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# Bachelor Thesis

**Title:** **Discontinuation of the Airbus A380 product line – a multi-level perspective on governance actors in Germany**


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## Abstract

This bachelor thesis examines the purposeful discontinuation of the Airbus A380 product line by conducting an exploratory case study analysis based on the multi-level perspective (MLP) approach by Geels and Schot (2007). Key governance actors involved in the discontinuation process as well as different phases of discontinuation are identified and studied. Also, the research touches upon the circumstances that led to the decision to stop the A380 product line as well as it sheds light on the consequences arising from the discontinuation. The bachelor thesis concludes with a new-developed pathway model that exemplifies the gradual fade-out of a socio-technical system.

**List of Abbreviations**

AfD: Alternative für Deutschland (Alternative for Germany, a right-wing political party in Germany)
BMWi: Bundesministerium für Wirtschaft und Energie (also referred to as: Federal Ministry for Economic Affairs and Energy)
EU: European Union
FDP: Freie Demokratische Partei (Free Democratic Party, a classical liberal party in Germany)
GZBV: Gesellschaft zur Beteiligungsverwaltung mbH & Co. KG
SCOT: Social Construction of Technology
WTO: World Trade Organization

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# 1. Introduction

Discontinuation means ‘the end of making, providing, or selling a particular service or product’ (Discontinuation, 2014). Discontinuation can take place in many diverse situations and has various effects on the society, as well as on governments and the economy. In contrast to technological innovation which seems to be subject to a lot of different researches in various disciplines, the discontinuation of systems appears to be an underexposed part in current political science research and existing literature. Although this research gap was noticed by a few researchers in the last years (Schulte, 2015), the topic still is underexplored as many aspects and issues have not been connected or even analyzed yet. This bachelor thesis aims at providing a better understanding of the purposeful discontinuation of technology in a socio-technical system, the Airbus A380. With an exploratory case study analysis based on the multi-level perspective (MLP) approach (Geels & Schot, 2007), not only issues of discontinuation are examined, but also key actors of the process.

In February 2019, the European corporation Airbus decided to stop the A380 product line by 2021. Various media reported on this significant change for the global aerospace industry. As a European corporation with its headquarters in Toulouse and other offices mainly in Germany, Spain and the UK, it becomes clear that this decision not only affects the finances and employees of Airbus itself, but also has an impact on the mentioned Member States of the European Union and the European economy. European Member States invested into and have shares in the business organization Airbus (Airbus I, 2019). According to several online articles, Airbus is not willing to pay back the received state loan as the repayment is connected to a successful delivery of the A380 aircraft. Furthermore, the A380 project as a whole is seen as a failure, according to BBC News (Thomas, 2019). This is why a lot of the articles raise the question if European tax payers of the countries that provided subsidies, have to pay the expenses. Although this exact situation still is in negotiation and remains unclear, the process of discontinuation is presented in a new dimension: the discontinuation process of the A380 product line can be seen as a pseudo gradual (fade-out) termination of the aircraft. The discontinuation process of the A380 product line is found to be in-between the immediate stop and the normal product life cycle gradual stop. The research paper elaborates a new model with the help of varied and adjusted theoretical approaches and methods.

## 1.1. State of Research and Contribution of Study

Connecting the underexposed subject of purposeful discontinuation of technology in a socio-technical system with the case of the termination of the Airbus A380 product line, this bachelor thesis examines how the stop of the Airbus A380 product line is dealt with in Germany and what role the German public policy has in this discontinuation process. There are different views on this process, as well as diverse actors involved. A new value added to the understanding of the purposeful discontinuation process is the identification of the different actors involved. The thesis

thus provides a multi-level perspective on the termination of A380 in order to better understand the purposeful discontinuation process of this socio-technical system. Also, the bachelor thesis is targeted at learning more about strategies, processes, actors, issues and power plays in the area of the discontinuation of the A380 product line.

Therefore, the research specifically is focused on the following question:

*How are the key actors in Germany dealing with the stop of the Airbus A380 product line in the context of the German public policy role in the process of discontinuation?*[1]

The meaning of discontinuation in the context of socio-technical termination in aerospace is developed by applying existing scientific literature in order to provide a constructivist analytical approach on the discontinuation of technology for socio-technical systems. Existing theoretical approaches are used as heuristics for discontinuation processes and issues. Moreover, they provide a sound understanding of the approach of MLP. This paper understands heuristics as a method of problem solving while the actual solution strategy is not clear and unknown. On the basis of subjective experience statements can be made in a short period of time while having incomplete information (Michalkiewicz, 2015).

## 1.2. Outline of Thesis

As mentioned before, discontinuation in the context of technology still is an underexposed part in current political science research and existing literature. Yet, in the last years, there has been an increasing number of studies about discontinuation of technology, such as the discontinuation of the incandescent light bulb (ILB) in the EU (Schulte, 2015) or the discontinuation of ICE transport in the Netherlands (Swarts, 2016). Looking at a European project that does not include an aspect of innovation, such as the ILB does, still appears to show new, unexplored issues of the governance of discontinuation in a socio-technical system.

According to Geels (2013), new policy research often is confronted with *Grand Challenges*, such as environment, climate and transportation. This is why recent literature often combines these challenges in terms of discontinuation research. Johnstone and Sterling (2015), for example, combine the issues of environment and climate. By doing research on nuclear power in Germany and the UK, the authors describe nine criteria that are considered to analyze the transition of the socio-technical system of nuclear power. The research of transition can be seen as one part of discontinuation. Another example of the combination of two of the challenges, is the research by Hoffmann et al. (Hoffmann, et al., 2017) that refers to transportation and climate. The authors examine the automobility regime referring to three major theoretical approaches: “multi-level perspective (MLP), multi-level governance (MLG) and MLG of socio-technical

[1] Sub-questions are developed and explained in the third chapter.

regimes“ (Hoffmann, et al., 2017, abstract). The study focuses on the restriction of a socio-technical system which does not mean final termination. In short: restriction and transition seem to predominate the current state of research. Transition assumes that an existing socio-technical system is being terminated while a new one already is in the process of being implemented. Restriction means that an existing socio-technical system is being constrained while it actually still does exist. Looking at the case of the A380 product line discontinuation, it becomes clear that neither restriction, nor transition are suitable categories for this research. Although the relevant case combines several *Grand Challenges* (Geels, 2013), it cannot be explained by the above-mentioned terms or case studies. The A380 product line will run out in 2021 which means that until that year, Airbus still produces new aircraft. Also, existing aircraft remain in use and service for several years. Until now, it is not planned to replace this huge aircraft by another one. Therefore, one cannot talk about an immediate transition or restriction. The termination needs to be seen as a gradual termination because at first, the production is stopped and only later the maintenance service will be stopped. But still, it remains a purposeful termination.

