significance also in the empirical study. In the case of product replacement, timing is about coordinating the removal of the old product with the introduction of the replacement product. As noted by both Avlonitis (1983) and Lim & Tang (2006) the success of the removal is strongly dependent on this timing. Since there is quite frequent new product development occurring at Axis, it was expected that the factor of replacement product development and the timing with removal would be of substantial importance to the product removal process.

Another challenge is the measurement of success. As previously discussed, there was found limited literature on how to measure the success of the process. The concepts of costs and customer service related to the removal process are the two most "hands on" and it was expected that these would be the first to investigate. However, it was not expected to find direct information on how the costs and customer service are affected by the removal process.

4 Empirics

This chapter summarizes the data gathered during the empirical case study. The information is based mostly on interviews that were conducted at Axis, but also on observations and archival records. The chapter begins with an introduction to the empirical study, followed by an explanation about Axis' organization and sales model. After that, the product removal process at Axis is explained from the perspective of all involved functions.

4.1 Introduction and Guideline to the Empirical Study

The purpose of the empirical study is to create an understanding for what the product removal process could look like in practice. The empirical findings were used for comparison with the theoretical framework to help the researchers find key issues and challenges, and build on to the body of knowledge. The empirical study was hence conducted to generate answers to both the first and the second research question:

1. *What are current gaps in literature regarding the product removal process?*

2. *What are the main problems with the product removal process at Axis and how can they be categorized and prioritized?*

Which in turn would enable answers for the third research question:

3. *How can the product removal process at Axis be improved?*

As described in the methodology chapter, the data was mainly gathered from interviews at Axis. The interview questions were generated to reflect the most important topics from the theoretical framework such as strategies, responsibility, influencing factors, planning, measurements, and evaluation. To get in-depth data from each interview, semi-structured interviews were executed with the interview questions as support. All interviewees did not help to answer all questions but everyone had at least some knowledge about the product removal process at Axis. Hence, all interviews contributed with something to the get a holistic view of the process. The interviews were designed to first get a description of what the process looks like at Axis. Questions such as "*What is your part of the process?*" and "*What tasks do you perform in the process?*" were asked.

Figure 16: Sequential process logic

The purpose was to find every high level activity in the overall process and link them together in a logic sequence, as illustrated in *Figure 16*. Then, the interviews were directed into the areas of challenges and possible improvement, and questions such as "*What do you experience as most problematic?*" and "*Do you feel that something could be done better?*" were asked. The interview protocol in Appendix 1 contains a list of the basic questions that were asked in almost every interview.
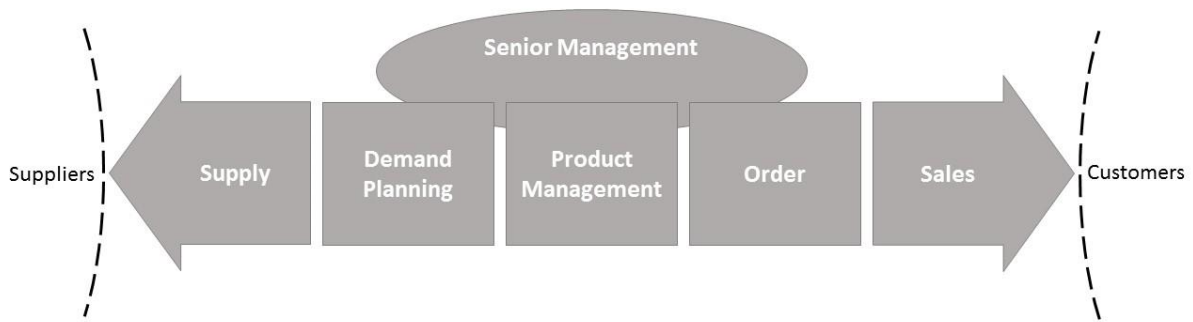
Figure 17: Departments and roles that were interviewed during the empirical case study at Axis. Note that suppliers and customers are outside the borders of this study.

The focus of the empirical data gathering was within the company and due to the limitations of this study, no effort was made to gather data outside of Axis' borders. *Figure 17* shows which departments and roles that has been inside the scope of this study. Interviews were held with representatives from each of the below departments. The list of interviews can be found in Appendix 6.

- The *Supply* function consist of operational purchasers and the capacity planner. The purchasing group is responsible for securing the right material and components at the right point in time, and at the right place. The purchasers have daily contact with Axis' suppliers and they manage all upstream material flow. In order to obtain an accurate understanding for the function, interviews were held with several purchasers at Axis and an additional interview was held with the capacity planner. The capacity planner represents the supply function in matters concerning ramp-up and ramp-down activities. This means that the capacity planner plans and directs Axis' EMSs during the beginning and the end of a product's life cycle (e.g. decides which EMSs produce what).

- *Demand planning* is a department that works with the sales forecast for Axis. They forecast the future demand with the help of sales data and analytical methods. It is this forecasted demand the purchasers base their purchases on.

- *Product management*. The product managers, or product owners, are responsible for several products each. It is the product manager that decides the fate of a product (e.g. the date for a product's launch or removal). The scope of the product managers is to plan, create and manage Axis' global product portfolio.

- The *Order* team is the main point of contact regarding orders, deliveries and other customer order related queries.

- *Sales* is Axis' interface towards their customers and was, hence, relevant to include in this study. Axis' Sales organization is spread all over the world and quite big compared to the other investigated functions. Several sales persons with different roles were interviewed (e.g. key account manager and distribution account manager).

Section *4.2.1 Partners & Sales Model* describes the sales organization and how Axis sell their products to their customers.

- *Senior management* persons were interviewed to get a more holistic view of Axis as a company. It was also desirable to understand how the product removal process is considered in the company overall (e.g. if the process is being considered as a big problem for others, outside of the process, or not). The researchers were also interested in the company's overall strategy and if there exists a stated clear strategy for the product removal process.

4.2 Organizational structure

To be able to understand the process, why it functions as it does and why certain parties are involved, one needs to understand the structure of the organization in which it operates. This also creates a better understanding for the difficulties that are faced in the organization when dealing with product removal. is a simplified organizational chart that roughly illustrates the different functions and which of them that are of interest for this project.
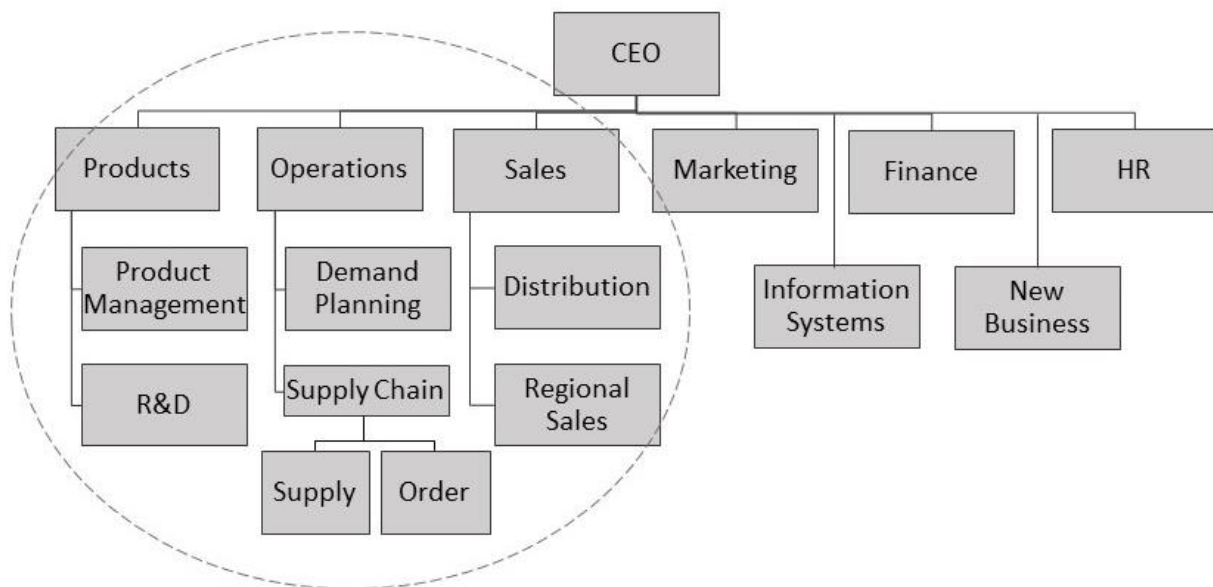
Figure 18: A simplified organizational chart with focus area

The reason why these functions are of interest is because they have a direct or indirect impact on the product removal process and its outcome. Marketing is mentioned in the theoretical framework as an important player in this process but the role of Marketing at Axis is not necessarily the same as for the typical organization. In some companies, Marketing may serve as the function that e.g. does thorough market analyses, search for new potential market segments, and decides which products to invest in for the future. Previous scholars suggests that Marketing and Finance are involved in the decision of which product to remove (e.g. Avlonitis & Argouslidis, 2012). At Axis, Product Management is the function that is responsible for product portfolio planning and they are the ones that decide when to remove a

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product. Marketing and Finance do not get affected by the product removal process at Axis, and they do not affect the process either. This is why they have been left outside of the scope.

4.2.1 Partners & Sales Model

An important part of Axis' overall strategy is the company's indirect sales model. This model is based on loyal long-term cooperation with distributors. Axis works in partnership with distributors in each operating country. They then reach their end customers via resellers and system integrators. According to Axis, this model creates loyalty and scalability in the sales organization and proximity to customers. The purpose of this model is to give competitive advantages for all who are involved.
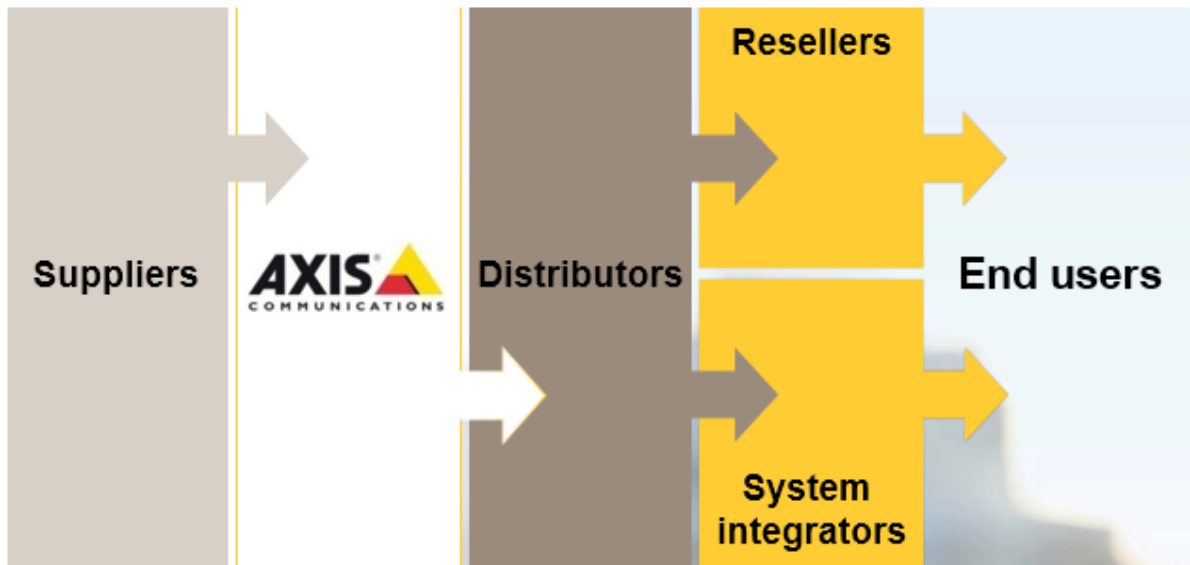
Figure 18: Axis' value chain. (Axis 2015)

This sales model brings some special characteristics to Axis' organization. The material flow is only between Axis and its distributors, as figure 19 shows, but Axis has representatives in all succeeding parts. Sales is divided into two general parts: Distribution and Regional Sales. Distribution account managers (DAMs) are the link between Axis and the distributors, key account managers (KAMs) and inside sales account managers (ISAMs) handle the selling to resellers and system integrators, and engineers from Axis provide service to end users. KAMs handle larger, more important partners (A) and ISAMs handle smaller partners (B). *Figure 19* illustrates the connections, filled arrows are material flow and striped arrows are information flow.
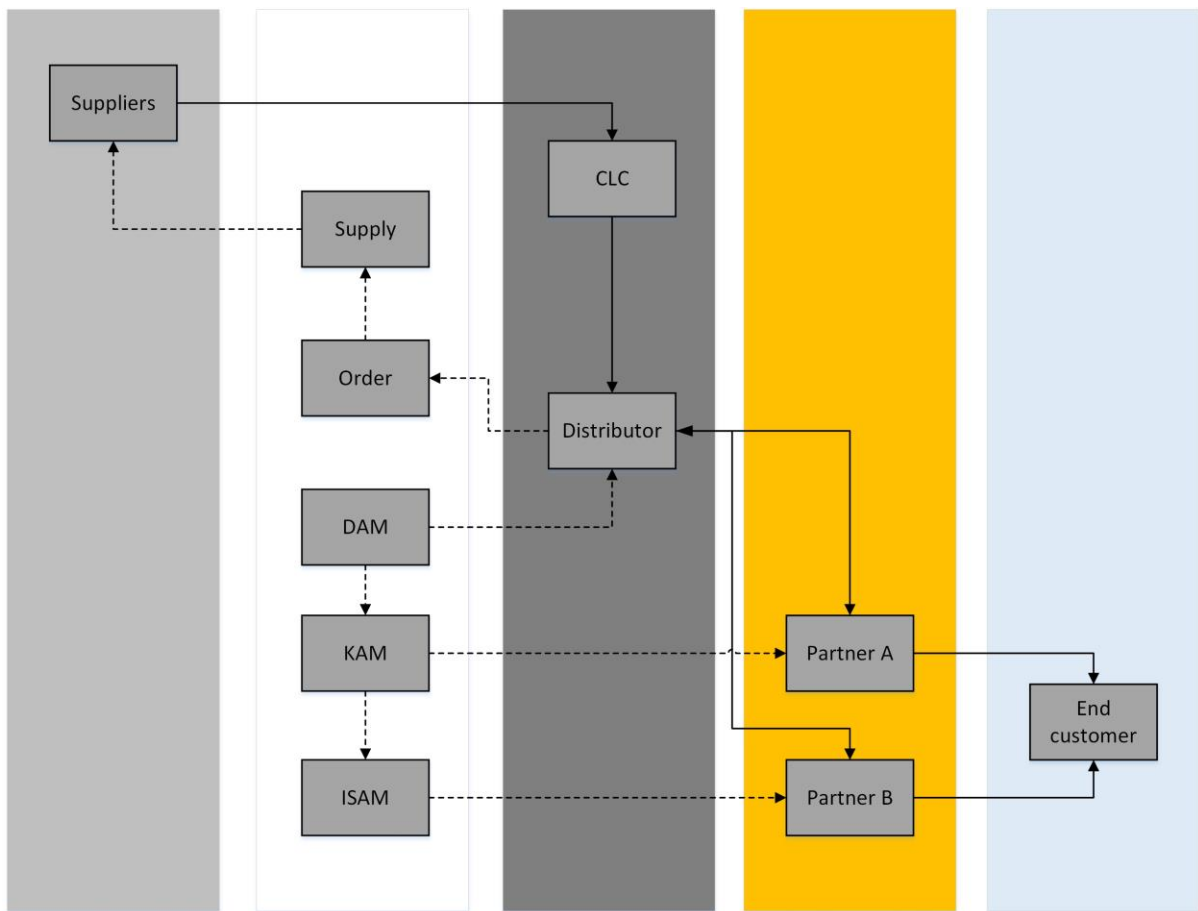
Figure 19: Information and material flow in Axis' value chain

The products that Axis produces are sold in two ways. The first is "off the shelf" sales through resellers. This is referred to as "run-rate" sales at Axis. Run-rate is only known after the actual sales and is handled completely by the channel (no Axis involvement). Typically it involves small installations of 1-20 cameras, e.g. a single store or office. The second is sales through projects. Projects are typically larger installations (e.g. an airport or hospital) where Axis employees (mostly KAMs) are involved and have end-customer interaction. This creates the opportunity to forecast these large sales projects. The projects are important in a product removal perspective since they can run over long periods of time. If for example, a large project is planned a year in advance, and Axis and its competitors get involved six months before the installation of cameras shall begin. Say that the end customer makes its decision on who to go with two months before the installation. The installation could then run over another six months with monthly deliveries. It is possible that the specific product sold to the project will get removed before the end of the installation. By forecasting large projects this could be prevented, but it is not fail safe. Product management has a mechanism to prevent this and it is described in section *4.3.2 Product Management*.

4.3 Mapping of Axis' Product Removal Process

Axis has a large variety of products in their product portfolio. Axis' networks cameras alone are in the amount of hundreds. Axis is continuously developing and releasing new products, and is also continuously removing products from their portfolio. There are always some products that are in the process of being removed. A product removal takes roughly about 9-12 months at Axis. The execution of a product removal is almost always the same, regardless

of the situation or product, except for a few exceptions. There have been situations when Axis has removed a product from the market but has continued to sell it to a certain customer to retain goodwill.

shows which departments affect and/or are affected by the product removal process. However, there are only a few departments that are involved in the process in the sense that they perform tasks related to the process. These are: Product Management, Operations (including Supply, Demand Planning and Order), and Sales.

The planning of each product removal is discussed every month at a meeting called "the ramp down-meeting". Demand Planning is the department that invites to this meeting and the participants are representatives from Demand Planning, Product Management, Supply, and Order. The purpose of these meetings is to notify and follow up on products that are about to be removed. At every meeting, each product manager informs if she/he plans to remove a product within the next 9-12 months. Then, they discuss and follow up on the ongoing removal processes. These discussions can be about e.g. the current inventory status of the product, or the status of the development of a successor product, or any other issues related to the process. Outside of these meetings, all involved departments executes their respective tasks and responsibilities related to the process. Below is a brief explanation of the steps in the product removal process at Axis. *Figure 20* and *Figure 21* illustrates the process in two different ways. This explanation and the figures show a "best scenario" of how Axis want this process to work, however this is not always how it turns out. Later, a summary of each interviewed function or role follows that explains the involved parties impression of the process.