As existing literature either focuses on discontinuation (Geels, 2004) or (technical) issues of aircrafts alone (Aranjo et al., 2012), the combination of both of the research subjects into a policy research provides new insights and knowledge in the governance of the purposeful discontinuation of technology. In 2006, for example, the production of the aircraft Airbus A300 was terminated because airlines, the customers of Airbus, ordered more current models with greater range. Nevertheless, studies about this or similar cases in the light of a discontinuation governance perspective are unknown as my scholarly research has shown. The case of the Airbus A380 seems to show a relevant and important topic in the context of socio-technical research. It is unclear what actors are involved, what kind of agreements or consultations there have been and who actually finally decided the termination of the A380 product line. Also, it is ambiguous what kind of influence the involved national governments had in this decision because of having shares in Airbus. Another issue that is aimed at being answered in this bachelor thesis is the question about state loans that need to be paid back by Airbus.

Considering existing literature with respect to the discontinuation of the A380 product line, one sees that there are helpful research projects. As a main basis, the research of Stegmaier et al. (2014) on policy termination provides helpful and important aspects. Also, other discontinuation literature, such as Turnheim and Geels (2012) who put emphasis on mere destabilization, provides other relevant views and points. The next chapter discusses the theoretical approaches in more detail. Further literature considering Airbus or the A380 in a scientific, socio-technical way does not exist. Most literature about the topic looks at economic or engineering issues. This is why this thesis contributes to providing an understanding as well as to broadening the literature about discontinuation of a socio-technical system.

The study is structured as follows: The introductory chapter leads to the theoretical framework (chapter two). This theoretical framework is used to examine and analyze the purposeful governance of technology discontinuation in a socio-technical system. The third chapter is about the research methodology including the research approach, the development of the sub-research questions and data including the data sampling process and data analysis. The case analysis and the conceptual analysis follow in chapters four and five. Within the case analysis, the bachelor thesis aims at evaluating and sorting of data, as well as developing a case structure based on the identified core aspects. In the conceptual analysis, the theoretical approaches are applied and adjusted according to the data. Chapter six concludes the bachelor thesis with a conclusion and discussion of the findings in which a broad conceptualization of the purposeful governance of technology discontinuation in the case of the termination of the Airbus A380 product line is given. Furthermore, at the end of chapter six the answers to the research-question as well as comments and remarks for further research are presented.

## 2. Theoretical Framework

In this chapter, a theoretical framework is developed in order to examine the governance of technical discontinuation. The framework is used as a basic heuristic that contributes to a better understanding of the general context as well as it is used to illustrate the case logic. As a result, the theoretical framework introduces a constructivist analytical approach on the discontinuation of technology starting with the discussion and adjustment of MLP and socio-technical change. Furthermore, essential scientific literature is discussed in order to close literature gaps. This is how the constructivist, heuristic approach enables a closer look at involved actors and at how the processes of decision-making were governed by these actors including a problem-oriented approach.

The relationship between technology and science has been studied and conceptualized from various disciplinary perspectives (Bijker, et al., 1989). According to social constructivism, SCOT (Social Construction of Technology), which is one of multiple theories within social constructivism, assumes that every development in technology is a social process. As every technology is socially constructed by relevant social actors, every actor has a different understanding and expectation of a certain technology. This seems to be highly important because different interpretations lead to different outcomes, including differences within the meaning of success, failure or problems. Social constructivist conceptualization emphasizes the embeddedness of technology in a wider social and economic context (Rip & Kemp, 1998, p. 328) which, again, highlights the need of interpretation. The focus on technology being socially embedded often is described as the socio-technical system that is a heuristic that is applied in the research.

One approach to socio-technical change was introduced by Geels (2004). Within his multi-level framework there are three levels of transformation while each of them goes through four identified phases of socio-technical change. This phase model seems to provide a good basic thought on socio-technical change, but needs some variation for the analysis of the case study that this

thesis deals with. According to Geels (2004), the three levels of transformation are: landscape developments, socio-technical regime, and technological niches. The emergence of novelty in existing socio-technical niches builds up the first phase that is followed by the second phase, which is characterized by technical specialization within the niche and by exploring new functionalities in existing regimes. The third phase is shaped by the competition with established regimes. The fourth phase occurs when the established regimes are replaced. This is when Geels (2004) talks about a landscape transformation. The figure below gives an overview of the dynamics of the MLP of transitions (Geels, 2004):

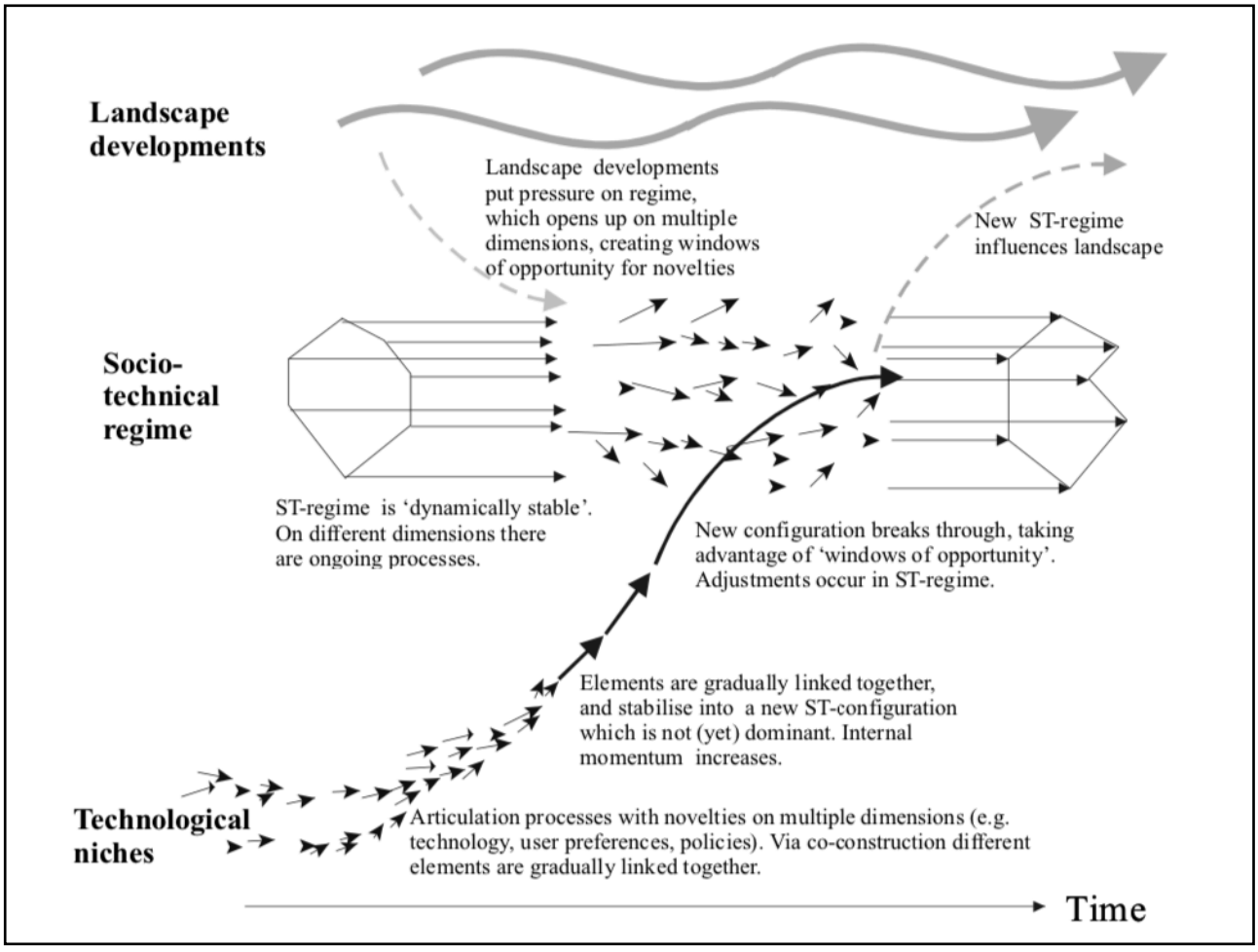


**Figure 1:** The multi-level dynamics of transition (Geels, 2004, p.38).

The approach of Geels (2004) is adopted in this bachelor thesis. One modification that needs to be made and discussed within this chapter is the division of the four phases of socio-technical change. Every phase and every level of transformation can be segmented into seven dimensions that were identified by Geels (2002). The seven dimensions are technology, user practices and application domains, symbolic meaning of technology, infrastructure, policy, and techno-scientific knowledge (Geels, 2002). All the dimensions are linked to each other and, therefore, have internal dynamics which could lead to tensions and pressure on regimes. As these dimensions are very general, they need to be interpreted as well as adjusted according to the case of the bachelor thesis. Geels (2002) continues by stating that the tensions and pressure can indicate uncertainty.

Before expanding on important theoretical approaches that are useful for the theoretical framework of this thesis, it is essential to determine a suitable heuristic for the term of 'discontinuation'. The socio-technical aspects are combined with the governance and public policy side of research in this paragraph. According to Stegmaier et al. (2014), the discontinuation of socio-technical systems is described as "*solving a governance problem which is the result of changed perception and formulation of a governance problem*" (Stegmaier et al., 2014, p. 115). The authors introduce the view of governance being seen as a process while solutions to problems within a socio-technical system often involve new problems. The integrated approach on socio-technical termination is examined not only as a problem, but also as a process of governance. As Stegmaier et al. (2014) refer to van de Graf and Hoppe (1996, pp.221-227), they explain the discontinuation of governance, aka policy termination. This means that termination is a result of "*changed formulation or perception of a policy (governance) problem or solution*" (Stegmaier, et al., 2014, p. 114). As this view is used as a basis, the researchers look at governance the other way around: governance of discontinuation (cf. fig. 2).

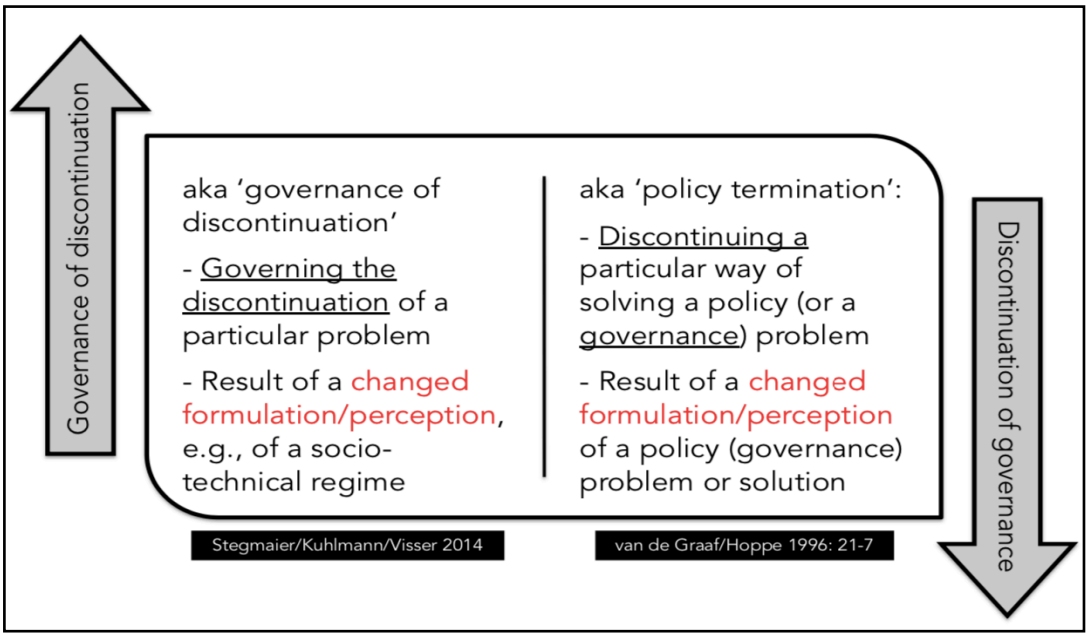


**Figure 2:** New theoretical perspectives: governance of discontinuation and discontinuation of governance (Stegmaier, 2017; Stegmaier, et al., 2014, p. 114).

When looking at the governance of discontinuation it seems advisable to not only look for politicians, but also to consider other actors because the context in socio-technical systems is much broader. Also, the "*combination of actions, structures, situations and circumstances*" (Stegmaier, et al., 2014, p. 115) needs to be considered in an adequate way. As most of the existing literature focused on discontinuation because of innovation and the establishment of new technologies, Stegmaier et al. (2014) apply a new aspect: they highlight the aspect of "*ending phenomena*" (ibid., p. 116) meting destabilization, deinstitutionalization, deconstruction, dismantling and termination within the socio-technical context. This is how the terms innovation and progress can get a totally different meaning. Accordingly, "*discontinuation*

*agents (…) have to manage the unbundling of forces and the dismantling of existing structures in order to overcome inertia of current systems and networks*“ (Stegmaier, et al., 2014, p. 123). While the approach does not place focus on a MLP on the governance of discontinuation, it is necessary to adjust this socio-technical concept according to the case study within this bachelor thesis. However, it provides good indications that can be considered as a useful heuristic.

There has not been shed a lot of light on the influence of discontinuation on a socio-technical regime in transition literature (Stegmaier, et al., 2012). Transformations seem to be related to technical substitution or progress only. Turnheim and Geels (2012) have contributed to closing this literature gap by introducing four strategies for the destabilization of existing regimes and industries. The authors focus on industries and show that within the process of destabilization the environment is a multi-actor environment that is exposed to external pressures. These external pressures are exerted by different actors who aim at influencing the process of destabilization.
The first strategy is the economic positioning strategy which means that the economic environment exerts pressure. The second strategy is the technology/innovation strategy which includes knowledge management , and product development alliances. The third strategy is the political strategy encompassing lobbying, legal proceedings and even organized pressure strategies. The last strategy is a strategy which Turnheim and Geels (2012) call the socio-cultural strategy. This strategy includes social debates, public opinion or advertising. The idea of the four different strategies is applied because it clearly shows the importance of the convergence of discontinuation as a multi-stakeholder issue. The strategies indicate that each of them can be assigned to a certain actor or level. Although the strategies need to be adapted according to their contents and their names, the approach of Turnheim and Geels (2012) seems to provide a good basic heuristic.