- *Roughly 9-10 months ahead of LTB[1].* The process is initiated once the decision to remove a product has been taken by product management. The product manager responsible for the product brings the information of the decision to the monthly ramp-down meeting. After receiving this information, Demand Planning adjusts the forecast of the future demand and the purchasers inform their suppliers and EMSs. This is the starting point of the downsizing of production which then continues until the product is removed. At every ramp-down meeting after this, the stock levels are revised and checked against the expected demand to ensure that there will be not too little or not too much material and products left in stock. If there is too large amount of material in stock, the removal can be postponed. This can be done as long as it does not disturb sales of any other product.

- *3-4 months ahead of LTB* the product manager sends out an internal message stating that this product is about to be removed. This message goes out to a list of people at Axis and it contains information such as LTB, and if there is any replacement product coming instead. The purpose of this message is to notify Sales so that they can get a heads up and alert if they have any projects in the near future containing this specific product. However, the interviews revealed that there is a lack in the information

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[1] Axis uses the term last time buy (LTB) when referring to the withdrawal date.

channel between Sales and Product Management. The product managers seldom receive any feedback back from Sales.

- *3 months ahead of LTB,* when the removal has been cleared by Sales, the product manager sends out a message to everyone at Axis. This is called the EoL[2]-statement. At this time, the DAMs forward this statement to Axis' distributors. Customers get informed about the product removal by a newsletter created by Marketing (this is the only time Marketing is involved and that is why Marketing was put outside of the scope).

- *1 month ahead of LTB* the product manager updates Axis' price list. The price list should now have a notification that tells that the product is about to be removed. The price list is used by Sales to see which products are available and to which price. The distributors also has access to it. When the price list has been updated, all ongoing orders are completed. New orders are only accepted if there are still products available in stock.

- *At the date of LTB* the product manager is supposed to remove the product from Axis' price list, showing that it is no longer available for sale. Now, no one should be able to order the product anymore since it should not be available. It happens that a distributor places an order on a removed product even though it is not available. This happens because the distributor has the habit of ordering a specific product and does not always look in the price list. In those cases, Order will notice this and inform the distributor that the product is obsolete and cannot be ordered anymore.

- *After LTB,* when the product is fully removed from the market, remaining inventory is recycled or scrapped. The capacity planner is responsible for the scrapping of old products and components.

The above bullets, together with *Figure 20* and *Figure* 21, briefly describes the main steps in the product removal process at Axis. The next sections explains the process from the view of each involved function and includes experienced challenges and difficulties.

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[2] Axis use the term end of life (EoL) when they talk about removing a product
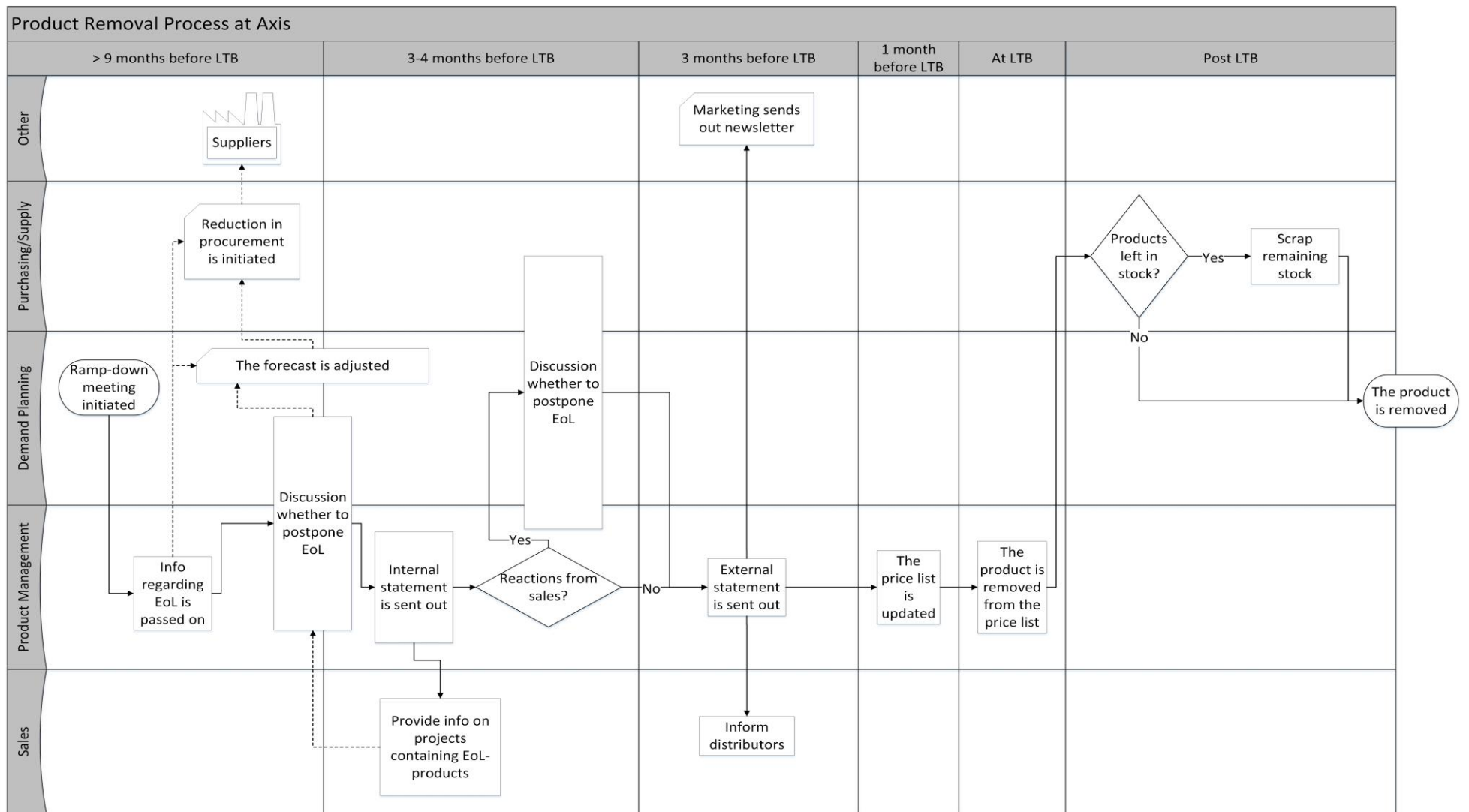
Figure 20: Flowchart map of the removal process

Timeline	Supplier	Input	Process	Output	Customer
> 9 months ahead of LTB	Product manager	The decision	Inform the decision	EOL information	Ramp down meeting
	Ramp down meeting	Information about EOL	DP adjust forecast	New forecast	Purchasing/supply
			Supply starts down sizing	Information/ forecast	Suppliers (EMS)
3-4 months ahead of LTB			Prel statement from PM	Prel EOL-statement	Sales
	Product manager	Prel EOL-statement	Sales revise the situation	Confirmation	Product manager
3 months ahead of LTB	Sales	Confirmation & 3 months before LTB	EOL-statement from PM	EOL-statement	Everyone at Axis
	Product manager	EOL-statement	Sales Inform external/internal	EOL-statement	KAM & Customers
	Product manager	EOL-statement	Marketing creates news letter	News letter/ EOL-statement	Customers / Market
1 month ahead of LTB		One month before LTB	Update price list	Note in price list: About to go EOL	Axis and partners/customers
LTB		At the time of LTB	Remove from price list		
Post LTB			Scrap remaining inventory		

Figure 21: SIPOC map of the removal process

4.3.1 The ramp-down meeting

According to the process denoted for Product Management, representatives from Demand Planning, Order, Supply, Sourcing, Sales and Product Management should attend this meeting. From attending the meeting and speaking to the attendees, it could be determined that only representatives from Demand planning, Order, Supply and Product Management attend. Sales does not attend even if the instructions say so. The meeting is the only regular event where all the different functions work together with product removal. The meeting is recurring and stock levels are revised before every meeting. On these meetings, the stock situation for all products that are about to be removed is followed up. Based on the stock situation, it is decided whether LTB should be moved. Some product managers are more willing to adjust the date after the stock situation than others. This willingness can also depend on other factors, such as the development of a replacement product.

4.3.2 Product Management

The product managers is highly involved in the product removal process. It is Product Management that decides which products to remove and when. The product manager, who is responsible for the product that shall be removed, is in most cases the final decision maker on decisions related to the product removal process. There are several reasons for a product removal at Axis:

- A new and improved replacement product is being developed.
- Certain components are no longer possible to purchase. The products containing these components will have to be removed.

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- Clean-up of the portfolio to make it neater and more easily understandable for sales and customers. If there are similar products, all but one model can be removed.
- The product is not selling in enough quantities to bring the desired revenue.

The most common one is that a new and improved replacement product is being developed. According to Axis, the new product is usually better and less expensive. It is therefore desirable to get the new product out on the market as quick as possible. Axis puts much emphasis on new product development. An investigation is made for the new product launch, but not for the product that will be removed. Factors that could affect the planning of the removal are sometimes brought up on the ramp-down meetings, but it is not something that the product manager always does.

The initial plan for product removals is very standardized, but it only contains two dates and some actions for Product Management. The actual execution often differs from case to case, and the plan is constantly a subject of change. Product management has, however, a defined, internal process for product removal. It is described here in short.

- *Nine month product removal plan*: Product Management and the Representatives at the ramp-down meeting review a plan of products to be removed. This plan shall cover nine months forward. The planned final order dates, the LTB, shall be finally settled at the latest three months before.

- *Before the elimination decision*: A decision to initiate the process is taken by the responsible product manager in agreement with the director for Product Management. According to Product Management internal document, a selected group from the Sales organization shall be informed about the intention to remove the product, giving them a possibility to comment. However, this is not how it is executed in reality. This information does not go out until 3-4 months ahead of the planned LTB.

- *3-4 months ahead of LTB* the product manager sends out the internal message stating that this product is about to be removed. As stated above, the purpose is to give Sales a chance to comment. This is a mechanism to catch projects that run after LTB and shall be sent out before the external statement. However, the product managers seldom receive any feedback back from Sales.

- *3 months ahead of LTB* the EoL-statement is sent out to all stakeholders (e.g. Axis' personnel and distributors).

- *1 month ahead of LTB* the product is updated in the price list. The product shall be marked as "EOL, contact Order dept for availability".

- *After LTB:* The stock situation shall be followed up with Operations. Based on this, the product manager shall decide when to remove the product from the price list. The documentation recommends that this occurs no longer than three months after LTB. According to interviews this is supposed to happen at the time of LTB, but it varies very much from case to case. If for example the product's stock level is low and there are not any holdover demand, it is easier to just take a decision to remove the product

from the price list. If on the other hand, there is a high amount of products left in stock, the product can remain several months in the price list before a decision is finally made.

Table 6 summarizes Product Management's inputs, activities, and outputs in the product removal process. According to the director of product management, the preliminary statement is sent out 4-5 months before LTB, which would give the sales managers 1-2 months' time to react. It has however been observed that the required response time can be as short as 3.5 days.

Table 6: Product management's part in the process

Input	*Activity*	*Output*
The product removal decision.	Announcement of the removal at the ramp-down meeting.	Demand Planning, Supply, and Order are informed of the coming removal.
3-4 months ahead of LTB.	Send out the preliminary statement to Sales.	Sales are informed of the coming removal and has the chance to react.
3 months ahead of LTB.	Send out external statement to all Axis employees and distributors.	All stakeholders are informed of the coming removal.

Evaluation, measurements and goals

According to product management, the target with a product removal is to avoid shortages and excess stocks, but also to avoid confusion among sales and customers. Another important factor is the availability of products to customers. This is important, not only, from a customer satisfaction perspective, but from a sales perspective. When switching from a precursor product to a successor, it is important that no sales gap occurs, i.e. that there is always one of the two available for sale. Otherwise there could potentially be lost sales opportunities. If an Axis product is not available at any point, the customer might choose another brand and stay loyal to that for a long time, resulting in even more lost sales opportunities.

According to the interviewed product managers, there is no structured or standardized way that removals are followed up or evaluated. Follow up of the process is only made when something goes wrong.

4.3.3 Demand Planning

Demand Planning creates the forecast that Supply follows. They take input from Product Management and Sales when creating the forecast. Hence they are often viewed as "the spider in the web", which is also the case with product removals. They are the ones arranging the ramp-down meetings, bringing the functions together. As soon as they receive the information of a coming removal, they update the forecast.

Table 7: Demand Planning's part of the process

Input	*Activity*	*Output*
Demand Planning are notified of the removal at the ramp-down meeting.	After the meeting Demand Planning adjusts the sales forecast of the product. It is part of their monthly work routine to update the forecast according to the information they collect.	A refined sales forecast showing the removal of the product.

Demand Planning is in contact with the sales regions regarding sales projects. They try to find the large projects that can affect the total demand substantially. Because of this, they are often contacted by project owners (mostly KAMs) also in connection to product removals.

Difficulties related to product removal

The forecast is an estimation of future demand. It is always difficult to make an accurate forecast since no one can foresee the future, but Demand Planning perceives that it gets even more difficult when a product is about to be removed. Demand Planning believes that the demand often gets higher than forecasted during the product removal process. This perception was compared to archival records that showed the forecast and actual demand of all removed products in 2014 and 2015, see *4.4 Quantitative Data* for details.

Evaluation, measurements and goals

Today, there is no follow up of the removal process at Demand Planning. They measure forecast accuracy on a monthly basis, but this does not include the last three months the products stay in the market. Some time ago, an initiative was started to begin measuring "ramp-down accuracy", i.e. forecast accuracy for the last three months the product stays on the market. This initiative was however not completed and no measurement has been developed for product removal.

4.3.4 Supply (Purchasing dept.)

As stated above, representatives from Operations attend the ramp-down meeting. The capacity planner is the one that represents Supply on these meetings. The information of product removal is provided to the purchasers from Demand Planning via an "EoL-list". This list is used to keep track of the inventory status of the products that shall be removed. Upon discovering a new product in the list the purchasers inform their respective supplier or EMS about the coming removal. This is to make sure that the EMS starts to take caution when pulling material for this product. Axis has a responsibility to take costs for the material that the EMS has to purchase for Axis' products. It is then continuously controlled that this downsizing continues all the way to LTB. The purchasers updates the EoL-list with details about the current stock levels for each product on the list. Updates of the EoL-list are made monthly by the purchasers in conjunction with the ramp-down meeting. The list is used as a communication tool between the purchasers and the attendants at the ramp-down meeting. Based on the stock levels, the attendants can choose to postpone the removal if the estimated excess stock is considered too high.

Table 8: Supply's part of the process

Input	Activity	Output
Demand Planning adds the product to the "EoL-list".	The purchasers inform their respective supplier or EMS about the coming removal.	The suppliers and EMSs start planning the downsizing of the production.
	The purchasers reduce the safety stocks.	Smaller safety stock on EoL-products.
	The purchasers update the EoL-list with details about the stock situation.	Updated EoL-list used as a basis at the ramp-down meetings.

Difficulties related to product removal

Customers expect the same level of service up until the removal date. This means that Axis must be ready to handle an order, big or small, until the day that the product is removed from the market, and deliver it according to the normal agreed service level. If inventory levels have begun to run out, it becomes difficult to maintain these service levels. According to the interviewed purchasers, the biggest problem is when the removal is postponed with short notice due to the delayed launch of a successor product. The demand that was forecasted for the successor will then instead shift to the precursor. This demand will then be higher than the forecasted, which means that there may not be enough material in stock, resulting in shortages. Furthermore, since the precursor was supposed to be removed, the safety stocks have been reduced, resulting in an even higher risk of shortages. The lead time for some components can be up to six months, compared to the delivery target to customer of 10 business days. To be able to satisfy the unexpected demand of the precursor product, the supply function will have to procure material "manually", resulting in much work effort for only one product. Since the product will still be removed, supply still wants to minimize the risk of having excess stock. Procuring material for only a few months might lead to purchasing smaller quantities than minimum order quantity, inducing higher prices. Hence, the postponement of a removal (due to delay of successor product launch) may result in shortages, which causes customer dissatisfaction and higher costs.

Another problem may be that the purchasers do not necessarily work in a similar way, and that their way of "ramping down" are not always synchronized. One product usually has one main part that is being purchased by one purchaser, and several other components that may be purchased by other purchasers. Sometimes, there is enough parts of e.g. the main part, but there is a lack of another component. The Supply manager believes that the coordination and synchronization between purchasers could be done better.

Evaluation, measurements and goals

According to Supply, no measurements are presented for product removal. Scrap costs are related to the removal, but they are bundled with scrap costs from production and are not distinguished between products. No follow up or evaluation was identified.

The aim for the Supply function is to, at the point of LTB, reach zero inventory of the product and its components, in order to be as cost-efficient as possible. However, the purchasers feel

that the most important thing for Axis is to keep the customer happy. Availability is spoken of as the most important factor, and costs seem to come second-hand.

4.3.5 Order

The Order department are not actually involved in the overall process, but they are affected by it and has their own internal process. They have recently established this internal process together with Supply when dealing with product removal. It consists of changing the coding used in the ERP-system to hinder that orders on removed products are accepted. This process is functioning with only minor faults, caused by human errors, not causing too much trouble.

Difficulties related to product removal

There are however two scenarios which the Order department find a bit troublesome. One scenario is that an order gets accepted, even though there is no possibility of fulfilling it since the product has been removed. This happens when there is no remaining stock on this product. Once it happens, an alert is sent to Order and thereafter they cannot accept any more orders. This means that this can only happen to a single order (the one that triggers the alert). The order department then have to get back to that customer and let them in on the situation, in most cases recommending a successor product. Most often, the customers are perfectly fine with this.

Another scenario is when a product that is about to be removed has a lot of orders pending. If the supply of products run out sooner than expected, the removal could occur much earlier than anticipated. All of these orders will then have to be maculated, and all customers will have to be informed. Prioritization between customers might have to be made and some orders might be able to fulfill but with long lead times. Much manual work will have to be performed in order to straighten out the situation and get the customers to place orders on successor products. It is an uncomfortable situation for the employees in the order department and the whole issue make customers have less faith in Axis' ability to deliver what it has promised.

Evaluation, measurements and goals

According to Order, customers have stated that it is more important that Axis can keep what they promise than to promise short lead times that are not fulfilled. It is better to promise a bit longer lead time and stick to it than putting an optimistic lead time and fail to deliver. The cost of missing, or postponing a deadline is greater than the cost of having a longer delivery time from the beginning. Customers also think it is important that they get notified about any delays well in advance.

4.3.6 Sales

The Sales function is, as previously described, separated into which tier it faces in the value chain. The work tasks therefore differs between Distribution and Regional Sales.