Furthermore, the phase model of destabilization (Turnheim & Geels, 2012) is used as a basic concept to reconstruct the destabilization process of the chosen bachelor thesis case. The phase-model consists of five stages. The first stage is named blindness and denial. Problems within the performance of an industry are denied and downplayed. The second stage is the state of incremental responses to problems which means that problems in performance are linked to external, clearer stated pressures. Industries identify the problems, but still remain defensive in their strategies. The third stage in the phase-model is the stage of increasing doubts and diversification. The external pressures increase even more and the industries cannot hide their problems any more because gaps in performance emerge. Existing regimes are doubted and actors begin to find solutions. The fourth stage, which is the stage of decline and destabilization that includes the shift from problems into crises and , can be divided into two sub-stages that focus in two different kind of changes that need to be made: the first sub-stage is reorientation. The focus is put on the development of new means in order to ensure viability. The second sub-stage is named re-creation which means that new hopes (industries’ core beliefs, values, mission) need to be created. The last stage is dissolution.

The last approach needed that needs to be looked at is by Geels and Schot (2007). By criticizing MLP, the authors developed a typology of transit pathways that focus on the correlation between the different levels MLP describes. Each pathway that is described by the authors, differs in time and nature of the interactions. The first pathway is the transformation pathway. The second one is the technological substitution pathway. The reconfiguration pathway is the third one. The last one, the pathway of de-alignment and re-alignment, is the pathway that is used to create a structure and comprehensive understanding of the case. However, this pathway needs to be altered accordingly, as it highlights some important characteristics of a termination process. Beginning with the levels of MLP, Geels and Schot (2007) determine that there is a high pressure exerted on the socio-technical regime on the landscape level. This is why some issues and problems in the regime-level might increase which then could lead to a degrading regime, which the authors refer to as de-alignment. Within the regime level, the technology dimension, which is one of seven identified dimensions by Geels (2002), reacts by terminating a socio-technical system. If there is no novelty in the niche-level that could replace the terminated technology, a so called “vacuum“ appears. However, the authors state that multiple innovations are developed in the niche-level and co-exist. One of these innovations might become prevalent and becomes re-aligned as well as re-institutionalized by being implemented in the regime-level. Through such a vacuum and novelty entering the regime, the socio-technical regime changes and, therefore, becomes a new one. This approach is needed and highly important for the study on the A380 product line termination as multiple dimensions seem to play important roles and interact with one another. Also, the approach shows that the actual process of discontinuation differs a lot through all identified MLP-levels and dimension.

Referring to the regime dimensions, it is important to study the structure of Airbus SE itself. Airbus Group SE is a European corporation and had the name EADS (European Aeronautic Defence and Space) until the end of 2013 when this name was changed into Airbus Group. In 2017, Airbus Group SE and its division Commercial Aircraft, which then was a S.A.S. (Société par Actions Simplifiée) - a subsidiary of Airbus SE in France- merged into the now well-known Airbus SE, which means Societas Europe and is a European public limited company. The divisions of the organization are (1) Commercial Aircraft, (2) Defence and Space, and (3) Helicopters. This organizational structure is important because the bachelor thesis focuses on the A380 aircraft, that is an important part of Commercial Aircraft (Airbus III, 2019). The bachelor thesis applies “Airbus“ or “Airbus SE“ when referring to the division of Commercial Aircraft.
The reason why the European countries Germany, France, and Spain have shares in Airbus is quite simple at first sight. Not only is Airbus important for the European economy, but is also regarded as a prestige company. Especially the production and development of the aircraft type A380, which is seen as a European prestige project, is a major reason for the state loan. Moreover, the European corporation includes an aspect of job security. In Europe, there are 105,256 employees working at Airbus (Airbus II, 2017). Strengthening the company, therefore, means making sure that all the employees have secure jobs. Also, European Member States try to strengthen the supplier industry behind the businesses of Airbus. Economically, there are several

companies and businesses connected to each other, and to Airbus. This highlights the alleged interest of European Member States in buying shares of Airbus.

As these approaches deal with the process tracing and aim at the identification of processes and reasons for technology discontinuation, it is an essential basis to develop the understanding of a problem-oriented approach. It is important to consider how the decision on the termination was made and who was involved in these complex processes. Furthermore, the theoretical approaches used as a basic heuristic help to analyze the collected data in order to have a specific perspective when looking at the data in detail.

## 3. Research Methodology

This chapter presents the research methodology to show how the governance of the purposeful discontinuation of technology is studied. Whereas the research approach is developed in the first section, the next one evolves the general research question and defines three sub-research questions that help to answer the general research question. Also, they are used in order to examine different angles and aspects that do not clearly follow from the general research question. In the third sub-part of this chapter the research design is developed, which includes the explanation of the data sampling process and the data analysis process. The last section clarifies possible and existing limitations of the research in the scope of the bachelor thesis.

### 3.1. Research Approach

It is the goal of the thesis to provide an improved understanding of the purposeful discontinuation of technology by combining the approaches of governance of discontinuation and socio-technical systems into a constructivist analytical approach on the discontinuation of technology. With the application of the specific case-study of the Airbus A380 termination, it is possible to improve the understanding of the purposeful discontinuation in a socio-technical system for social sciences. Furthermore, the case-study sheds light on an undiscovered area of policy research from a discontinuation governance perspective and, therefore, contributes to gathering new data and results.

The case-study applies a theoretical heuristic groundwork for determining empirical findings in a qualitative empirical research. Based on the assumption that the nature of reality is socially constructed, but also that technology is a social construct (Rip & Kemp, 1998) this social constructivist view indicates an inductive process in qualitative research which proceeds from a specific case to the general. Inductive research is not based on given theories or approaches, but aims at developing a new theory. However, this bachelor thesis has the goal of interpreting the collected data in order to be able to combine “features for which there is no appropriate explanation or rule in the store of knowledge that already exists“ (Reichertz, 2007, p. 219). This leads to the next sub-part of this chapter that presents the logic of *abduction* according to Reichertz (2007) as well as it provides necessary and basic insights into the approach of

grounded theory (GT). The combination of the approaches is applied to this bachelor thesis as a qualitative method in order to best answer the research question.

The logic of *abduction*, according to Reichertz (2007), is referred to as a term next to induction and deduction. Abduction seeks for a meaningful rule on the basis of surprising factors. The goal of abduction is to build a hypothesis. With his paper *Abduction: the logic of discovery of Grounded Theory* (Reichertz, 2007), Reichertz examines if GT actually is abductive. This is why the next sub-part of this chapter deals with the approach of GT followed by an explanation of the importance and application of abduction.

### 3.1.1. Grounded Theory

The Grounded Theory approach is a method used in qualitative research. The application of an inductive research process indicates the experience and observation of phenomena that can be explained by theories that were constructed by the data itself. Simply put: grounded theory means developing a new theory that is based on data or observation. For this bachelor thesis this implies to reconstruct the discontinuing governance process of the Airbus A380. Corbin and Strauss (1990) mention three major constructs: category, coding, and saturation. Categories are here seen as groups of certain circumstances that coordinate with each other because they have similar characteristics. The interpretation of the categories does not only remain descriptive, but also needs to be analytical. Another construct is coding. Categories are integrated into units because they are interconnected. Finally, the last construct is theoretical saturation. Saturation is seen as the final aim of data collection and analysis. Both strive for saturation of the units or categories in terms of sampling until there cannot be found any further new category. When new data does not provide new knowledge or information, saturation is achieved. However, it is necessary to keep in mind some predetermined aspects, such as the research questions that are further developed in the next sub-chapter.

### 3.1.2. Abduction

The term of abduction was introduced by Peirce. According to him, the success of the logic and application of abduction lies within two factors: indefiniteness and misjudgment of the benefits of abduction that are dependent on the indefiniteness. The intention of abduction is to discover new aspects and issues by applying a logical and methodological orders method (Reichertz, 2007). According to Reichertz (2007), collecting data means evaluating [-] and trying “to typologize them according to particular features and orders of features“ (Reichertz, 2007, p. 218). In order to do so, Reichertz (2007) proposes three procedures of analysis. The first procedure is called *subsumption*. It is a deductive type of procedure which means that it proceeds from the general rule to the specific case. The application of the general known rule implies that there are no new findings. The second procedure is called *generalization*. This procedure is quantitatively inductive, i.e. it proceeds from a certain case to the general. The rule is based on a single case. The third

and most important procedure of analysis is *abduction*. According to Reichertz “assembling or discovering, on the basis of an interpretation of collected data, such combinations of features for which there is no appropriate explanation or rule in the store of knowledge that already exists“ (Reichertz, 2007, p. 219), generates the last procedure of analysis. It proceeds from the result to the rule and case. This creative way of analysis discovers new relationships and interconnections (ibid.). A substantial aspect is looking at GT based on the occurrence of new codes. Reicherts also states that research needs to be designed in a way which makes it possible to advance new hypotheses while new codes and categories can be developed. Coming to a conclusion, one can see that GT does apply the logic of abduction. This approach functions as an important and basic guideline for the empirical case-study at hand. Applying the methods and procedures described in this chapter, helps to develop an explanatory framework as well as it supports the aim of conducting an explorative research in order to analyze the process of discontinuation of governance of technology. The following sub-chapter deals with the predetermined research questions.

## 3.2. Research Questions

The bachelor thesis focuses on the analysis of the governance of the purposeful discontinuation of the Airbus A380 product line. Connecting and applying the approaches of GT, abduction and MLP to this particular case of discontinuation, the research questions could be predefined. The main research question, therefore, is:

*How are key actors in Germany dealing with the stop of the Airbus A380 product line in the context of the German public policy role in the process of discontinuation?*

Looking at the key players helps to reconstruct the decision-making of the discontinuation process. The actors are responsible for the decision to stop the A380 product line and hence, play an important role.

This main research question is subdivided into three further sub-research questions that have a descriptive character as this is the result of the application of an exploratory analysis:

1.) *Under which circumstances was the decision made to stop the A380 product line?*
2.) *Who are the main actors involved?*
3.) *What consequences arose from the discontinuation?.*

Putting these three sub-questions in correlation to each other, one can say that the key players were incited to act due to the change of non-influential circumstances. These actions, that need to be considered as the decision to stop the A380 product line, entail consequences for the different actors.

### 3.3. Research Design

The qualitative empirical research focuses on the analysis of the discontinuation governance of the Airbus A380 and “is applied to discover and describe issues in the field or structures and processes in routines and practices“ (Flick, 2013, p. 5). As can be seen in the main research question, the research paper aims at reconstructing the discontinuation process of the A380 product line. A documentary analysis functions as the unit of analysis because it looks at the documents that are publicly available. These documents mainly are online articles of quality newspapers as well as official state (governmental) documents and published documents by Airbus SE. Early general research in the form of looking and collecting new articles and regularly looking for new governmental updates on government websites helped to find useful documents as well as it helped to identify possible relevant actors that were contacted in order to conduct expert interviews. The collected documents were further used to examine and analyze how the relevant actors governed and framed the discontinuation of the Airbus A380 product line. This is also how the criteria for the relevant actors were established and revised during the process of the actual research. In a further step, the relevant actors were contacted with the request for an interview providing essential and valuable information for this bachelor thesis.

Next, an overview of the data sampling process is given. It consists of the description of the data and the conducted expert interviews. The second sub-part describes the data analysis, which is an explanation of the interpretation and coding process of the data.

#### 3.3.1. Data Sampling Process

Beginning with the publicly available data, it can be said that a lot of online magazines and newspapers write about the discontinuation of the Airbus A380 product line. Relevant articles are from quality newspapers and magazines, but also were collected from online journals. Reliability was given because the contents on a specific subject stayed the same. So, the information given were often confirmed by other articles. Also, most of the times, the authors were mentioned. Most of the authors were qualified journalists and experts dealing with the aviation industry. Furthermore, some governmental documents also are publicly available, either on governmental websites or the website of Airbus, that is one of the main actors in this bachelor thesis. Also, documents like financial reports or official press releases were identified as valuable. In addition, three interviews were conducted to check the validity of the other data, helping to analyze the discontinuation process on a personal and internal level.

As the Airbus A380 issue underlies ongoing processes and consultations, there will be articles that cannot be considered in this bachelor thesis. This is why the data are limited to 19/06/2019. Three interviews in the form of non-standardized interviews were conducted via Skype and telephone calls in order to gain multi-perspectival as well as detailed insight information. The information are necessary as the availability of specific useful data is limited.

The first interview was conducted by talking to a representative of the Federal Ministry for Economic Affairs and Energy (BMWi). It was very challenging to get a positive feedback and confirmation for an interview. As the articles and government documents reveal, Airbus received a state subsidy from the German government about 943 million Euros. A lot of the used data state that Airbus does not want to pay back remaining subsidies due to the stop of the A380 production. The interview with the BMWi gave an insight in how the German government and Airbus interact with each other. The second interviewee is a manager of the Lufthansa Group. He is a representative of the biggest German airline. Lufthansa owns 14 Airbus A380 aircraft and is, therefore, the most relevant customer for Airbus in Germany and Europe. Not only does the interview provide an insight from this Airbus-customer view and relation, but also offers valuable information about what the termination of the Airbus A380 product line means for the identified actors and levels. The third and last interview is a representative of Airbus itself. With this interview, insights in the company and the decision making process were provided. All interviews were recorded and transcribed in order to have a written document that can be better used for the analysis using ATLAS.ti, that is described in the next paragraph.

### 3.3.2. Data Analysis and Limitations

In order to analyze the found and gathered qualitative data, the software ATLAS.ti was used. It enabled to structure the data using and creating codes that helped to find correlations and connections in different documents. This is also how the data was conceptualized in order to be able to improve and further develop an appropriate heuristic for understanding the termination of the Airbus A380 product line. Moreover, the inductive style of coding with ATLAS.ti helped to divide the data in schemes so that new insights became visible. With the tools of ATLAS.ti it was possible to analyze the collected data with high efficiency, accuracy and performance systematically. While selecting documents and quotations, codes were developed that were improved by multiple rounds of coding. These codes then were analyzed in more detail which led to establishing three categories. The exact meaning of the codes and categories as well as the interpretation of them follows in chapters four and five.
Despite several analytical categories being outlined, the mechanisms working on the purposeful discontinuation of technology in the case of the termination of the Airbus A380 product line can only be touched on its surface. This is why this research offers a broad overview of the topic. Secondly, the topic of the Airbus A380 termination is a very recent case. Therefore, publicly available useful data is very limited.