4.3.6.1 DAMs

The DAMs are made aware of a removal when they receive the external EoL-statement three months ahead of LTB. At this point, it differs what their actions are. There is no standardized process within Sales for what they should do when they receive it. However, one thing is mutual, and that is that they inform their respective distributors about the coming removal and ask them to start downsizing their inventories of the product. Some DAMs inform the

KAMs and ISAMs in their region or country, but there is no instruction that says it should be done.

Table 9: DAMs' part of the process

Input	*Activity*	*Output*
The external statement.	Inform the distributors, and possibly other colleagues within Sales.	Supposed: The distributors start downsizing their stocks of the product. Reality: Sometimes they do, sometimes they do not.

Difficulties

Some DAMs feel that they could do more in the removal process. They often work as "consultants" to the distributors and can therefore control what they put in inventory. Today they do not have any instructions or actions to take in the removal process.

Evaluation, measurements and goals

The DAMs do not perform any evaluation on the product removal process. There is no measurement for customer satisfaction related to the removal. Sales emphasizes that customers value availability.

4.3.6.2 KAMs

The KAMs are not involved until the last phase of the process. They receive the external EoL-statement, at the earliest, three months ahead of LTB. It differs between individuals from who the statement is sent. At the latest, they can receive it after the LTB date. When the statement has been received, there are no instructions on what to do. They can be "asked to scan their projects" to make sure that no active projects contain the product that shall be removed. However, this is not always performed accurately. KAMs have quite limited time for administrative work tasks and scanning projects is very time consuming. There is no feature in the current system that can track specific products in projects, this have to be searched for manually. An EoL-statement is therefore not prioritized highly.

Twice a year, there is a roadmap conference for KAMs. At these conferences it is presented how the product portfolio will evolve in the future. This means that sometimes, KAMs can know of a product removal even before the statement is sent out.

Table 10: KAMs' part of the process

Input	*Activity*	*Output*
The external statement, information from DAMs, change in the price list or own inference from information presented at conference.	None.	None.

KAMs are only involved in sales projects until the "papers have been signed". They are not there when the deliveries are supposed to happen. They are hence not involved in the checking of inventory status (they only check the price list to see if the product is available).

From there, it is someone else's task to see to it that the products actually reaches the customer.

Difficulties

KAMs themselves are not very troubled by product removals. They see it as "a part of doing business" in this industry. They also mention that the customers are used to technological advancement and expect that product will be replaced. The customers are often not troubled by the removal of a product as long as it does not disturb the availability of products. According to KAMs, availability is the most important factor to the customers.

Some KAMs feel that customers do not trust in Axis' new products. According to one KAM, customers expect the new products to have initial problems in functionality (bugs etc.) and long delivery lead times. It is therefore believed that customers rather stick to the precursor product until the successor has achieved full functionality. Other KAMs state that the customers always wish to have the very latest technology, and therefor prefers to quickly switch over to ordering the successor products. According to the interviewed KAMs, the form factor (physical appearance) of the products are the most important aspects when considering their "switchability".

Evaluation, measurements and goals

The KAMs do not perform any evaluation on the product removal process. There is no measurement for customer satisfaction. Sales emphasizes that customers value availability.

4.3.7 Senior Management
As noted in the Literature Review, it is important that the design of a process is aligned with the overall strategy of the company. Therefore, a series of interviews was conducted with senior management to establish the actual goals and targets of Axis and its different functions. It was found that the overall goal for Axis is growth. The goal for Product Management is to have a competitive, up-to-date product portfolio with cutting edge technologies. The primary goal for Operations is to enable growth through product availability. Secondary it is to be efficient in cost, capital, and sustainability. The goal for the product removal process, according to Product Management, is to avoid shortage and excess of products and components and also to avoid confusion among Sales and customers. These goals were not stated in any document or material related to the product removal process, but they were given in interviews when asked for.

4.4 Quantitative Data

4.4.1 Replacement Product Launch Delays
The delay of launches for replacement products was frequently mentioned as an issue in interviews, and the truth behind these statements was therefore investigated. It should be noticed that these delays are a natural effect of the launch strategy chosen by Axis. The launch strategy is quite aggressive in order to get new products to the market as quickly as possible. This means that the estimated time consumption for each event that leads to the launch are based on best case scenarios. Best case scenarios are seldom achieved in reality, and it is therefore natural that the launch dates are postponed. These dates do not affect the

customers since they are only an internal part of the product development. The following paragraph explains how the calculation was executed and the result from it.

Demand Planning stated that the forecast they create can impact the availability of products three months ahead. This means that a forecast that is changed today will affect the availability of products in three months, generally speaking. The reason for this is the lead times on components that Supply has to work with. It is therefore interesting to look at the delays of replacement product launches that occur with shorter notice than three months (i.e. when less than three months remain to launch). The launches during seven months in 2015 were investigated and the result clearly showed that many of the products were delayed with 2 months' notice or shorter, and some products were even delayed with 1 months' notice or shorter. The statements collected in the qualitative study were hence confirmed. The launches of replacement products are delayed with short notice considerably often.

4.4.2 Actual Demand and Forecast

A general impression at Operations is that the demand changes when the EoL-statement has been sent out. To investigate if this statement was true and if it had any impact on the process, data from archives was collected. Demand data from all cameras that were removed during 2014 and 2015 was extracted. This data consisted of monthly actual demand, i.e. the amount of products that were ordered with desired delivery within each month, for the last 10 months of each product's life span. The average demand for the last 3 months was then compared to the average demand for the earlier 7 months. *Figure 22* shows normalized demand patterns for four product categories. They show that the demand, generally, decreases after the statement send-out. However, some products experienced an increased demand after the send-out. No pattern connecting different product types experiencing increase or decrease was found.
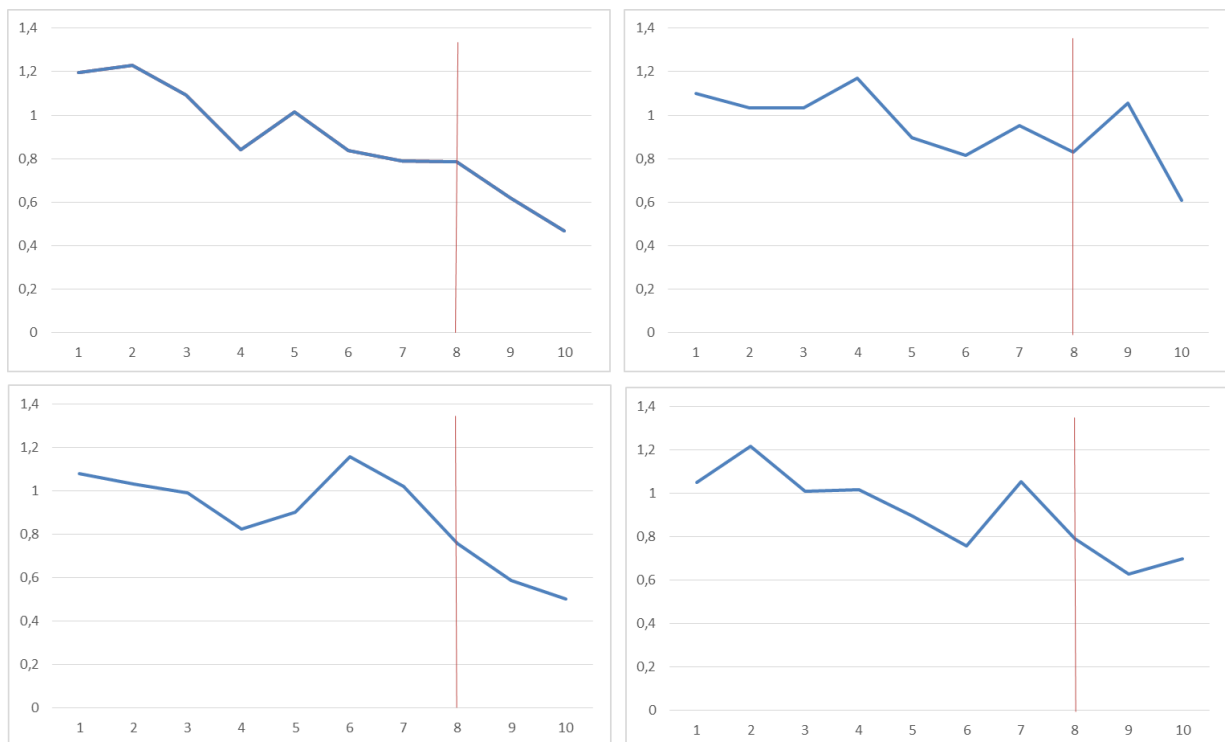
Figure 22: Normalized demand patterns

There were also indications that Supply felt that the forecast generally turned out to be lower than the actual demand in the end of products' life span. Therefore, the forecast data for the same products and period as for actual demand was extracted. Due to the delayed effect the forecast has on the availability (explained in 4.4.1 Replacement Product Launch Delays), the forecasts that were created 2 months before the EoL-statement send-out for each removed product were investigated. This data was then compared to the actual demand. Due to the complexity of forecasting and the vast possibilities of statistical investigation, some simplifications were applied to the calculation. If the forecast and demand matched exactly, the forecast accuracy is 100%. If the demand was lower than the forecast, the accuracy is more than 100% and vice versa. A forecast accuracy under 75% is considered low and an accuracy above 125% is considered high. With these rules the following results were computed. 35% of the products had a low forecast and 23% had a high forecast. It should be noticed that this is by no means a precise calculation and that these figures are only created to draw general conclusions.

5 Analysis

This chapter explains the analysis of the empirics. It consists of two analysis methods and presents the categorization and prioritization of the identified problems at the case company.

In order to make sense of the data collected in the empirical study, a thorough analysis is required. The analysis consists of two main analysis methods followed by further handling of the refined data through categorization and prioritization of the found main problems. The first analysis method is pattern matching. Pattern matching consists of comparing the empirically found patterns with the "predicted" patterns created in theory. The purpose is to find out whether the case company's removal process resemble the one presented in the theoretical framework. *Figure 23* visualizes the logic of the analysis method in this study.
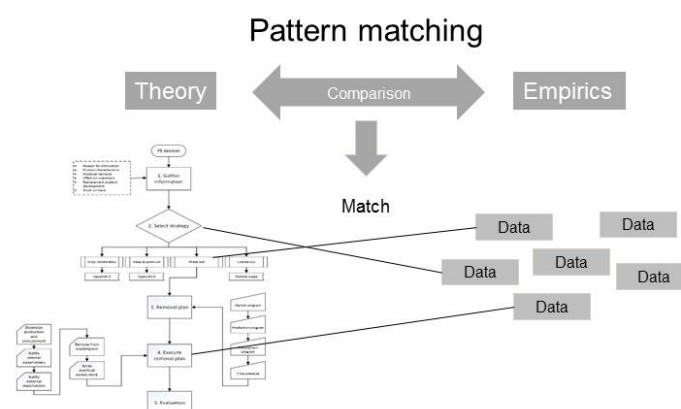
Figure 23: Pattern matching logic

The second analysis method is content analysis. In the content analysis, the empirical data is organized and refined to create themes and topics that are of interest. The data is structured and conclusions can be drawn from the outcome. The purpose of the content analysis is to make an internal evaluation of the situation at the case company and to bring forth its weaknesses and potential improvement areas. The results from the content analysis are then used in the categorization and prioritization. *Figure 24* illustrates the logic of the content analysis in this study.
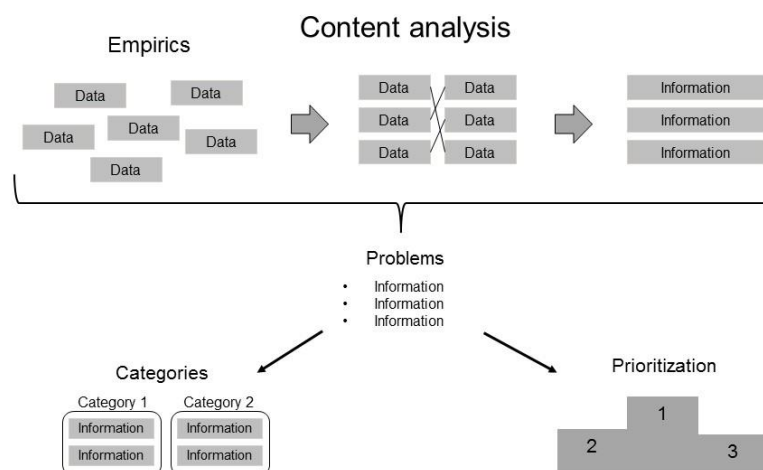
Figure 24: Content analysis logic

5.1 Pattern Matching

This section provides a comparison between the theoretical framework and the product removal process at Axis. *Table 11* includes the steps of the process and other important topics presented in the theoretical framework, and shows if they are present at Axis. Below follows an explanation of the results for each of the points listed in the table.

Table 11: Pattern matching table

Product Removal Process activities	Yes	Partly	No
There are different reasons for elimination	X		
Step 1: Gather information		X	
Axis gather information about:			
• The effect on customers		X	
• Stock on hand	X		
• Reason for elimination	X		
• Holdover demand		X	
• Replacement product development		X	
• Product characteristics		X	
Step 2: Select strategy			X
Step 3: Develop removal plan		X	
The removal plan includes a			
• Market program	X		
• Production program		X	
• Procurement program		X	
• Time schedule		X	
Step 4: Execute the removal plan	X		
• Downsize production and procurement	X		
• Notify internal stakeholders		X	
• Notify external stakeholders	X		
• Remove from marketplace	X		
• Scrap eventual excess stock	X		
Step 5: Evaluation			X
Other			
There is a responsible person for the product removal process (process owner)			X
There is a way to measure the product removal process			X
Axis uses an ERP system to hinder orders on removed products to be accepted	X		

5.1.1 Gather information

Axis has the ambition to gather relevant information before a product's removal. It is clear that Axis want to be pro-active in this matter - the ramp down meetings are proof of this. However, even if there are indications that different aspects are taken into account, this could be done more extensively. Some aspects could be investigated more in detail and the actions that are taken could have clearer instructions and be more structured.

- *The effect on customers* – Until some years back, Axis had not considered the effect the removal would have on its customers. Today, they are aware that it may have consequences, but it does not seem like it is studied in detail. It is only discussed in

the ramp-down meetings very briefly. The effect on customers is not a factor that will influence the pace of the phase out. However, there have been situations when Axis have continued selling a product after it has been declared removed, and the reason for this is that Axis want to maintain goodwill towards customers. Some consideration is therefore given to how important the customers purchasing the product are. Regarding Axis' position and power in the market, no consideration was found. The costs of delaying the removal were sometimes discussed, but mostly by the Supply function. Supply states that they cannot know what the products are used for, or in what way. They imply that it is difficult to understand the effects the removal will have on the customers from the view of Operations.

- *Stock on hand* - At every ramp-down meeting, the stock levels are revised and checked against the expected demand to ensure that there will be not too little or not too much material and products left in stock. Axis is clearly aware of the importance of keeping track of inventory status. They sometimes also postpone the removal date if the inventory levels are high. In a way, Axis handles this matter in a responsible and mature way. The purchasers try to be as proactive as they can to avoid excess stock and they seem to do a good job. However, since the demand varies, it gets challenging for the purchasers to secure the availability of material and at the same time, aim to have as little excess as possible at the removal date.

- *Reason for elimination* - The reason behind a product removal is usually that Axis has a new product, a successor, that will be launched, but the situation can differ between the possible reasons described in 4.2.2. The reason may be taken into consideration and it can impact the product removal pace, but only in an ad-hoc manner. There is not a detailed plan or structured way to differentiate the different possible reasons behind a product removal, all product removals are planned alike.

- *Holdover demand* – This is not something that Axis take into account during the first ramp-down meetings and that is probably because they do not really know the holdover demand that far ahead. As described above, Axis have at some occasions continued to sell products due to holdover demand. However, this is not something that Axis plan to do in a proactive way. These types of decisions have been reactive and decided at short notice, often because of a "hidden" project with a customer that Axis do not want to disappoint. Demand Planning are responsible for the forecast and they gather as much information as they can from Sales and build a forecast which the purchasers use. This is an ongoing process and the forecast is altered every month until the removal date. One thing that may not be unique for Axis is the uncertainty of this forecast. In a perfect world, someone analyzes the situation accurately and creates a forecast. In the theoretical framework this is described as the marketing program. In reality, an estimation of the future is very difficult, especially at Axis where the sales network is very large and spread out over the world.

- *Replacement product development* – This factor seems to be the one that Axis takes most accountability for. The most common reason for a product removal at Axis is the launch of a new product. The date of removal is planned so that the precursor product

is removed just in time for the successor to replace it. Just as it is described in theory, this is easier said than done. Theory has suggested that it is challenging to be right on schedule with the new product launch (Lim & Tang, 2006), and this is something that also Axis experiences.

- *Product characteristics* – There have been no clear indications that Axis differentiate the removal strategy based on the characteristics of the product. However, the people involved can have different attitudes towards different products. For example, a low volume selling product or a low price product may not get as much attention as an expensive one. The representative from Supply may also have some inputs regarding e.g. long lead times on components, which may influence the removal strategy. Though some considerations may be taken there exist no structured or formal way of considering the product characteristics when planning the removal.

When looking at *Table 11* it seems like Axis performs a product removal process relatively similar to the theoretical framework. The majority of the steps and factors described in theory have also been identified at Axis. However, there is still a difference between the theoretical framework and Axis' product removal process. In the theoretical framework, all relevant information is gathered before a removal plan is suggested, and the plan, including important dates, are based on this information. At Axis, the predetermined process means that the product manager sets a removal date and then all information is gathered frequently up until the removal date. In theory, a phase out starts with gathering information about the demand and supply. If the demand (e.g. open orders and expected orders) is greater than current supply (e.g. inventory levels, ongoing production and other products in the "pipeline"), a production plan is made to fulfill the demand. Axis does not have a fixed quantity of demand to aim at. Their phase-out-period is quite long and they constantly update their forecast up until the removal date. The decision to produce (purchase) more or not, is not something that is decided only once. Instead, Supply has to regulate the material flow from Axis' suppliers all up to the removal date.

5.1.2 Select Strategy

In the process description for product management it is stated how the product removal process should be executed. According to this description and interviews with the involved people, Axis aims to always use a phase out strategy. Therefore, the step of selecting a removal strategy is not really a step at Axis, but it is predetermined. There have been situations when Axis have executed the removal in accordance with other strategies. For example, Axis have been in situations where they have dropped a product immediately and other situations where they have continued to sell the product to a certain customer. However, these situations are exceptions that arose due to certain unplanned circumstances. Again, in the few cases when Axis do not follow their predetermined plan, it has been due to ad-hoc reactive decisions and solutions.