## 4. Case Analysis

The following chapter presents the first part of the analysis: the case analysis. According to Eisenhardt (1989), a case analysis is “a research strategy which focuses on understanding the dynamics present within single settings“ (Eisenhardt, 1989, p. 534). Therefore, this part of the analysis aims at describing the case by identifying and determining the relevant main actors and

the correlations between those factors. By evaluating the data, the case structure becomes clear. A detailed explanation of the case analysis will be given in this fourth chapter. The analyzed structure functions as a basis for the conceptual analysis following in chapter five. Chapter five is based on the case analysis because it uses the identified structure in order to be able to apply the discussed theoretical approaches with variations and changes to develop an own theoretical idea about the discontinuation of a socio-technical system.

In the beginning, all data were uploaded to ATLAS.ti. Thematically collating the data helped to find out the main focuses and aspects of the case. As a guideline, the first initial codes were created in order to capture the key massages within each document and then create the initial categories which are groups of certain circumstances that fit together because they have similar characteristics. Already during the process of coding, some codes have been combined as ATLAS.ti allows to connect codes by providing a set of given correlations, e.g. describing a correlation between two codes as “is part of“, “is a“ or “contradicts“. This is how the final categories and codes were found and developed. By axial coding, the relationships between the main identified codes were added. This led to the network map shown below, that includes three categories that will be analyzed in more detail within this chapter.

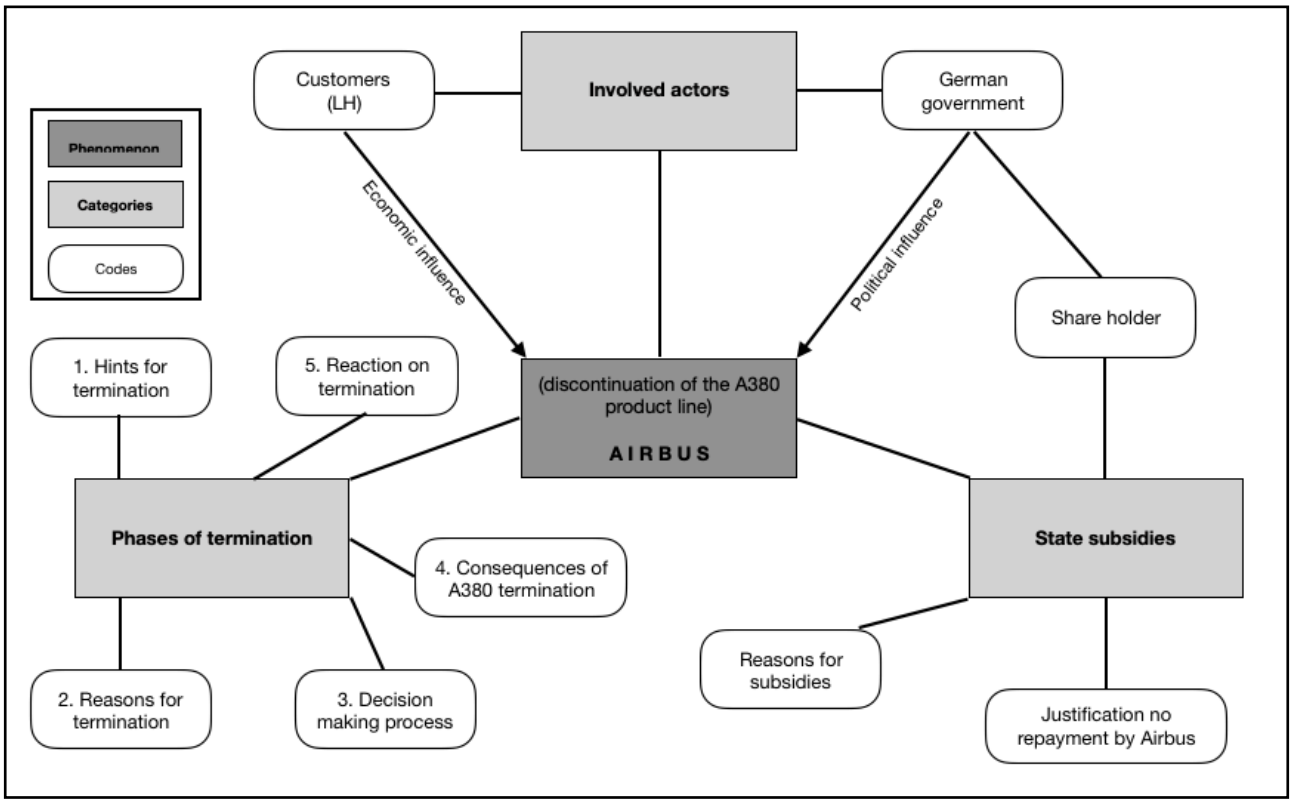


**Figure 3:** main identified final categories and codes in the context of the discontinuation of the Airbus A380 product line (© Kesore, 2019).

The object of research is the discontinuation of the A380 product line of Airbus. Hence, the phenomenon is the center of the model. Having analyzed the data in detail, ten of the applied 65 codes could be identified as the most relevant ones. As the model illustrates, the rectangular

boxes in light grey are the three categories that were detected during the coding process of GT. All the categories are indirectly connected to each other as they are linked to the phenomenon directly. Referring to the main research-question as well as to the second sub-research question, the category “involved actors“ plays a major role within this research. The codes connected to this category are “Customers“ and “German government“. What is special about these two codes is that both of them are connected directly to the phenomenon because on the one hand, the customers exert an economic influence on Airbus, and, on the other hand, the German government exerts political influence on Airbus. As Airbus’ customers are airlines that order and buy the aircraft produced by Airbus, Airbus is dependent on them. Therefore, they are in the position to pressurize Airbus into taking a specific action. As the research focuses on the German national level, the customer Deutsche Lufthansa AG (referred to as Lufthansa throughout the paper) was chosen. However, another and even more important reason is that Lufthansa is the third largest customer in terms of ownership of A380 aircraft. The German government, on the other hand, influences Airbus politically. The correlation is strengthened by another code that belongs to the category of “state subsidies“. The German government holds a 11.07 % percent share in the company Airbus. Moreover, the German government granted a state subsidy for the A380 program to Airbus, just like the French, the British and the Spanish governments (BT-Drucks. 19/8665). The reasons for these subsidies build another code in the category state subsidies. Due to the fact that the repayment of the subsidies is connected to the deliveries of the aircraft, Airbus does not see an obligation to repay the state loan as the program is stopped. However, the German government sees this differently: the German government started discussions and negotiations about the issue of the state loan. Thus, the code “justification no repayment by Airbus“ was integrated into the network map. The third category is termed “phases of termination“ and includes five significant codes. It was established by focusing on the temporal classification of the discontinuation process. The codes can be arranged in a chronological numerical order. The first phase of termination is identified as “hints for termination“, which is followed by “reasons for termination“ and “decision making process“. The latter highlights the actual decision made by Airbus, to terminate the A380 product line. This phase (and code) is chronologically followed by the “consequences of A380 termination“ and, finally, by the code of “reaction on termination“. The following section describes and interprets the meaning of the codes and categories in more detail, referring to the discontinuation process of the A380 including its case structure.