According to the theoretical framework, the pace of the phase out is depended on the five different factors described in section 3.5. Even though Axis look at several of these factors, they do not really form different strategies from case to case. Axis phase out strategy is basically to notify internal and external stakeholders approximately three months before LTB and they do not differentiate between products or situations (e.g. reason for elimination).

5.1.3 Develop Removal Plan

Axis do not define a clear removal plan for their products. A time schedule exist but it is far from detailed. Basically the only parameter that is written down is the LTB date and when to send out the EoL-statement. The theoretical framework mentions three programs: Market-, production-, and a procurement program, which are plans for how much to sell, how much to produce, and how much to purchase, respectively. The marketing program is in Axis' case created by Demand Planning and it consist of the forecast. Axis outsources its production which means that the production program and the procurement program is the same thing in this case. Although the purchasers are careful to inform suppliers and make an important effort to downsize the production and procurement, it does not exist any formal plan for how to proceed with this.

5.1.4 Execute the plan

Although there does not really exist a sophisticated removal plan, all the steps described in the theoretical framework are followed at Axis and in the right sequence.

- *Downsizing production and procurement* - Is done by the purchasers who purchase material based on the forecast served from Demand Planning. The steps and actions done by the purchasers are correctly executed, but the forecast will almost always be inaccurate, which leads to either excess or shortages of stock.

- *Notify internal and external stakeholders* – Two notifications are sent out, the preliminary EoL-statement, and the external EoL-statement. As previously mentioned, the preliminary statement is for internal stakeholders within Sales. The external statement is supposed to reach the whole Sales organization and distributors, but it is unclear if the information reaches all stakeholders, and even if it does, it is unclear for the receiver what she/he should do with the information.

- *Remove from marketplace* – This happens when the product is removed from Axis' price list. The product manager is the one responsible for removing the item from the price list. According to documentation about the product managers' internal process, this is recommended to be done no later than three months after the removal date. However, interviewees have stated that this is supposed to happen at the determined date of LTB, hence inconsistency exists in the perception of when products are to be removed. If there is remaining stock, the product usually stays on the price list. This may get a bit confusing for both employees at Axis and for their customers.

- *Scrap remaining stock* – This step can be postponed due to delays in the supply chain and other aspects such as financial reasons. There are no guidelines for when to scrap the remaining products and components. It has been shown that products that are considered EoL can stay in inventory more than a year after LTB (however not in the price list).

5.1.5 Evaluation

There is no such step as an evaluation step at Axis. Even if there existed an ambition to evaluate each product removal to improve the process, it would be difficult since it does not exist any defined goals for the process. When there are not any specific goals with the

process it is difficult to know what to measure. In addition, measure is nothing that Axis do to a greater extent. For example, there are not any measurements of the total costs to a specific product during its life cycle, and no measurements of the scrapping cost to each product. The scrapping costs are lumped together in a total scrapping cost (including scrapping in production). In other words, Axis need to know what they want to measure and how to measure it before they can evaluate this process.

5.1.6 Responsibility

Axis do not have any one that is responsible for the whole product removal process. In a way, the product manager may be seen as the one responsible because she/he is the one that starts it all and decides over a product's destiny. However, the product managers do not feel that they are responsible. The lack of a responsible person has several negative consequences. First of all, no one is held accountable for the outcome of the process which may result in a lack of incentive to make the process successful. There is also no one that looks to the performance of the process, and therefore there is never any follow ups or evaluations of the process. Without a responsible person, there is no one that the involved persons can turn to when they have questions about important decisions regarding the process. A product removal process is a cross-functional process. Without someone with a holistic view that can oversee and supervise all involved functions, the "handoffs" that occur between functions tend to be ignored. Axis growth as a company has been significant the past few years and with that it is getting more challenging for all functions to work in close association with each other as every function has their own internal growth. This just makes the product removal process even more challenging since there is no one to manage the involved persons from different functions in a proper and synchronized way.

5.1.7 Measurements

Today, there is no measurement of the product removal process at Axis. There was little written about this important topic in literature and it seems like it has been neglected at Axis. Since there is not any way to measure, it gets difficult to evaluate the process. Without any measurement or evaluation it also gets difficult to continuously improve the process for Axis.

5.1.8 Sub-process within Order

After interviews with the Order department, it was concluded that any improvements effort should not be focusing on their part of the process. Just as the theoretical framework suggest, Axis will not allow incoming orders on products that are about to be-, or have been removed without controlling with Supply. Order have developed a sub-process which consists of changing the coding used in the ERP-system to hinder that orders on removed products are accepted. This seems to be working fine and the Order department do not experience the product removal process as problematic. According to several interviews, neither do the customers.

5.2 Content Analysis

The content analysis reviews the empirical data and creates a structured meaning of it. It begins with a presentation of the themes found in the empirical data. These themes present topics that were frequently found and are of importance to the case company. From these themes, problem statements that describe the issues identified at the company are derived.

5.2.1 Qualitative Content Analysis

Firstly, the many different quotations and subjects that were brought up were categorized into themes. The themes are shown in *Table 12*.

Table 12: Open coding themes

Balancing supply & demand	Communication	Holdover demand	Costs	Time to LTB	EoL-statement
Wrong order acceptance	Measurements	Change in removal plans	Products are specified into customers' projects	Systems	Sales projects
Changing demand	Goals	Toughness	Product characteristics	New product launch	Responsibilities

Some themes were rooted in the theoretical framework, e.g. "Measurements", "Responsibilities" and "Goals". Others were created substantively, i.e. as they consistently appeared in the data, e.g. "EoL-statement", "Wrong order acceptance" and "Change in removal plans".

With these themes, the matrix was created and the data was placed into it. Iterative search through the data led to assigning more data to the different themes. After examining the themes closer, some were bundled together due to their similarities. This resulted in a total of 15 themes, from which a total of 19 problem statements could be derived. The reasoning behind these themes and their respective problem statements are described below.

Communication

Communication is one of the wider themes and therefore contains more data. On several occasions, the topic of communication between Sales and Operations was brought up. Firstly, there is no representative from Sales on the ramp-down meeting, the only cross-functional activity regarding product removal. This clearly shows how separated the different functions are from each other in this matter. The only inputs that Sales receive are the EoL-statements. The preliminary statement does not seem to be functioning as intended, more about that under EoL-statement below. The external statement is sent to Sales, but there is no cognizance whether it reaches its intended receivers, or what they do with it. Even within the Sales function, there are no structured ways of distributing the information or what actions should be taken upon receiving it. Because of this, Sales rarely communicate back to Operations and Product Management regarding ongoing projects that are affected by the removal.

In addition to the unclear directions to Sales, there also seems to be ambiguous information available to the customers. After the external statement has been sent out, the product is supposed to be available for another three months. Sometimes the stock runs out sooner than this. Due to long lead times and the risk of ending up with excess stocks, no more material is procured and the product gets removed before the determined LTB. Customers trying to purchase the product get upset when the product that, according to the statement, should be available, is not at all. The reverse scenario occurs as well. At LTB, there are still products left in stock, and it is decided that the product shall not be removed from the price list. The customers are surprised since they expected the product to no longer be available. This causes them to not trust the EoL-statement, and expect that other products that are going to be removed will be available after LTB as well, and get upset when they are not.

Another communication channel that is lacking in performance is the one between Supply and projects for new product development (NPD). The success of the removal is tightly connected to the development of the replacement product. Supply plans the procurement of material according to the estimated launch of the replacement product. If the launch of the replacement product is postponed, it is crucial that Supply gets informed immediately. In cases where the cooperation between the functions have been tighter, the outcome of the removal has also been better.

> **Problem statement A:** Poor communication between Operations and Sales.

> **Problem statement B:** Inconsistency towards customers.

> **Problem statement C:** Poor communication between projects for NPD and Supply.

EoL-statement

The EoL-statement works as the communication tool for product removal towards Sales and customers. The distribution of it and the way it is received and acted upon is however inconsistent. KAMs have reported that they can receive a statement after the actual LTB has passed, as well as they can have it three months in advance, as intended. KAMs and DAMs have no instructions what to do upon receiving it, which leads to that, most often, nothing is done. Since the purpose of the statement is to bring awareness to, and possibly reaction from (preliminary statement), the Sales function, the process is incoherent. Product Management does not have any way to follow up if the statement has reached out. They simply push out the information and leave it as that. Again, the lack of structure in the channel between Sales and other functions is recognized.

> **Problem statement D:** No clear instructions on actions to be taken within Sales when removing products.

> **Problem statement E:** The distribution of the EoL-statement is not working well.

Change in removal plans and New Product Launch

This theme considers changing time schedules and planned actions in the removal plans. It was found that the changing of the date for LTB could be very troublesome, especially for the Supply and Order function. Changing LTB to an earlier date hurts the Order function if there are orders on the product that will have to be maculated. Changing LTB to a later date, with

short notice, hurts the Supply function since they have planned to reach zero inventory at the previous LTB. The postponement then creates a high risk of shortages. The postponement of LTB was found to be most often due to the delay of the launch for the successor product. It was found that this delay, or postponement, is quite frequent at Axis, as described in *4.4.1 Replacement Product Launch Delays*. This depends on the aggressive launch strategy for new products. In the projects for NPD, the launch is set to an aggressive date in order to be as fast as possible to the market. This results in many launches being postponed, and therefore also removals being postponed. If this strategy is preferred, and availability is the most important factor, then the removal strategy should also fit into this theme. Right now, the removal strategy to reach zero inventory at LTB focuses on cost, and not availability.

Problem statement F: The launch of the replacement product is delayed.

Responsibilities
The responsibility for product removal is not something that exists cross-functionally at Axis today. Product Management's authority could be seen as some sort of responsibility, but they do not share this vision. Much time is used during ramp-down meetings to discuss matters that could be resolved if someone took a decision. This could be whether to scrap remaining stock, when to supply holdover demand, and when not to. There are no follow-ups of how removal goes since no one is held responsible for the outcome.

Problem statement G: No one is responsible for the process.

Measurements
Finding measurements for the process proved to be difficult due to the fact that there is barely any follow up at all. The only measurement that came up was the possibility to measure scrapping costs for a removed product. This is today not possible since costs cannot be derived to individual products.

Problem statement H: There are no measurements for the removal of a product.

Goals and Toughness
When the interviewees were asked about the goals with the product removal process, the answers were a bit equivocal. Everyone agreed that the goal was to avoid shortages and excess stock, a goal that is very connected to costs. But when the interviewees was asked about what was most important: costs or availability, many said that availability was most important. It is clear that the involved people do not have a clear answer to this question because they simple do not know. They do not have any rules or guidelines to follow because none have been suggested. This ambiguity creates uncertainty and confusion for the people that work with the product removal process, especially when it comes to taking important decisions.

The subject of "toughness" came up several times during interviews. The issue was described as that Axis is too kind to its customers, that they "never say no" to a request. The Supply function felt that Axis always took costs in order to satisfy whatever the customers wanted. This might be a result from the ambiguous targets some functions face. While the Supply function wants to reduce costs, the overall goal for Axis is to provide availability of products

and to be as service-minded as possible. To be able to do this, Axis might have to take costs. And if it is part of the strategy, everyone involved should be aware of that.

Problem statement I: Confusion and uncertainty about the goals.

Problem statement J: Confusion and uncertainty about decision making.

Product characteristics

The product characteristics' impact on removal was found to be a notified subject at Axis. The transition from precursor to successor product was said to be easier the more similar the products were. New products were referred to as "direct replacement" or "replacement" depending on their similarity. It was stated that the physical appearance, the "form factor", was the single most important characteristic when evaluating the "switchability" of the product. Larger customers can use the cameras very specifically, designing other mechanical installations to fit the exact physical features of a specific camera (e.g. screw holes in the interior of a train cart). Switching to another physical appearance might be very costly to these types of customers. Today products are not initially treated differently in the removal process, even though their characteristics are discussed. The removal plan and time table looks the same.

Another characteristic of the product that was discussed was the lead times of components. The long lead time of certain components are the reason why shortages easily occur when there are changes in the removal plans. This is also the reason why Axis tries to restrain from supplying additional batches to satisfy holdover demand.

Problem statement K: No differentiation in removal strategy based on product characteristics.

Holdover demand

There are two scenarios where Axis sells products after LTB. The first one is where the product is still in the market due to remaining inventory after LTB. Axis wants to sell it out rather than scrapping it and keeps it in the price list, available for customers to purchase. The other scenario is where it is decided that more products shall be produced after LTB, in order to satisfy the demand of an important customer.

There is also a scenario where there is holdover demand, but Axis decides to not sell any products. Even though the product is no longer in the price list, customers can still have the product number at hand and use it to place orders. This can be a result of the ambiguity regarding the EoL-statement. Since products sometimes are kept in stock and on the price list after LTB, Axis creates the possibility of holdover demand.

Problem statement L: Products are sold after LTB.

Products are specified into customers' projects

Several times there was frustration over that customers could not switch to a successor product due to that contracts had already been signed for the project. Once the contract had been signed, the product's name was in there, and delivering a product with another name was clearly unthinkable. Bureaucracy and administration made it so that it could take several months to change a contract with a new product name, even though the product was very similar. An initiative has been started to reduce this effect by using versions in product series.

Successor products can now have the same name as the precursor, but with a "mark II" added. This has facilitated switching products that are already specified into projects, making product removal easier. This type of "psychological" product portfolio adaptation comes with other effects that are outside the scope of this study.

> **Problem statement M:** Customers cannot/would not switch to successor products.

Sales projects

This type of selling and contracting is part of the business segment that video surveillance is in, and this is difficult to affect. Some things can however be affected. The reason this causes problems is because customers are not informed well enough. As explained before, it can actually be missed to inform customers that the product they have specified into a project is being removed. Again, this is due to the missing structure in the way the Sales function works with removals. The "scanning" of projects is not working, and that is where these kinds of projects are missed and overlooked. The follow-up of projects is not structured enough.

> **Problem statement N:** There is hidden holdover demand in projects.

Balancing supply & demand, and *Changing demand*

This difficult task was described as the largest challenge for the Supply function and Demand planning. The product removal process definitely affects how well this is succeeded and top management is aware of this. According to several interviewees, this task is even more difficult in proximity to product removal. The statement send-out is said to have unpredictable effects on the demand. At the same time, Supply is downsizing the procurement, which gives less flexibility when trying to satisfy the demand.

> **Problem statement O:** Product removal affects demand.

Costs

The costs that were mentioned in relation to product removal were scrap costs, "cost" of lost sales opportunities, and opportunity costs at suppliers and EMSs. Scrap costs of removed products are bundled together with scrap costs from production and are not distinguished between products. It is therefore difficult to follow up how much the scrapping of removed products add up to. It is possible to estimate the value of current products being removed, but it is never documented or followed up. The only regulation on scrap costs is the budget that Supply are allocated. There is also no way to measure the total cost of a product during its life cycle. The cost of the development and the cost of goods sold (COGS) are measured, but added cost, such as warehousing, handling and scrapping are not.

The lost sales opportunities are mentioned as an argument to keep supplying certain customers with removed products. It is said that they will bring large sales in the future if Axis can supply them now. There has however not been any figures or calculations on what this could mean. It is used as an argument, not as a solid basis.

> **Problem statement P:** Not possible to measure total costs for individual products.

Time to LTB

The three months' notice that customers and Sales are given was mentioned as problematic in the beginning of the study. More thorough research, however, revealed that this was not the case. The three months are, according to Sales, just about enough. However, it does not seem like this "three month rule" is being followed. The time at which the product is removed from the price list varies greatly. According to the denoted process for Product Management the product shall be removed from the pricelist no longer than three months after LTB. This means that LTB is not what is says it is. Last time buy is not the last date to order the product, in many cases. This contradicts what is written in the EoL-statement. Sometimes there is not even a LTB. The product can be removed from the price list "when we run out of stock". Again, this creates uncertainty towards customers and Sales.

Problem statement Q: Deadlines towards customers are not followed.

Systems

KAMs describe that the system for projects does not support the tasks that should, or could, be done when receiving an EoL-statement. There is no way of searching for the removed product to see which projects it is in. There is also no way of seeing how much each customer has historically purchased of the product. This function could be useful to determine if certain customers might require additional products in the future (anticipating holdover demand).

Problem statement R: Sales' IT-system does not support or facilitate tasks required in removal scenarios.

Wrong order acceptance

Initially, the problems for the Order department were described as one of the larger issues. It was told that they had problems with orders being accepted on removed products and that they had to maculate orders, which affected customer relationships. Digging deeper into the issue it was found that the Order department have already set up a process to prevent this from happening. This process is not flawless and therefore the statement remains.

Problem statement S: Orders are incorrectly accepted.

5.2.2 Axial coding

The different data points were then linked together in what could be interpreted as relationships, i.e. where a connection between two points from different themes could be seen. This is the rule set for the analysis. *Table 13* shows the relationships between the different themes as arrows. Full arrows, striped arrows and striped with dots arrows represent one, two and three connections respectively. The exact quotations that were linked together are not shown due to the size of the full matrix.

Table 13: Axial coding matrix
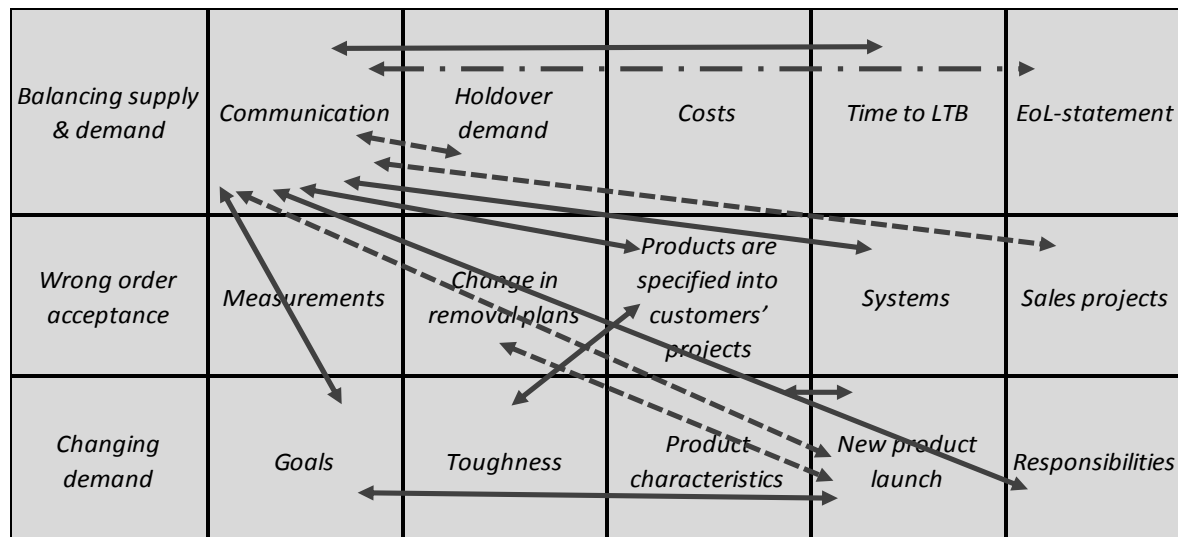
The many relationships to communication show that it is a vital part in the bigger picture and that several other problems might be related to this theme. New product launch have many connections as well and can be considered a central part of the problems. However, the topic of new product launch is an external disruption to the process, i.e. it is not part of the process, but affects it. The issue with specified projects is also an external disruption. The time to LTB and EoL-statement are both connected to communication, and specifically relates to the communication to customers. No connections were found to measurements, which indicates that this highly important topic is overseen.

5.3 Categorization

Using the results from the content analysis and the axial coding, the 19 statements created in the content analysis were reviewed and common factors were linked together to create categories. This resulted in seven different key categories: (1) Responsibility and overall goals, (2) Measurement, (3) Communication, (4) Customer interface, (5) Tasks & tools, (6) External disruptions, and (7) Demand.
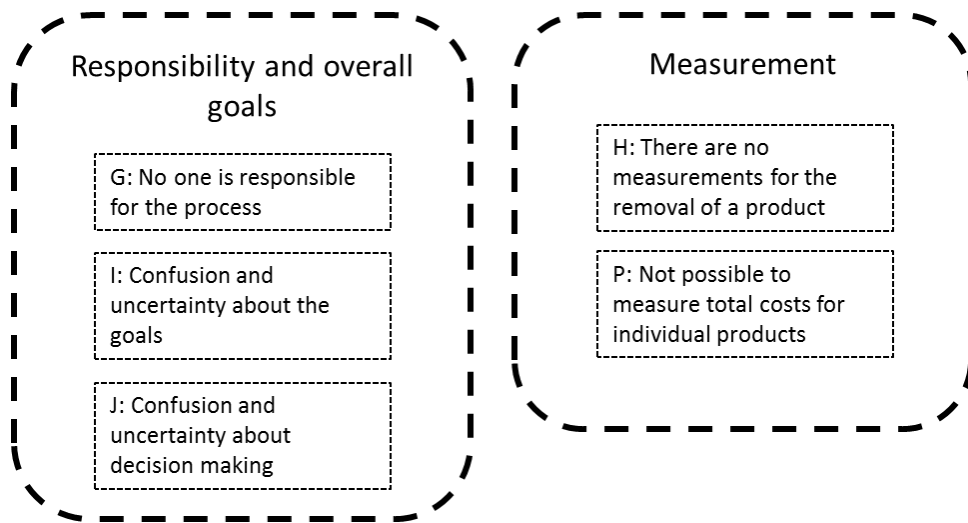
Figure 25: Categories Responsibility and overall goals, and Measurement

Responsibility and overall goals have been found to be of great importance in the literature. The lack of it in the empirics show that this is a category which has large room for improvement. Measurement is not mentioned in either literature or empirics, which shows an even greater room for improvement. As previously mentioned, to improve, one must also measure. *Figure 25* shows the statements included in responsibility and overall goals, and measurement.
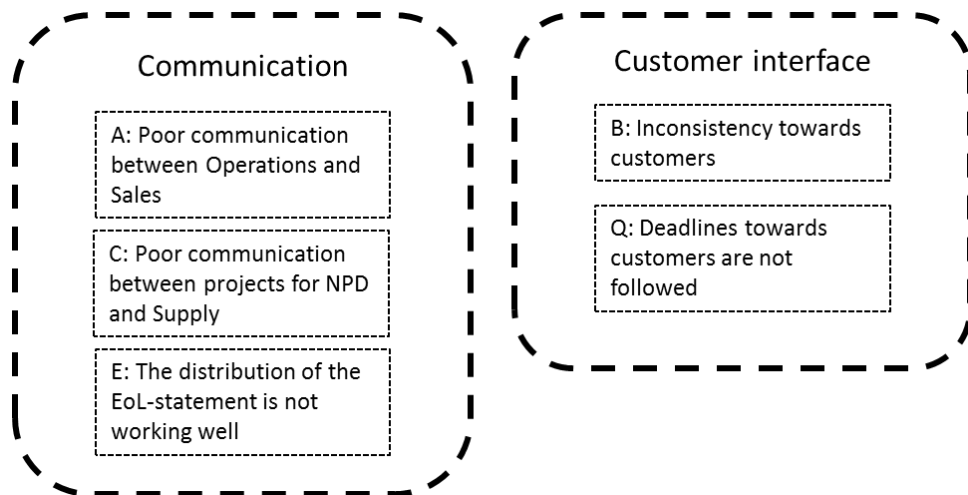
Figure 26: Categories Communication, and Customer interface

Communication strategies should according to Harness & Harness (2012) be developed to inform, instruct and reassure important stakeholders. The lack of these strategies have been found important in the empirics and therefore deserves its own category. This is also highly connected to the lack of cross-functionality. The communications between different functions are of greatest interest and has large room for improvement.

The interface towards customers plays a large role in product removal. Homburg et al. (2009) describe how the customers are affected more by the perceived quality of the process than the

outcome of it. Interviewees explaining that it is more important to customers that Axis keeps its promises, than the signification of the promise itself, only strengthens the importance of this topic. The issues regarding the customer interface were therefore included in a category. *Figure 26* shows the statements included in communication, and customer interface.
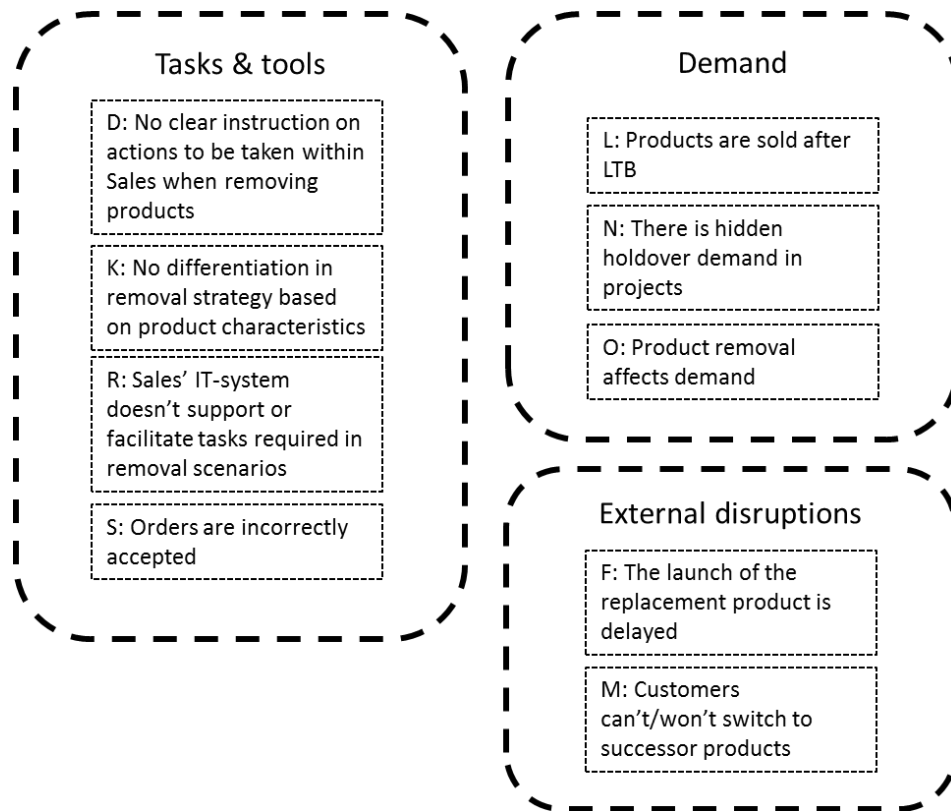
Figure 27: Categories Tasks & tools, Demand, and External disruptions

The category Tasks & tools include some statements that are more specific and related to what individuals are doing. Most can be connected to the lack of structure and definition in the removal process. This is also something that literature mentions as important. The category Demand includes statements that are connected to the demand of products and how it affects, and gets affected by, the removal process. External disruptions is a category that includes statements that affect the removal process, but are not a part of it. For example, replacement product launch is outside the scope of the process but highly affects the performance. These statements will typically be difficult to impact, and the process will instead have to be built around them. *Figure 27* shows these three categories' included statements.

5.4 Prioritizing the Main Problems

For the prioritization of the problems to be of any significance, multiple factors will have to be considered. Three major factors have been found significant in this matter. (1) The frequency of appearance in interviews and observations, (2) the possibility of improvement, and (3) the connection to literature.

The frequency of appearance is simply based on how many times the statements were brought up during interviews and observations. This represents what the employees involved

in the process feel are the most important problems. A statement brought up several times in interviews with employees of similar function will still only be counted as one. This is done to reduce the bias from interviewing a larger amount of employees from some functions. Appendix 7 shows in which functions the different statements have appeared.

The possibility of improvement for a statement can be explained by how possible it would be to acquire substantial improvement through actions taken at Axis. Areas that have already been improved, or lie outside the authority of Axis, typically have lower possibility of improvement, while unexploited areas that are within the grasp of Axis typically have higher. The connection to literature could be measured in two ways, either the statement is connected to what was found to be important in previous literature, or it is connected to important topics that were not covered in previous literature, i.e. the gaps.

Each statement was graded towards each factor by a high (H), medium (M), or low (L). These grades were then converted to a number (H=3, M=2, L=1), and the sum of them represents the total importance of the statement. The frequencies of appearance are converted accordingly (0-2 = low, 3-4 = medium, and 5-7 = high). The individual grading can be found in Appendix 8.

The statements are presented below with their prioritization justified.

5.4.1 High Priority
A. Poor communication between Operations and Sales (9)

The topic of communication between Operations and Sales was brought up from both sides in interviews. It was described as "we do not know them and they do not know us". Operations wonder why Sales cannot make the customers phase over to the new product, and why they constantly sell old products in projects. Sales cannot understand why Operations find it so difficult to deliver products that were promised to be available. These kinds of issues are the reason why the statement is considered to have high frequency of appearance. The interface between Operations and Sales have not gotten much attention, especially in cross-functional processes, at Axis. The problem is very well within the limits for what Axis can do, and therefore it is considered to have high possibility of improvement as well. The connection to the literature is considered high since there is a direct correlation to the lacking involvement of Sales in the literature.

D. No clear instruction on actions to be taken within Sales when removing products (8)

No Sales personnel felt that they had any tasks to conduct in conjunction with product removal. Yet, some felt that they could need it. No one from Operations or Product Management could state any instructions given to Sales on what to do. The possibility of improvement here is high since nothing has yet been done. The connection to literature is the same as for Statement A.

E. The distribution of the EoL-statement is not working well (7)

The EoL-statement is part of the communication from Product Management (and Operations) to Sales. But it also functions as the communication for product removal within the Sales function. Sales personnel did not mention the EoL-statement as being the problem, and therefore the frequency of appearance is considered low. However, they were often poorly

informed of product removals, even if they did not recognize the EoL-statement to be the faulty link. Again, this is a matter in the interface between Sales and other functions, and it has not received much attention and relates to the same gap in literature.

F. The launch of the replacement product is delayed (7)

When Supply faced trouble in connection to product removal it was often mentioned that the postponement of the replacement product's launch had been delayed. The possibility of improving the accuracy of the launch for new products is considered low, partly since it is outside the scope of the study, and partly since Axis has stated that it will follow its aggressive launch strategy. However, the literature states that the removal plan should partly be based on information regarding the development of a replacement product. This is highly relevant. Consideration to this type of consecutive postponement should, according to literature, be taken when planning the removal. This is something that has not been discovered at Axis.

G. No one is responsible for the process (7)

Literature clearly states that every process must have a process owner. Many of the ambiguities surrounding product removal are based in the lack of responsibility. Multiple times, the issues with decision making and targets to aim towards were brought up and there constantly missed someone to take a stand in these questions, to guide the ones in the process. The lack of responsibility also means that no one is accountable for the result of the removal, which means that the results are not looked over and measures to improve them are not taken. It has however been difficult to recognize who would be the appropriate candidate for this responsibility. Axis also explains that they do not want to be too hierarchically structured, and this is why the possibility of improvement is considered low.

I. Confusion and uncertainty about the goals (7)

This statement is tightly connected to the issues described under Statement G. When speaking to different functions at Axis, there is no unity of which target should be followed. Growth is the target and product availability is the key facilitator, but the Supply function are cost-oriented. This does not go hand in hand. Literature clearly states that competitiveness requires a clear distinction of strategy, not any half-measures.

5.4.2 Medium Priority
H. There are no measurements for the removal of a product (6)

Measurements for the product removal process was not something that was recognized at Axis and the frequency is therefore considered low. This was expected from the literature, since no measurements were found there either. The connection to the gap in literature is therefore considered high. The possibility of improvement is considered medium due to two reasons. The first reason is that finding measurements for the process might be difficult. There are currently no directions on what to measure as there is no clear goal for the process to achieve. Despite this, costs can be seen as an important metric to consider in any way. But even the costs are difficult to follow since they are not distinguished between products. This makes it even more difficult to find and use appropriate measurements for the process. The second reason is that if measurements are found, the process will benefit greatly from this.

This beneficial impact might create an incentive to look harder for these measurements and therefore increases the possibility of improvement.

J. Confusion and uncertainty about decision making (6)

This is strictly a sub-problem of Statement G. If there is no one responsible, neither is there anyone to make decisions regarding product removal. The possibility of improvement and connection to literature are however somewhat different to Statement G. This is due to the fact that for this to improve, no one responsible for the whole process has to be designated. A smaller role within each function is easier to find, but comes with less benefits.

K. No differentiation in removal strategy based on product characteristics (6)

There were only few who mentioned that the removal of products should differ between different types of products. Literature clearly states that a thorough evaluation of each product must be conducted before a removal strategy is chosen and plans and time schedules are developed. Product characteristics is one factor to consider when differentiating removals, but the overarching issue is that products are not initially differentiated at all. Starting to differentiate products should not prove to be very demanding and there could be benefits to it. The possibility of improvement is hence considered medium.

B. Inconsistency towards customers (5)

Examples of this were stumbled upon several times at Axis. The issue with inconsistency was not found in literature, but the interface towards customers is discussed. It is said that the removal plan shall include specific instructions on when, and how, to inform customers. The lack of such a plan might be connected to the inconsistency found at Axis. The size of Axis' Sales function may make the interface towards customers difficult to oversee, but the issue is quite clear and therefore the possibility of improvement is considered medium.

L. Products are sold after LTB (5)

The issues that Supply faces when products have to be supplied after LTB were not that frequently brought up. It seems that the exceptions are the ones that causes substantial trouble, and they are not part of the process. Literature describes the strategy where products are intentionally kept at the market and sold out, but at Axis it seems that this happens unintentionally. It is a reactive solution to having not successfully balanced supply and demand, and not a willingly chosen approach.

M. Customers cannot/would not switch to successor products *(5)*

The holdover demand that is sometimes faced (and sometimes satisfied) can be a bit troublesome. There are measures that could be taken to reduce this holdover demand, i.e. to make customers switch over to replacement products, and therefore the possibility of improvement is considered medium. The issue with holdover demand is also discussed in literature, and it has to be a part of the process to determine its impact and plan the removal accordingly.

N. There is hidden holdover demand in projects (5)

This is a sub-problem to Statement L However, there are some interesting features to it. The problem did not come up many times, but when it did, it had been very impactful. The fact that some projects are hidden means that rather simple measures to expose these projects could have significant impact on the removal process. The possibility of improvement is therefore considered high.

5.4.3 Low Priority
O. Product removal affects demand (4)

According to several interviewees from Demand Planning and Supply, the demand for products got more unpredictable after the removal statement had been sent out. Since the collected data could not show any pattern of how demand is affected by the product removal, the possibility of improvement is considered low. The topic was not discovered in literature.

C. Poor communication between projects for NPD and Supply (4)

This problem was only mentioned once, but it shows potential of improvement due to the significance of Statement F. The connection to cross-functionality in literature is also considered.

P. Not possible to measure total costs for individual products (4)

This is an overall hinder for measurement within Axis, but it is outside the scope of this study.

Q. Deadlines towards customers are not followed (4)

This is a sub-problem to Statement B, but is connected to the time frame (time from statement to LTB) that customers are given.

R. Sales' IT-system does not support or facilitate tasks required in removal scenarios (4)

This statement is ranked low due to its specificity, but it can have great impact if solved. The hidden holdover demand (Statement N) exists since project owners (often KAMs) lack the appropriate system tools to search for, and report these projects. Due to the possible chain reaction this can bring the possibility of improvement is therefore considered high.

S. Orders are incorrectly accepted (3)

This issue was presented early in the study but has shown to be of low significance. The process for order acceptance connected to product removal has already been improved, and is today not prioritized.

6 Possible Improvements

This chapter explains how Axis can improve their product removal process. It starts by describing how the different improvement proposals are linked to strategical, tactical and operational change. Thereafter more detailed descriptions of each proposal are presented.

Throughout the study it has become clear that Axis does not treat product removal as a process. Many of the elements described in theory about process management are missing and this can be considered the overall cause for the problems that are faced at the company. In order to possibly solve, or reduce the impact of, these problems Axis needs to apply some measures developed within process management. Some recommendations from literature regarding product removal can also be applied in order to improve the process. The design of this process can be divided into three levels, namely strategic, tactical and operational. The strategic level consists of determining the goals and objectives of the company or business unit. The tactical level consists of deciding how the process shall be designed on a high level, to accomplish the overall goals and objectives. The operational level deals with designing in detail how each activity in the process shall fulfill what is decided on the tactical level. This chapter includes eight possible improvements that are all related to these levels. *Figure 28* shows how they fit into the framework.