Starting with the category of “involved actors“, it needs to be said that the category initially was a code, used as a category that included nine other codes in ATLAS.ti. All identified actors either had an impact on the actual decision of the termination, or showed a reaction on the termination decision. This is why the category is directly connected to the phenomenon “discontinuation of the Airbus A380 product line“. Applying the basic heuristic of MLP, one can see that the involved actors appear on different levels or dimensions in the process of discontinuation. One of the identified key players is the German government. It is seen as a highly relevant actor not only because it has a 11.07% share in Airbus SE through the Gesellschaft zur Beteiligungsverwaltung

mbH & Co. KG (GZBV) (Airbus IV, 2017, p. 108), but also because it shows the interconnectivity between the categories “involved actors“ and “state subsidies“. Furthermore, the code can be seen as a sub-category as several actors within the German government can be identified: BMWi (institutional role), AfD (party), FDP (party), DIE LINKE (party). Their role is analyzed in chapter five. However, with reference to Turnheim and Geels (2012), a special feature was examined: the economic and political influence. According to Turnheim and Geels (2012), there are strategies that have an impact on the destabilization of existing regimes. In the case of the A380, there is not necessarily a strategy exerted to evoke a discontinuation, but most definitely there is an influence of political nature connected to the actor German government. The second significant actor is the airline customer Lufthansa. As the main European customer of Airbus, the consideration of Lufthansa’s view provides valuable insights into several stages of the discontinuation decision-making process. In its annual report of 2004, Airbus states that “to ensure the aircraft met the needs of its market, the A380 was designed in close cooperation with major airlines, airports and airworthiness authorities“ (EADS, 2004, p. 77). This shows how close the customers and Airbus really are. The customers are not only customers, they also have an advisory role, to some extent. Although the research focuses on important actors within Germany, attention needs to be paid to Emirates who is another highly relevant and important actor in the process of the A380 production stop. Thus, major customers of Airbus have an economic effect on the discontinuation process because if there is no demand for the A380, why should it be produced? Again, the economic influence mirrors the close interaction processes between Airbus and its customers.

The second main category to be analyzed in the discontinuation process is “state subsidies“. The relevance of the state loan became clear during the process of data collection. Financial aspects play a central role within the discontinuation of the A380. Although the term “state subsidies“ was applied to the data as a code, it turned out to function as a category as it best describes some further codes that have an essential meaning for the research. In 2002, Airbus SE requested state support in terms of financial aid for the A380 program (Airliners, 2019). The German government allowed a state loan of 943 million Euros (BT-Drucks. 19/9481) which, again, underlines the interdependence of Airbus and the German government. The category was built upon three codes: “shareholders“, “reasons for subsidies“, and “justification no repayment by Airbus“. The issue of governments having shares in Airbus SE is highly discussed in all German (online) newspapers and magazines. Also, the German party actors (AfD, FDP, Die Linke) have interest in getting to know details and results about the not yet repaid state loans. The parties posed brief inquiries (coded as “request German parties“) to the BMWi asking about risks for the federal budget arising from the A380 program termination (see BT-Drucks. 19/10438, BT-Drucks. 19/8665). As a matter of fact Airbus SE received state support in financial terms, however, it seems unclear why these loans were actually granted. This is why the code “Reasons for subsidies“ was created. These reasons are expressed reasons and cannot be seen as objective ones. On the one hand, the reasons are closely connected to the idea of creating a strong European company that is competitive to the world leader US aircraft manufacturer Boeing. In the view of Airbus SE, the non-support of the German government would have led to a competitive

disadvantage (BT-Drucks. 19/9481). So, a strong and competitive European company is directly associated with a successful European Union. On the other hand, the idea of a strong Europe offering many people an employment is another important motive for granting the subsidy. The A380 became the flagship for European, and, therefore, German technological and economic strength and power (Airbus IV, 2017). In short: without the state loan, Airbus would not have been as competitive to the US competitor Boeing as it is now. An article by the Frankfurter Allgemeine Zeitung summarizes the reasons as follows: without public funding, meaning state loan, the American monopole could not have been broken[2] (Schubert, 2019). As regards the repayment of the state loan, it is linked to the successful delivery of the aircraft A380. However, as it was now decided to stop the product line, there will not be sufficient further deliveries in order to repay the still outstanding state loan. This debate has been made public by the German government actors identified above. According to the official statement of Airbus SE, the state loan are conditionally repayable loans. This is why Airbus SE does not agree to pay back these loans. The CEO at that time, Mr Enders, said "the fact is this is a risk partnership and these loans are based on the promise of the governments who are giving the loans that if the plane is not successful, they put money at risk" (Pfeifer, 2019). Airbus SE finds further justifications for its opinion of not being responsible for repaying the received state loan. Apart from the risk partnership, Airbus SE argues that the A380 program ensured tax revenues and payments for social funds as well as it generated high-paid jobs and supported many suppliers (Schubert, 2019). Additionally, Airbus SE highlights that there have not been as many jobs as now during times of peace. This is supposed to be seen as a success, and not a failure or loss for European tax payers (Schubert, 2019). Furthermore, as the German actor DIE LINKE states in an official minor inquiry, according to the name of the given subsidy 'performance-related repayment' which has been agreed to in the contract between the German government and Airbus SE itself, Airbus SE does not have to pay back the loan (BT-Drucks 19/10438). The dispute between the German government and Airbus SE is also subject to the WTO in which the US claims that European states gave Airbus subsidies illegally. Inversely, the EU accuses the US to have given Boeing illegal subsidies in order to maintain the global market leadership. Both conflicts are closely related to the code "unclear (legal) situation".

The final category is "phases of termination" which stands out as the second most important category in this research. The category combines different stages of the discontinuation process. The phases follow a simple logical structure in which the process of termination can be put into a chronological order. This chronological order helps to further analyze the case with regard to providing a comprehensive understanding of the case from a discontinuation perspective. The first code, considering the chronological order, is "hints for termination". With this code, the early indications in the form of problems for a possible termination of the A380 are described. It needs to be seen as the first phase of termination since the hints clearly show the arising issues that the

[2] original citation: "Ohne die öffentliche Förderung hätte man das amerikanische Monopol am Himmel nicht brechen können" (Schubert, 2019).

A380 had to deal with from the beginning. Starting in 2006, Airbus SE had problems in delivering the aircraft which finally “led to a delay of nearly 18 months for the plane being put into service“ (Schlappig, 2019). Due to the delivery delays, Airbus SE stated in its annual review report from 2006 (EADS, 2006) that “the degree of integration achieved to date – both within Airbus and across the Group – is by no means sufficient“. Until 2009, there still were problems with the production (EADS, 2009). Furthermore, the reduction in production and deliveries is a speaking for itself. In 2014, Airbus SE delivered 30 A380, in 2016 there were 28 A380 aircraft delivered, and in 2018, Airbus delivered only 12 A380 aircraft. Due to the declining demand by airlines that critique the acquisition and operating costs (Tagesschau, 2019), hints for the termination definitely were given and present.