- Determine overall strategy and goals
- Appoint a process owner

Strategic

- Introduce measurements and KPIs
- Cross-functional integration
- Define a process within Sales

Tactical

- Differentiate the product removal
- Upgrade instead of removal
- Quantity, instead of time restriction
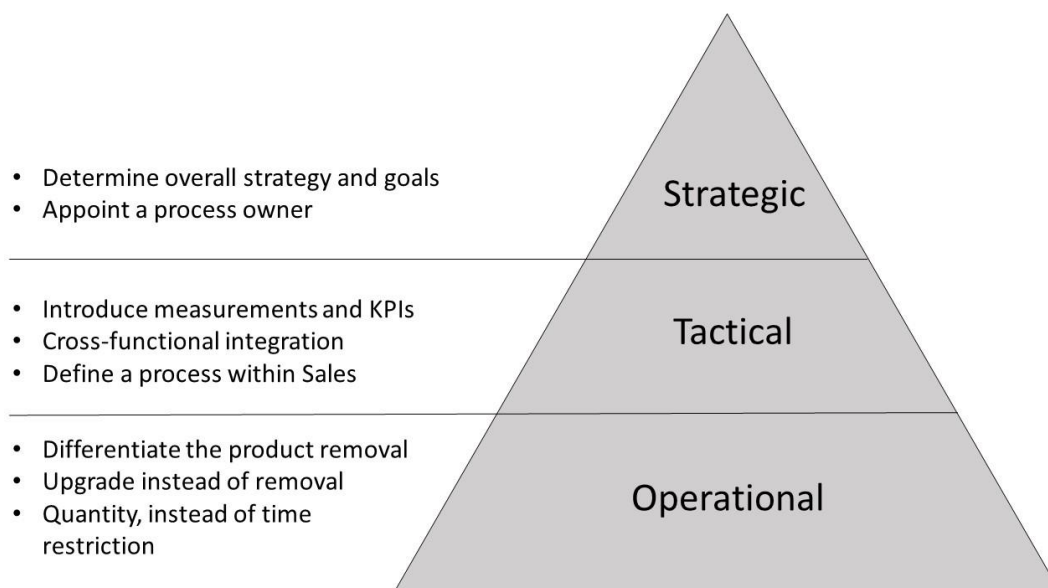
Operational

Figure 28: Strategic-, tactical- and operational pyramid dividing the improvement proposals

6.1 Determine Overall Strategy & Goals

One recurring issue is the ambiguousness regarding costs. On one hand, it has been said that the goal with the product removal process is to avoid unnecessary costs by reaching zero in the supply and demand equation. On the other hand, it has been said that the main goal towards Axis' customers is availability. The two objectives counteracts each other because one goal makes it difficult to succeed with the other. For a company to have a high degree of availability, they need to have a buffer, and if they want to save costs through less inventory, they will lose flexibility and possibly their ability to satisfy a volatile demand.

According to Fisher (1997), products can fall into one of two categories: they are either primarily functional or primarily innovative. He also points out the importance of choosing the right supply chain strategy to match the particular company's situation. If a company sells functional products, they should have a cost-efficient supply chain strategy, whereas if a company sells innovative products, they should have a responsive supply chain. The matches between a company's products and its supply chain is described in *Figure 29*.
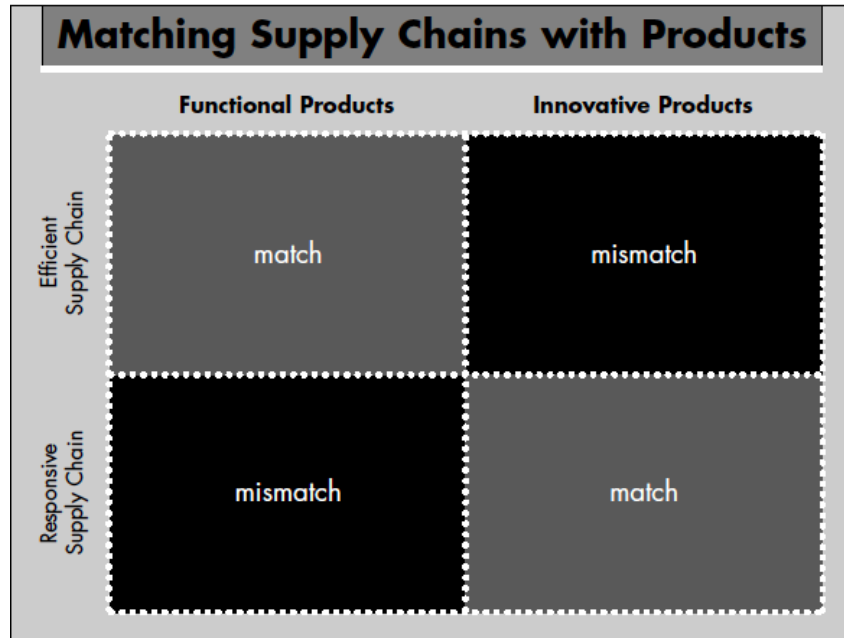
Figure 29: Efficiency vs responsiveness, adopted from Fisher (1997)

The big difference between a functional and an innovative product is usually that the first category has a stable and predictable demand whereas the latter's demand is unpredictable. *Table 14* shows some differences between a functional and innovative product. (Fisher, 1997)

Table 14 Functional versus Innovative products: differences, adapted from Fisher (1997)

	Functional	**Innovative**
Product life cycle	Long	Short
Contribution margin	Low	High
Product variety	Low	High
Average margin of error in the forecast	Low	High

Since Axis' products are primarily innovative, they should have a responsive supply chain strategy. According to Fisher, this means that Axis should deploy significant buffer stocks of parts or finished goods.

It is important that everyone involved in the product removal process strive for the same goals, and to do that, everyone need to know the goals. It is also important that everyone understand these goals and why they are in the best interest for Axis. The first suggestion to Axis is that they need to determine: what is most important for Axis and what should be the objective with the product removal process? When that is agreed upon, everyone involved

must work together to achieve this objective. Today, it is difficult to improve this process because no one really knows what to improve. Should Axis focus on minimizing the costs that are related to the product removal process or should they focus on availability and customer satisfaction? In either case, there must be an agreement and understanding from all involved stakeholders.

6.2 Appoint a Process Owner

The single most important action that makes the greatest contribution to lasting process management is the appointment of an "owner" for each key process (Rummler & Brache, 1991). The role of a process owner is to oversee the performance of a cross-functional process. He or she monitors the process and evaluate how well it is meeting customer requirements and internal goals. Without a process owner, the "handoffs" that occur between functions, in "the white space", tend to be ignored. The owner helps resolving the interface problems among different functions and serves as "the white space ombudsman" (Rummler & Brache, 1991). In Axis' case, a process owner would mean that the involved people would have someone to turn to if they were uncertain on which action to take in a specific situation. A process owner does not only help resolve problems in the white space, he or she ensures that all actions and decisions within the process are made in the best interest of the company. Rummler & Brache (1991) suggest that a process owner should be a senior manager with a major equity stake in the total process. The person should be someone who has much to gain if the process is successful and much to lose if it fails. It would probably be difficult to find a person with "a major equity stake" in the product removal process, but the message from Rummler & Brache is clear: the process owner must feel accountable for the result of the process and thereby have a great incentive to make it work well.

Many of the problems stated above could be diminished if Axis appointed a well suited process owner with great incentives to make the process successful.

6.3 Cross-Functional Integration

One of the main issues with the product removal process at Axis is the lack of communication between the involved functions. This lack of communication could be considered lack of integration between internal functions and this leads to lower organizational performance (Pagell, 2004). It is rather clear that Sales are not aware of the challenges and difficulties that Operations experience when they are in the process of removing a product. To make the product removal process better it is important that more units get involved in it, and that all connected functions work together to reach the same goal. Today, it is basically only Operations that actually takes action and work with the process in their daily work, but there are several functions that can affect and disturb the product removal process. For example, Sales can disturb the process if they keep selling the old product when Demand Planning have forecasted that the new product will be sold instead of the old. Another example is if R&D postpone the launch of the new product. If Axis would work cross-functionally with this, they would make sure that all functions have better communication with each other, more involvement from other functions than Operations, and a better understanding for what is best for Axis and not just functional interests.

All functions that can affect the process need to be involved in it, and since the product removal process gets affected by Operations, Sales, R&D and Product management they

should also be the ones that are involved and share responsibility. The ramp-down meeting is an excellent forum where different functions join parts to work with product removal. Involving Sales and R&D in these meetings, or creating a new forum where they can participate, could help in obtaining a higher grade of cross-functionality.

6.4 Introduce Measurements

If the overall goals and strategy are settled, it will be necessary to introduce some kind of measurement system. Today, Axis does not have any performance measurement at all related to the product removal process. This means that it is difficult to know if a product removal went well or not. The use of measurements has also been encouraged by scholars within process management (e.g. Gardner, 2002; Rummler & Brache, 1991). The performance measurement should be aligned with the company's interests. It should be used as an indicator to if the product removal process is helping the company achieve its overall strategy (Gardner, 2002).

Even though a company's overall strategy is to be responsive, it cannot totally neglect its costs. Axis' overall strategy is growth, and Operations' primary objective is to enable growth through product availability. Operations' secondary goal is to be cost efficient. For a process owner or senior manager to evaluate if a product removal was cost efficient they would need data that covers all the costs related to each product. Today, Axis do not have data on the scrapping costs connected to each product. Instead, they lump together the scrapping costs from all products in a total cost. This makes sense since Axis primary objective is not to be cost efficient. It may seem enough to evaluate on the total scrapping cost. However, Axis have a large variety in their product portfolio and without individual measurements it is difficult to distinguish between each product removal and know which ones that were successful or not. According to the theoretical framework, a company should differentiate the product removal process for each specific case and if Axis cannot evaluate each situation separately it will be difficult to analyze and conclude on what to improve for the next removal. It is therefore in Axis' interest to be able to measure the costs for each product removal.

Measurement can be divided to measure internal efficiency and external effectiveness. One example of an internal measurement is to measure the use of resources in the process. An example of external measurement could be customer satisfaction.

6.5 Upgrade Instead of Removal

The most common reason for a product removal at Axis is due to a new product replacement. Axis want to sell the new product instead of the old and their customers should want to buy the new one instead of the old, but that is not always the case. A common question that employees at Axis ponder, is why some customers want the old product when the new one is usually better and cheaper. One explanation could be that the customer have specified the old product name into their project, and since the successor does not have the same name, they would rather have the old one. Another reason may be that the customer simply does not know that the old product have a better and cheaper successor. It seems like Axis' routine of changing the names of their products may cause confusion amongst their customers. A possible way to handle this problem could be to keep the name when there is a direct successor to an old product, and mark the new product with mark two instead (e.g. the

successor for a product named Q60 will be named Q60 MK II). Then, instead of sending out a removal statement, an "upgrade statement" is sent out.

This is not a solution that will solve all problems related to holdover demand but it will facilitate in situations where the customer have specified a certain product into a contract. This set-up will also remove some of the negative tone that, according to Homburg et al. (2009), is associated with a product removal. Instead of a product removal, it will be a product upgrade. An announcement that a product will be upgraded is more likely to be received in a positive way than an announcement that a product will be removed.

This action cannot be implemented for all product removals. An "upgrade" can only be done when the difference between the old and the new product is not too big. Generally, this would only be appropriate for one generation of products (i.e. not use MK III). After one upgrade, the product should culminate in a new model, with a new name, to keep the attractiveness of novelty in new product launches. However, in the cases when this is applicable, it is a simple action that may provide an improved outcome.

6.6 Define a Process Within Sales

For the product removal process to work better, Sales must be involved in a higher degree than they are today. To start with, Sales must be more aware of how this process works. Employees at Sales must be educated so that they understand how their actions can impact the product removal process. Today, Sales sells Axis' products and then it is up to Operations to make sure that those products get delivered in time. This way of working is just how Axis do its business and that is fine. However, when a product is about to be removed there is usually an underlying plan to replace the old product with a new one. This plan originates from Product Management and Operations gets aware of this during the ramp down meetings. In that way, Operations gets the "bigger picture", but Sales does not. If Sales would know Axis plans for their products as Operations and Product Management do, they could also contribute to the product removal process. There is however always risks with letting Sales know about the removal early on since they may advise the customers to wait with their purchases until the replacement has been released (Avlonitis, 1983).

A good idea would be to let representatives from Sales attend the ramp down meetings so that they get informed of the long term plans and so that they can contribute with valid inputs as well. Then there must be someone or a group of people that are accountable for how Sales is selling Axis' products. These persons will ensure that everyone at Sales get the necessary information regarding the product removal process. They will also take into their responsibility to make sure that everyone at Sales do all actions required. If, for example, it turns out that there is a big project going on, with an old product that is supposed to be removed, that the employees at Operations are unaware of, then someone at Sales has to be accountable for this.

A process for Sales would have to include some instructions on what actions to take in different removal scenarios. Preferably, this could be used to control where the focus is put when selling products. Depending on e.g. the stock on hand, Sales' focus could be put on either the precursor or successor product. This focus could be determined at a later stage at the ramp-down meeting. *Table 15* shows how it could be a part of the planning for the

removal. Using this type of demand shaping would make the demand more predictable at the same time as Sales becomes more involved in the process.

To make it easier to unveil hidden holdover demand, Axis should look into the opportunities to develop and integrate tools in the Sales' IT-system to facilitate the necessary actions at a removal. A necessary and simple solution would be to, in conjunction with the send out of the preliminary statement, have the system make an automatic warning to a salesperson (most often a KAM) when she/he has ongoing or potential projects that involve the product that shall be removed. If a salesperson receives this signal, she/he must report it to someone at Sales, tentatively the regional sales managers. Each regional sales manager then consolidates the information from respective region and sends it to another unit, either within Sales or Demand Planning. The second unit then consolidates the information from all regions and send it to the product manager, where it acts as the foundation for decision making on the phase out pace. It is highly important that the preliminary statement clearly states the requirement of this response, and that the regional sales manager (or the second unit within Sales) is responsible for the response to reach the product manager in time. *Figure 30* shows how the process would work.
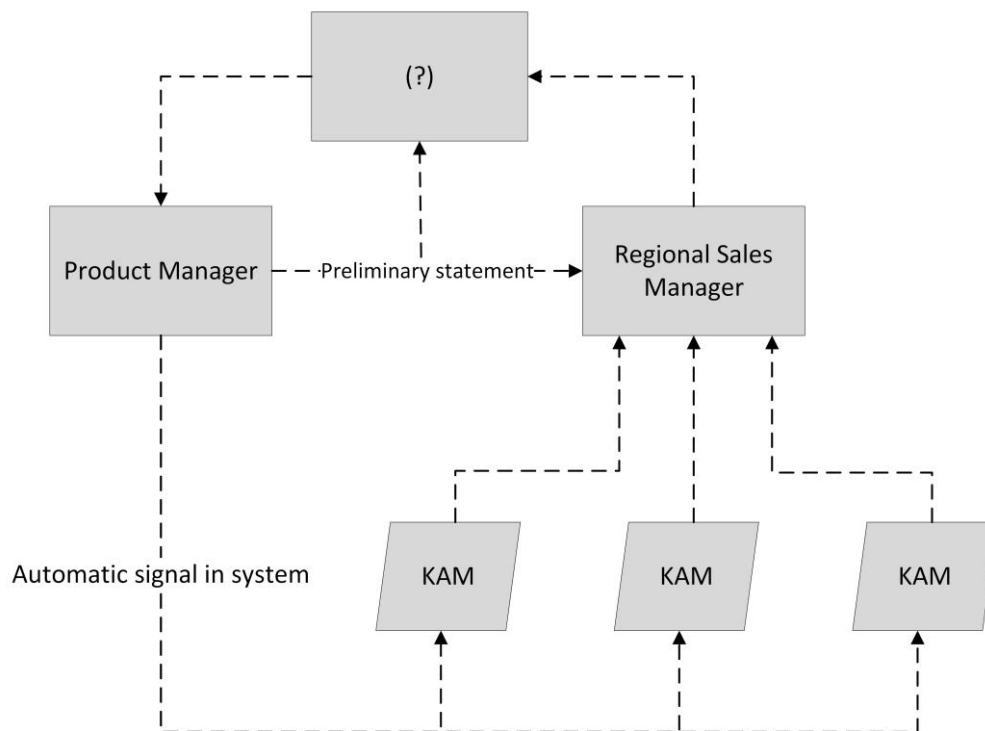
Figure 30: Sub-process for Sales

In order to better estimate the effect the removal will have on customers, another tool could be developed. The purpose of this tool would be to reveal how much each customer has bought of a product historically. KAMs could then, for each product removal, run a search on all their customers to see if anyone has bought substantial amounts of the product previously. This could mean that they would want to purchase more of the product. The KAM could then inform the specific customers about the coming removal and ask for their input. If any input is received, this could be reported to the regional managers who forward the information in the same way as for ongoing projects. This would not only help reducing, or unveiling,

holdover demand, but would also show customers Axis' interest in them – possibly improving the company-customer relationship.

This is one suggestion of what the process for Sales could include. There could of course exist more actions and sub-processes, but the most important thing is that there actually exist a defined, structured set of activities and actions (Harness & Harness, 2012).

6.7 Differentiate the Product Removal

One of the outcomes of the theoretical framework was the finding that the product removal process must allow for different products to be treated differently. This was based on that the effect on customers, reason for elimination, and product characteristics (amongst others) creates different requirements of the removal. How these different factors should affect the removal is discussed in 3.8 Analysis of the Literature Review. Axis does not differentiate the removal plans today, and should start doing so. A suggestion on how to begin is to create a template with instructions on when to collect what information and how the removal should be affected by that information. *Table 15* shows an example of what this template could look like. Each product is evaluated on these different factors resulting in different phase-out paces for different products (time from statement to LTB could be considered as the "pace" of the removal), and different instructions to sales. The pace of the phase out should be considered according to the figures in *3.8*. For the factor of replacement product development, a risk assessment would have to be done to estimate the risk that the project will be delayed. A higher risk could mean that the phase out period becomes longer or that buffer stock is used to secure availability. The configuration of this risk assessment is however outside the scope of this study.

Table 15: Example of what a template for the removal could look like

PRODUCT REMOVAL TEMPLATE								
	10 months ahead of estimated LTB			*3-6 months ahead of estimated LTB*				
Product	*Reason for elimination*	*Product characteristics*	*Effect on customer*	*Replacement product development*	*Holdover demand*	*Stock on hand*	*Time from statement to LTB*	*Instructions to Sales*
P1210	Replacement (DR)	Basic	Low	Risk evaluation: Low	Few projects	Normal	2 months	No actions
Q1306	Replacement (R)	Advanced	Medium-high	Risk evaluation: Medium	Few projects, important customers	Low	4 months	Focus on selling new product

Tentatively, it could be the process owner's responsibility to make sure that this information is collected and that the removal plan is built upon the results. The reason for having different time periods is that some information, if collected 10 months ahead, is not valid at the withdrawal. New customer projects may be initiated during the period and the projects for new product development can be delayed just before the withdrawal. Some factors will therefore have to be investigated multiple times during the removal. This particular template does not show that some information should be collected several times, but it could easily be added. The template will not only help creating a necessary tool for differentiation, but using it will also make the process more structured.

6.8 Quantity, Instead of Time Restriction

Suggestions on other types of removal procedures were discovered during the interviews. One of them was the fixed quantity restriction. This procedure involves a quantity restriction instead of a time restriction. As it is now, the statement says that the product is available for another three months and then it is removed. Instead of this, the statement could say that a fixed quantity of the product will be available for sale, and when they run out, the product is removed. First come, first served would be applied. This greatly simplifies the procedure for Supply and Demand Planning. Once the decision has been taken to send out the statement, inventory and incoming batches are summed up and this becomes the fixed quantity that will be available. Supply stops procuring the product and does not have to worry about getting excess stock, eliminating the risk of scrap costs. Demand Planning also stops forecasting the product since it is no longer needed. Without changing the procedure for new product launch, this would however create some complications. By using fixed quantity, one risks getting a sales gap, i.e. a period where no product, precursor or successor, is available. This happens when the fixed quantity of precursor products runs out before the launch of the successor product. Always using fixed quantity would affect the availability of products negatively. Adjusting the launch date of the successor product to the level of remaining precursor products (e.g. launch when there are X products left in stock) would solve this problem, but it does not fit with Axis' current aggressive launch strategy.

The fixed quantity could however be used in situations where there is an excess of the precursor product. This would be a replacement for the postponement method that is used today at Axis. It would also circumvent the ambiguity that is created when the product is left in the price list after the three months that were communicated to the customers.

7 Conclusion & Discussion

This chapter involves the conclusions drawn from the analysis and a concluding discussion. It begins with the answers to the research questions, followed by a revised version of the model described in chapter 3. The chapter ends with a discussion about research implications, limitations and further research.

7.1 Answers to the research questions

The three research questions from the introduction are answered below. The third contains recommendations for Axis Communications.

7.1.1 What are current gaps in literature regarding the product removal process?

The largest gaps in literature were found to be connected to three different topics, (1) measurements and evaluation of the process, (2) the sales function's part in the process, and (3) the influence of the overall strategy on the product removal process. According to the theory of process management, a process should have an input, an output, a clear goal, and related measurements to ensure that the process is aligned with overall strategy. Previous scholars also emphasize the importance of a process owner that ensures that the process is managed properly (e.g. Gardner, 2002; Rummler & Brache, 1991). The findings from the literature review combined with the case study at Axis showed that the product removal process has not been seen as a process and has not been handled as a process should.

Previous research have not found any single, right way to execute a product removal. Nor has it demonstrated any suitable measurements to use for this process. The majority of scholars seem to agree on that a product removal should be executed to the lowest cost possible with the least disturbance of customer as possible. Most companies are different and it is difficult to find a proper solution that fits for everyone. However, it should be possible to develop different ways to measure this process. The measurements should be possible to adapt depending on what you wish for the outcome. This leads into the third gap. A business should be driven by either cost (efficiency) or service (effectiveness). All processes in a company should be performed in accordance with the specific overall strategy of the company. An interesting future research would be to develop a framework that differentiates the product removal process depending on the two different overall strategies.

It became apparent that there was no previous research regarding either success factors or pitfalls for the product removal process in the reviewed literature. This case study has not been able to demonstrate any specific evidence of possible success factors. The theory within process management emphasize, however, the importance of a process owner. Many of the difficulties that have been observed on Axis can be traced back to the lack of a clear leader who takes full responsibility for the entire process. The conclusion can be drawn that an important piece of the puzzle to get a well-functioning process is to appoint a responsible process owner.

One pitfall that managers should be aware of is to ignore Sales in this process. After the literature review was conducted it was concluded that one of the biggest gaps in previous studies was the absence of the Sales function's part in the process. The case study at Axis has

shown that even if this process was well planned and well executed within Operations, there would still be great risk for others to put a spanner into the works. Since Sales usually have the opportunity to influence what customers are buying and thus also may affect the demand, there is a great risk that the outcome will not be as Operations had anticipated. Future research within product removal should include how Sales should act during a phase out.

7.1.2 What are the main problems with the product removal process at Axis and how can they be categorized and prioritized?

From the empirics, 19 problem statements were created representing the main problems with the product removal process at Axis. A prioritization model was built upon three factors: Frequency of appearance in empirics, Possibility of improvement, and Connection to literature. The 19 statements were evaluated on each of these factors and given a score of high, medium or low, which was quantitatively converted to a score of 3, 2 and 1, respectively. The sum of the scores equals the prioritization of the statement. This prioritization can be seen in *5.4 Prioritizing the Main Problems.*

The seven categories described in 5.3 Categorization are (1) communication, (2) responsibility & overall goals, (3) customer interface, (4) tasks & tools, (5) measurement, (6) demand, and (7) external disruption.

Communication

Lack of cross-functional cooperation is a recurring issue. It is clear that there is a lack of understanding between the functions. The information channels between the functions are insufficient and the handoffs between the functions tend to be ignored.

Responsibility & Overall Goals

No process owner with overall responsibility for the product removal process exists. No one is held accountable for the outcome of the process, which results in a lack of incentive to make the process successful. Axis has no determined or defined goals for the product removal process which in turn result in confusion about decision making for the people involved in the process. They are uncertain in which situations they should aim to reduce costs and in which situations they should focus on customer satisfaction. This leaves Axis stuck somewhere in the middle without knowing where and how they should improve the process.

Customer Interface

Sometimes, the deadlines that were set up are not followed. Axis' promises are not always followed and Axis seems to be inconsistent towards their customers. Axis' way of executing their product removal process can create confusion and reduce their reliability towards their customers.

Tasks & Tools

The tasks and frameworks (instructions) could be better within some parts of the product removal process. There is no defined sub-process within Sales. Today, Sales is not really involved in the process and they are not aware of the difficulties that Operations experience. Sales does not experience the product removal process as problematic because they seldom affected by it.

Measurements

The process is not measured, which means that it is difficult to evaluate and improve the process.

Demand

The most challenging task for Operations is to satisfy the demand at the same time as they try to downsize production and inventory. The demand can fluctuate greatly during a product removal. This fluctuation is difficult to predict and may depend on several unknown factors, but two reasons have been identified. There can be hidden demand in projects that are unknown for Operations, and another reason can be that the customers want to buffer up on a product that is about to be removed. Both reason have a close relation to the category of *communication* and to Sales.

External Disruptions

New product development is often delayed, resulting in disruption for the removal process. This issue is outside the scope of the removal process but it still affects the process since the old product often has to cover up for the demand of the new product when the new product launch gets delayed.

7.1.3 How can the product removal process at Axis be improved?

The following section states what actions Axis should take to establish an improved product removal process. The recommendations are based on both the literature review and the empirical study in this project.

Recommendation 1: Determine Overall Strategy & Goals

The first suggestion to Axis is that they need to decide: what is the most important for Axis and what should be the objective with the product removal process? It must be clearer for everyone involved whether they should focus on availability towards customers or to minimize costs. A clear statement from top management will reduce any uncertainties and give the involved people more confidence to make the right decisions when they are faced with a dilemma.

Recommendation 2: Appoint a Process Owner

In both the theory of product removal and the theory of process management, scholars put great emphasis on the importance of a process owner. Axis needs to improve its cross-functional integration, and it needs a process owner to supervise this process. With a process owner that has a personal responsibility, there will be strong incentives to make this process more successful. The process owner would make sure that handoffs are not ignored in the "white space" between functions.

Recommendation 3: Increase Cross-functional Integration

Axis needs to increase its cross-functional integration. All functions that can affect the process need to be involved in it, and since the product removal process is affected by Operations, Sales, R&D and Product management they should also be the ones that are involved and share responsibility. If Axis were to improve their communication and cooperation between their functions, the product removal process will run much smoother. Supply and Sales are the two functions with interface towards Axis' suppliers and customers

respectively. If Axis could synchronize these two functions in a better way, it will be easier to supply the demand.

Recommendation 4: Introduce Measurements

If Axis were to introduce measurements related to this process, it would be much easier for them to keep track of how potential adjustments in the process work for the better or not. Without measurements it will be difficult, almost impossible, to continuously improve this process. Today, no one really knows when a product removal is successful or not, and it is difficult to compare what is wrong or right from case to case. The performance measurement should be aligned with the company's overall strategy and interest. Measurement can be divided to measure internal efficiency and external effectiveness.

Recommendation 5: Upgrade Instead of Removal

In the cases when the difference between the old and the new product is not too big, Axis should not change the entire name of the new product. Instead they should mark the new product with MK II. In addition to this, a "product upgrade statement" should be sent out instead of the current removal statement. This will facilitate in situations where the customer have specified a certain product into a contract. This set-up will also remove some of the negative tone that is associated with removing a product. An upgrade will make it easier for customers to switch from the old to the new product and, hence, make the demand less unpredictable.

Recommendation 6: Define a Process Within Sales

As explained in recommendation 2, Supply and Sales are functions with interfaces outside Axis borders. Supply is highly involved and active in the product removal process but Sales is not. Sales has a great opportunity to facilitate this process but today, they do not know how. This is mostly because there is no defined structured process within Sales when it comes to product removal. Establishing a systematic approach, and making someone within Sales responsible for that other salespeople work in accordance with the removal plan, will make Supply's work much easier. A good idea would be to have a representative from Sales present on the ramp down meeting. Another idea is to develop tools in their IT-system that facilitates a salesperson's actions at a removal.

Recommendation 7: Differentiate the Product Removal

The product removal must allow for different products to be treated differently. Different situations create different requirements for a product removal. All factors that influence the pace of a removal must be investigated. Some factors, e.g. reason for elimination and product characteristics, can be investigated early on in the process whilst some other factors may have to be investigated later. Some factors will have to be investigated multiple times during the removal. This could, preferably, be done with the help of a template similar to *Table 15*. This template will not only help creating a necessary tool for differentiation, but will also make the process more structured.

Recommendation 8: Quantity, instead of time restriction

Instead of making a statement saying that a product will not be available in three months, Axis could say that they now have a fixed quantity left for customers to buy. This way of executing a product removal will facilitate Operations' part of the process. This method could

be used as an alternative in the removal plans, e.g. when excess stocks remains and Axis does not want to postpone the removal.

7.2 Product Removal Model

As a final remark, an updated version of *Figure 15* is presented in *Figure 31*. The new process model is built upon the same basis in the literature, but with additions from the empirics. All steps will not be gone through in detail since they are described in 3.8.2 The Product Removal Process. The differences from the original model will however be discussed below.

The first two steps are practically the same. The only difference is the amount of information that should be gathered in the initial step. As can be seen, the information gathering is now divided into three steps. This demonstrates that information collected in the beginning of the process might not be up-to-date when the plan shall be executed. It therefore needs to be collected periodically.

The removal plan is quite the same, but with an addition. The removal plan can now include the decision whether to make use of the "upgrade method" described in *6.5 Upgrade Instead of Removal*.

The step of downsizing production and procurement is now initiated before the beginning of the execution of the removal plan. This demonstrates that the downsizing can begin at a very early stage. At Axis this happens almost immediately after the first ramp-down meeting.

Step 6. Sales plan is the biggest difference from the original model. Since the market program consists of a forecast, it is important that this is up-to-date. Typically, it is more difficult to make a long term prognosis than short term, and this is why the market program should be updated. Based on this and the stock on hand (investigated in the previous step), the sales program can be created. This program is intended to function as an instruction to Sales on how they shall proceed in selling the soon removed product, and possibly its replacement. It will work as a demand shaping tool, where the sales effort is based on stock levels and estimated demand. Another addition to this step is the decision whether to use the "fixed quantity method" described in *6.8 Quantity, Instead of Time Restriction*. When these decisions have been made, the time schedule is updated, if needed, and the two last steps are followed as before.
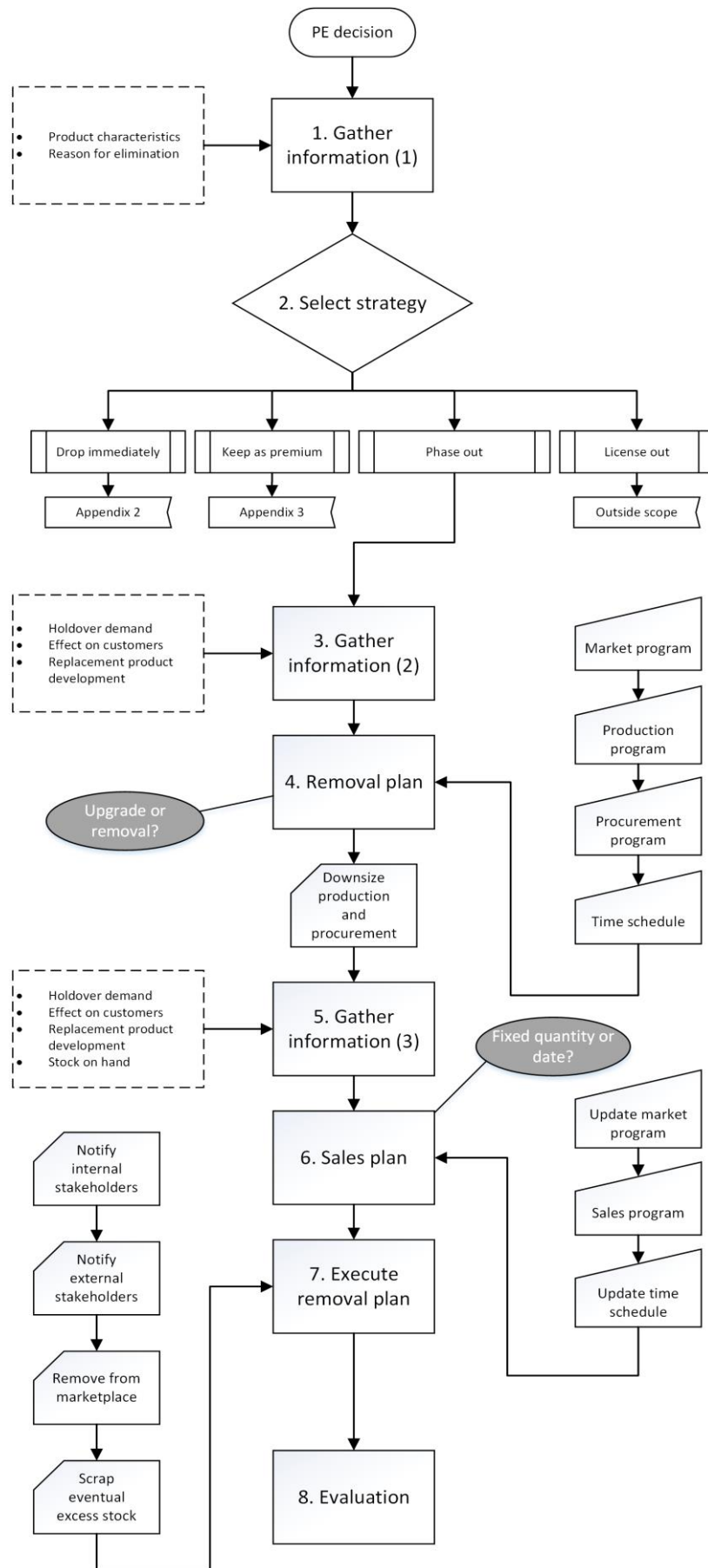
Figure 31: The revised product removal process with the phase out strategy

7.3 Research Implications

This study set out to add on to the body of knowledge regarding the product removal process and has, to some extent, succeeded. It has discussed this understudied subject and tried to raise the awareness of its importance. It has, in some areas, enlightened new subjects. The exclusion of the Sales function from the product removal process has been discovered, both in literature and in empirics. The missing topics of measurements and the impact of overall strategy on the process also stand as new and undiscovered. The problem statements and improvement proposals developed for Axis are quite specific, but the findings can be used as a part of generating more generalizable propositions. The study also provides a theoretical model for the product removal process upon which practitioners and academics can base further development and improvement.

This study may act as a support for future development within Axis. This paper does not explain in detail how Axis should implement improvements to their product removal process. Instead, it highlights the most important challenges related to the process, and suggests in which areas Axis should lay its focus.

Before this study was conducted, very few at Axis had a holistic knowledge of this process, meaning that only few could tell in detail what all involved parties were contributing with. A big practical contribution to Axis is that this study contains a thorough mapping of the process. It was this mapping of the process that unveiled the lack of cross-functional integration and understanding. This paper educates the reader of how this process works at Axis and after reading this paper, the reader will hopefully have gained more knowledge about the product removal process. It will give the reader an understanding of the main challenges and how Axis should tackle these.

7.4 Limitations

In *2.1 Research Approach* the topics of inductive and deductive research are discussed. It is mentioned that this study uses an inductive approach, which implies that a substantive theory should be developed. There has not been enough resources to develop scientific propositions, which indicates that the theory is not complete. The theory developed within the study can, however be considered as the start of, or the foundation for, substantive theory building. Future researchers can use what has been developed to continue building and validating this theory.

In *2.5 Case Study Design Tests* it is explained how the quality of the study can be ensured through the use of different design tests. *Table 3* explains some measures that have been taken during this project to achieve this. However, there are still some flaws to the study since the measures taken do not completely ensure the validity and reliability.

This study has utilized mostly qualitative sources of data. This gives a more in-depth understanding of the specific issue, but hinders the generalizability of the conclusions and hence weakens the external validity. The use of a single-case study also reduces the generalizability. The time limit and the required depth of this study hindered the investigation of the product removal process at other companies.

The project was initiated from Operations and the authors have been located in proximity to this function. The supervisors at the company are both from within Operations and

observations were therefore more frequent in this function than in others. This might have biased the focus of the study and the results, which weakens the reliability of the study.

Since it was determined that the boundaries of the company would be the limitation of the empirical study, the direct connection with customers has been left out. Customer experiences and perceptions have been described by employees at the company, and this leaves room for interpretations. The information connected to customers can therefore be questioned. The focus of this study have been on the product removal process. Hence, the process of new product development has been outside the scope. However, the two processes are often related to each other and it would be interesting and probably necessary to investigate the two processes together to find the best suitable solution.

The empirical study is based on 14 semi-structured interviews (including two focus groups), with 20 employees. This might indicate that the sample of sources is not large enough. However, the authors have been located at the company throughout the whole project and have had 15 meetings with supervisors and other employees. Observations from just being located in the facilities have also been recurring and have given greater understanding for the company and the situation. Due to this, the authors were confident in not continuing the interviews when the same answers appeared from different sources. A deeper investigation would require a larger amount of interviews and would have to cover a larger part of the organization. Due to the time limit of the study, only parts of the Sales function could be investigated. The Sales organization is big and vastly scattered across the world. Only the mature markets of Northern and Middle Europe have been investigated and other large markets, such as the USA and the Middle East have been left out. Obtaining a comprehensive visualization of processes and structures within the whole Sales organization would require substantial travelling, which has not been possible with available resources.

7.5 Future Research

This study covers only a fraction of the subject product removal. The area is still understudied and future research has much potential of becoming essential to both academics and practitioners. The reviewed literature on the topic has mostly been written by scholars specialized in marketing. The authors believe that the subject is also of high importance to research within operations management and has to some extent tried to connect the two fields. The authors would therefore like to encourage scholars from operations management to continue studying the subject. Below, some interesting topics are mentioned. They have been discovered during the project but not investigated.

The search for best practice within product removal has not been extensive by any means and requires further attention. Some key factors to the process have been discovered, but what are really the necessary ingredients for a successful removal? Research within measurement and success factors would contribute greatly.

Homburg, et al. (2009) showed how product removals almost always affect customers negatively. This study provides an example of how to circumvent this issue, but it does not address the issue itself. Future scholars are encouraged to investigate further into customers' perception of product removal and how the negative effect can be negated.

The topic of demand shaping has been touched upon in this study, but only briefly. A more thorough investigation of how demand shaping could be used to facilitate the removal of

products could benefit practitioners and increase the cooperation between Sales and other functions.

There is a need to investigate product removal in a larger scope than just a single case company. A multiple case study involving different industries and different strategically positioned companies would help to generalize the theory of product removal. What aspects are important in different industries? How should the process be designed based on industry, overall strategy and products? *Figure 32* displays a matrix where differences in market and strategy could lead to different designs and aspects. Answers to these questions would undeniably increase the knowledge of the subject and improve its applicability.

Figure 32: Process aspects in different scenarios

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Appendix

Appendix 1

Interview Protocol

"*The interview protocol is the piece of material that guides the interviewer through the interview process with beforehand determined guidelines.*"

What shall be done before the interview?

Determine influences of the three subjects: structure, size, and category

Preparation of questions

Preparation of what to inform the interviewee(s) about

*Discretion

*Purpose of the interview

*Expectations

Preparation of answers to questions that could arise from the interviewee(s)

How shall the execution of the interview proceed?

Inform interviewees of the "discretion" of the collected data

Schedule for the interview, including time scope

e.g. 10 min introduction/instruction, 20 min walkthrough, 10 min discussion

What shall be done after the interview?

Revise whether the interview successfully acquired the desired information

What worked, what did not, how can introductions, questions, and tactics be improved?

Eventually, ask the interviewee(s) to review the gathered information to ensure that it is correct

Change the protocol

Make sure to include the interviewee(s) when sending out information on how the project develops

How shall the collected data be analyzed?

See 2.4 Data Analysis

Focus group

1. Introduction
    a. Agenda

    b. Purpose of the project

        i. Map the process
        ii. Help Axis identify key factors and issues in the process
        iii. Categorize and prioritize key issues
        iv. Suggest improvements

    c. Purpose of the focus group

        i. Obtain high level understanding for the process
        ii. Obtain inspiration for further research focus
        iii. No focus on improvement suggestions

    d. Explain what is expected of the interviewees

2. Walk the flow: Let every interviewee describe their part in the process and simultaneously draw a temporary flowchart

    Product manager
    Demand planner
    Purchaser
    Distribution account manager (Sales)
    Order specialist

        i. Loop
            1. Trigger
            2. Activity
            3. Output
            4. Time frame

3. Identify problem areas
    a. Internal
        i. For you
        ii. For Axis
        (Related to costs)
    b. External
        i. For customers
        (Related to service)

The questions should be compared with the research problem and the scientific research questions to ensure consistency between the interview and the purpose of the study. The questions can be tweaked, removed or supplemented depending on the characteristics of the interviewee(s).

General questions

For mapping

1. What is your part in the process?
   a. Input – instructions, information, tasks
   b. Activity – tasks
   c. Output – instructions, information, tasks
2. How are others affected by your work?
3. Does it always look the same?
4. Who is responsible for your part?
5. Do you have any defined instructions on actions?

For measurement

6. What is the most time consuming activity?
7. Do you have any direct costs related to the EoL-process?
8. Do you see any result of the process, is there any evaluation?

For problem identification

9. Does anything work less well with the EoL-process?
   a. Who are affected negatively and why?
   b. Problems for you, for Axis, and for customers?
10. Do you believe that any tasks are non-value adding?

Questions for senior management

1. What are the main goals and targets for Axis?
2. What are the goals and targets for the EoL-process?
   a. Do they differ from situation to situation?
3. Who is responsible for the process?
4. Is there any evaluation of the process?

Appendix 2

Twelve different removal strategies identified in previous research.

	Harness et al. 2006	Mitchell et al. 1997	Kotler 1965	McSurely et al. 1973	Avlonitis et al. 2000	Avlonitis 1983	Harness & Mackay 1997
Drop immediately Cease production, production line and remaining stocks are "scrapped".	X	X		X	X	X	X
Run out (1) Cease production of new units, sell existing units to exhaust all stocks.	X			X			X
Run out (2) Attempts to runout sales on a minimum cost basis while ignoring any growth potential of the product line. The costs of producing and selling the products are dramatically reduced and when sales reach the breakeven point, the product line is discontinued.				X			
Phase out immediately Cease production when able (complete contracts, use raw materials, sell existing stocks).	X	X			X	X	X
Phase out slowly Specific changes in the product's marketing strategy are imposed (e.g. reduction in marketing, promotion, product formulation change, price changes) which capitalize upon the remaining strength of the product and any hard-core customer support.					X	X	
Drop from standard range reintroduce as a special Cease production, but retain ability to produce "specials" for a premium price when requested by customers.	X					X	X
Sell out The rights to produce a product or the production processes are sold.	X			X		X	X

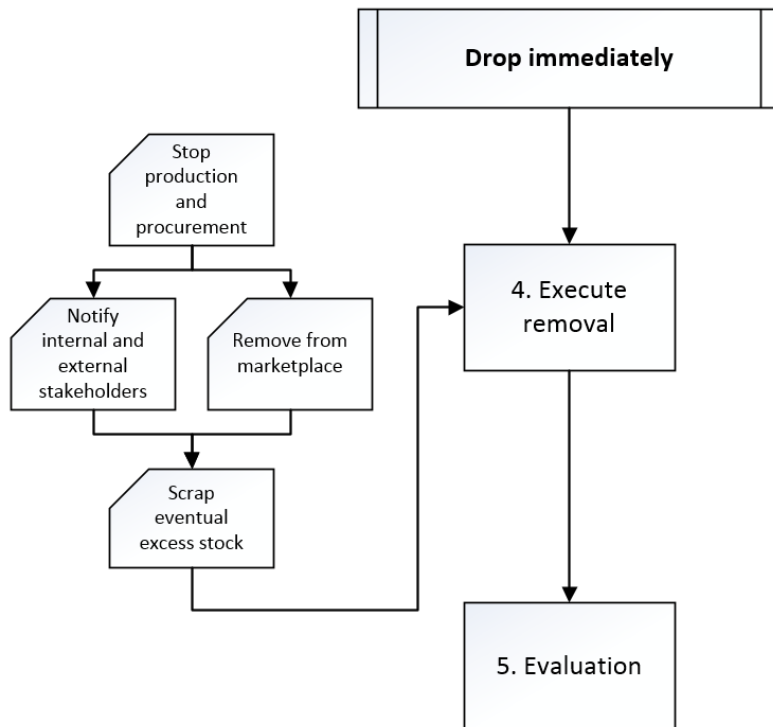|							
Launch new product simultaneously to eliminating existing offering Cease sale of product to enable new substitute product to be sold, scrap existing product units.	X						
Slow harvesting Sharply reduce long-term investment in plant, equipment, and R&D, but only gradually reduce operating expenditures such as marketing or service.		X					
Fast harvesting Sharp reductions in operating expenses (and possibly price increases) to maximize short-term cash flow, while minimizing the possibility that any additional money be invested in the business.		X					
Milking The company carries the product at a greatly reduced level of promotion and cost, hoping to salvage what it can. Milking amounts to phasing out very slowly.			X		X		
Make product a closed issue Product is withdrawn from new customers, existing customers are unaffected (used in the financial service)							X

Appendix 3

A sequential flow diagram for the implementation of the product elimination decision (Avlonitis, 1983).
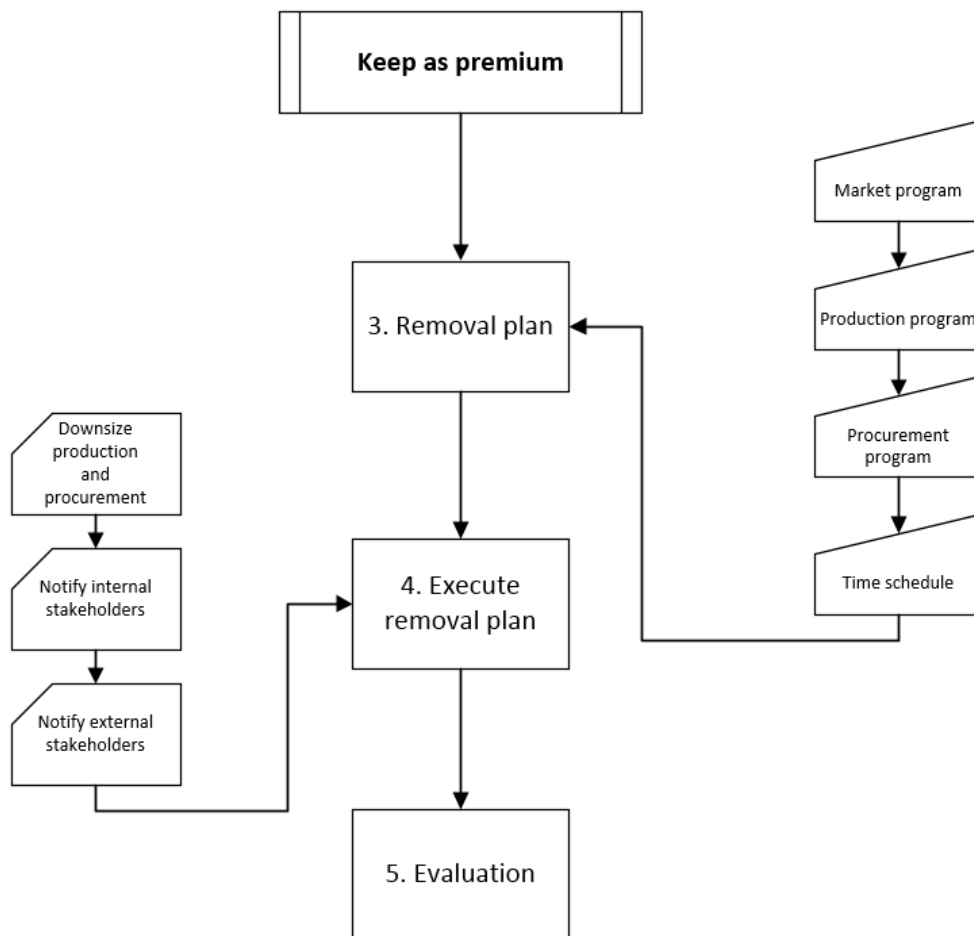
MANAGEMENT DECIDES TO ELIMINATE A PRODUCT

DETERMINATION OF THE MARKETING PROGRAMME UP TO ELIMINATION DATE

MARKETING ESTIMATES: 1) THE SALES PATTERN UP TO ELIMINATION DATE, 2) THE FUTURE SPARE REQUIREMENTS

INVENTORY AND CAPITAL PLANT FACILITIES AUDIT

CHIEF PRODUCTION ENGINEER AND CHIEF TOOLING ENGINEER PROVIDE DETAILS ON THE EQUIPMENT INVOLVED IN THE PRODUCTION OF THE PRODUCT

STOCK CONTROL AND PRODUCTION CHECK THE FINISHED STOCK AND W.I.P.

STANDARDS DRAUGHTSMAN COMPILES A PRODUCT BREAK-DOWN (MATERIALS, COMPONENTS ETC)

STOCK CONTROLLER PROVIDES DETAILS ON VALUE, QUANTITY OF THE STOCKHOLDING OF EACH PART

IS THE CURRENT LEVEL WHAT IS NECESSARY TO FULFIL THE MARKETING PROGRAMME?   YES / NO

IS THE CURRENT MATERIALS AND COMPONENTS STOCK LEVEL WHAT IS NECESSARY TO FULFIL THE MARKETING PROGRAMME?   YES / NO

STOP PRODUCTION IMMEDIATELY

BUILD THE FINAL BATCH TO FULFIL THE MARKETING PROGRAMME

ESTIMATE SURPLUS STOCK & KEEP FOR REPLACEMENT PARTS

STOP PURCHASING MATERIALS AND COMPONENTS

PURCHASE ADDITIONAL MATERIALS & COMPONENTS REQUIRED TO FULFIL MKTG PROGRAMME

PRODUCTION DEPARTMENT

MATERIAL PROCUREMENT DEPARTMENT

MATERIAL PROCUREMENT AND PRODUCTION CONTROL MANAGERS ESTIMATE THE TIME TO BUILD THE FINAL BATCH

MANAGEMENT AGREES ON THE ELIMINATION (WITHDRAWAL) DATE

FINAL BUILD COMPLETE, SPARES IN STOCK

IS THERE AN ADEQUATE SUBSTITUTE FOR THE PRODUCT?   YES / NO

IS THE REPLACEMENT PRODUCT READY FOR INTRODUCTION?   YES / NO

IS THERE ANY RESIDUAL DEMAND THAT NEEDS TO BE ACCOMODATED?   YES / NO

POSTPONE ELIMINATION AND ADJUST THE MARKETING PROGRAMME / BUILD AN EXTRA BATCH

NOTIFY MATERIAL PROCUREMENT AND PRODUCTION DEPARTMENTS OF NEW PLAN

EXTRA BUILD COMPLETE

PRODUCT TO BE WITHDRAWN FROM PRODUCTION

MANAGEMENT CIRCULARIZE SALES FORCE / DISTRIBUTORS / CUSTOMERS AS APPROPRIATE WITH THE DECISIONS REACHED

THE SPARES POLICY IS IN EFFECT

THE CUSTOMERS' ORDERS ARE PHASED OUT

PRODUCT DATA & FACILITIES ARE WITHDRAWN / DISPOSED OF

STOCK CONTROLLER ENSURES THAT THE PARTS REQUIRED UNDER THE SPARES PROGRAMME ARE MAINTAINED AND THOSE NOT REQUIRED ARE DISPOSED OF

STANDARDS DRAUGHTSMAN COMPILES A LIST OF PARTS TO BE OFFERED AS SPARES AND THOSE TO BE SCRAPPED

STANDARDS DRAUGHTSMAN WITHDRAWS ALL DRAWINGS, TIME STUDY RECORDS AND INVENTORY CARDS RELATED TO THE PRODUCT AND ITS COMPONENTS

CHIEF PRODUCTION ENGINEER, CHIEF TOOLING ENGINEER, QUALITY CONTROL MANAGER DISPOSE OF THE MANUFACTURING TOOLING & QUALITY CONTROL FACILITIES

THE PRODUCT'S BURIAL IS COMPLETED

Appendix 4

Step 4-5 for the strategy: "drop immediately".

Appendix 5
Step 3-5 for the strategy: "keep as premium".

Appendix 6

List of interviews conducted at Axis Communications in the fall of 2015.

Interview	Title	Date
Focus group 1	Product manager, Order specialist, Sales & Operations planner (Demand planning), Distribution Account Manager (Northern Europe), Capacity planner,	November 3, 2015
Interview 1	Product analyst	November 5, 2015
Interview 2	Order manager & Order specialist	November 5, 2015
Interview 3	Purchaser 1	November 6, 2015
Interview 4	Process development engineer	November 6, 2015
Interview 5	Director of Product Management	November 10, 2015
Interview 6	Operations development manager	November 11, 2015
Interview 7	Vice President of Operations	November 11, 2015
Interview 8	Capacity Planner	November 12, 2015
Interview 9	Purchaser 2	November 12, 2015
Interview 10	Key Account Manager 1 (Northern Europe)	November 13, 2015
Interview 11	Distribution Account Manager (Northern Europe)	November 16, 2015
Interview 12	Key Account Manager 2 (Northern Europe)	November 16, 2015
Interview 13	Sales & Operations planner	November 26, 2015
Focus group 2	Operations development manager, Operations trainee, Demand & project manager, Supply manager, Capacity planner,	November 27, 2015

Appendix 7

Frequency of appearance of problem statements in interviews.

Problem statement	Product Management	Demand Planning	Supply	Order	Sales	Senior Management	Focus Group
A.	X	X	X			X	X
D.		X			X		X
E.			X		X		
F.	X	X	X			X	X
G.		X	X		X	X	X
I.	X		X	X	X	X	
H.			X			X	
J.		X	X				X
K.		X	X				
B.			X	X		X	X
L.			X		X		
M.		X			X		
N.		X					
O.		X	X			X	
P.		X	X				
C.			X				
Q.			X			X	
R.		X			X		
S.				X		X	

Appendix 8

The priority list of the problem statements.

Problem statement	Frequency of appearance	Possibility of improvement	Connection to literature	Sum (L=1, M=2, H=3)
A. Poor communication between Operations and Sales	H	H	H	9
D. No clear instruction on actions to be taken within Sales when removing products	M	H	H	8
E. The distribution of the EoL-statement is not working well	L	H	H	7
F. The launch of the replacement product is delayed	H	L	H	7
G. No one is responsible for the process	H	L	H	7
I. Confusion and uncertainty about the goals	H	L	H	7
H. There are no measurements for the removal of a product	L	M	H	6
J. Confusion and uncertainty about decision making	M	M	M	6
K. No differentiation in removal strategy based on product characteristics	L	M	H	6
B. Inconsistency towards customers	M	M	L	5
L. Products are sold after LTB	L	M	M	5
M. Customers can't/won't switch to successor products	L	M	M	5
N. There is hidden holdover demand in projects	L	H	L	5
O. Product removal affects demand	M	L	L	4
P. Not possible to measure total costs for individual products	L	M	L	4
C. Poor communication between projects for NPD and Supply	L	M	L	4
Q. Deadlines towards customers are not followed	L	M	L	4
R. Sales' IT-system doesn't support or facilitate tasks required in removal scenarios	L	M	L	4
S. Orders are incorrectly accepted	L	L	L	3