The second code directly follows the hints as the code is named “Reasons for termination“. The difference to the first “phase of termination“-code is that the identified reasons mainly are the reasons Airbus SE itself gave in press releases, annual reports, interviews, online newspapers and articles. Airbus did not assess the hints as possible reasons. However, as MLP is applied in a varied way, it was possible to identify reasons from other involved actors. The conceptual analysis focuses on the classification of the reasons according to the identified groups of actors. Within the case analysis, a few reasons are elucidated in order to understand the process of discontinuation. One of the main reasons that was mentioned several times by various actors is the decision of Emirates to cancel its order of 36 A80 aircraft. In general, it can be said that the lack of interest and airline demand (see Thomas, 2019 and Airbus V) contributed to Airbus making the decision to terminate the product line. Moreover, some airlines argue that from an economic viewpoint, the A380 des not constitute a good investment (Spiegel Online, 2019).

So, hints and reasons for termination are needed for decisions. This is why the third phase of termination is the “Decision making process“. The code was used to identify the actual decision-making process that led to the decision of the A380 product line termination. The reasons function as the logical basis for the decision. Decisions within a technological context are only made with enough and reasonable justification which almost goes hand in hand with the identified reasons for the termination. For this phase it is crucial to follow the chronological order in order to identify all relevant steps of the decision making process. This also highlights the involved actors, how they were informed and how they took part in that decision making. Generally speaking, it should be clear that there are discussions with several actors. According to Lufthansa, Airbus SE is in a close dialogue with its customers, not only talking about new orders, but also discussing ongoing projects which means that Airbus received critical feedback referring to the A380 project. Besides, in several annual reports, Airbus SE states that there are constant talks between the company and customers. Additionally, discussions and meetings between the management of Airbus SE and government representatives take place in a permanent dialogue. Since 2015, the German government, as well as the governments of France, Spain and the UK, have been in negotiation with Airbus SE due to the difficulties of the program development (BT-Drucks. 19/9481). Only two years later, in 2017, the discontinuation of the A380 product line was

discussed for the first time (BT-Drucks. 19/9481). This probably was the first time when the German government seriously considered possible consequences of the production stop. However, in 2018, Emirates ordered 36 new A380 aircraft which, at that time, seemed to secure the further production for years. Then, Emirates entered negotiations with Rolls Royce in order to make a contract about the configuration of the engines. It later turned out that these negotiations were unsuccessful. This led to Emirates and Airbus SE signing an agreement on the A380 fleet, determining that Emirates reduces its A380 order book by 39 aircraft (from 162 to 123 aircraft) on 11th February 2019 because of the unsuccessful negotiations (see Airbus V, p. 73). Shortly before, on 4th February 2019, the German government was informed about the possibility of a short-term decision about the production stop of the A380 (BT-Drucks. 19/9481). This shows that even before signing the contract with Emirates about the cancellation of the ordered 36 A380 aircraft, Airbus SE considered the negotiations of Rolls Royce with Emirates as failed. Due to the reporting obligations because the German government holds shares in Airbus SE, the phone call was made on 4th February 2019 while the actual publication of the decision was on 14th February 2019. In its 2018 annual report, Airbus SE states that "due to Emirates' decision to reduce its order and the lack of airline demand overall we had to make the painful decision to wind down production of the A380, with last deliveries in 2021“ (Airbus V, 2018). As can be seen from the linguistic expression “painful“, the decision, finally made by the former CEO Tom Enders, was a hard and difficult one. This can be explained by looking at logical economic aspects: as soon as a company announces the production stop of a certain product, no customer will buy this product any more. Coming back to the research case this means that Airbus probably already knew about the production stop some time before informing the governments or the public. One year of unsuccessful negotiations between Emirates and Rolls Royce surely had an impact on Airbus' decision. It can only be speculated about to what extent the general regular meetings and talks of Airbus SE with the (German) government had an impact. However, as the consequences of the termination, which is the penultimate code included in the category of “phases of termination“, will show in the next paragraph, the dispute between Airbus SE and the German government about the state loan shows that the governmental opinions and sensitivities do not seem to play a major role in the actual decision making process. It becomes clear that the decision-making process began with the hints of termination. The mentioned issues and technical problems that led to delayed delivery and other identified challenges never really vanished for the A380. A lot of money was put into the European (prestige) project and the fact of Airbus being able to build such a huge aircraft not only shows success for the aircraft manufacturer in terms of technical performance. It also represents the success of a European company being competitive to the Boeing.

Decisions are always followed by consequences, and some of them cannot be predicted. The identified code “Consequences of termination“ needs to be divided by distinguishing the affected parties. On the one hand, consequences for Airbus SE were identified. Airbus SE has to deal with the actual discontinuation of the A380 program. Emirates' decision leads to the consequence of Airbus ceasing its deliveries and production in 2021 (see Airbus VI). Another corollary is the issue

of job losses. Airbus SE states, that “3,000 and 3,500 positions will be potentially impacted over the next three years“ (Airbus VII). On the other hand, there are consequences for the German government. First of all, the German government is worried about the employment of 1,100 to 1,200 employees in Germany (Airbus VII). Further, as the dispute between Airbus SE and the German governments about state loan continues, the German government is concerned about who has to come up for the remaining repayment of 630 million Euros. Moreover, not only the German government and Airbus SE itself are affected by the termination. Consequences for the airports and airlines need to be considered as well. As the A380 was too big for maintenance halls, both airlines and airports had to invest in their infrastructure, for the airlines additional to maintenance, acquisition, or operating costs (Rudolph, 2019). Another consequence was identified to Europe’s prestige. As a consequence of the discontinuation of the A380 product line it is now questioned how Airbus SE, as a European company, is supposed to stay competitive to Boeing. The consequences are very diverse and reflect the complexity of the termination process.

The final code included in the “Phases of termination“ is the “Reaction on termination“. This code completes the phases of the termination process. A reaction is seen by some of the identified affected actors in the socio-technical system due to a decision that suddenly changes the way of normal and regular, daily practices. The production stop of the A380 evokes a lot of heated discussions and reactions. However, only the publicly available data was used in order to create this code. The reaction on termination is evoked by the decision. Again, the single actors can be identified with the help of this code. A first reaction could be seen on the stock market. After the publication of the decision to discontinue the product line, an increase in the share value could be observed (Spiegel Online II). Also, Airbus itself reacts calmly and confidently by stating that the order situation concerning other aircraft still is satisfactory. As far as job losses are concerned, the company states that a lot of employees will be deployed in other production lines (Rudolph, 2019). Lufthansa’s reaction is calm and non-surprised because the airline saw the decision about the stop of the A380 product line coming. As the feedback was increasingly critical and the orders for the A380 aircraft were declining, the discontinuation could have been foreseen. Also, Lufthansa reacted to the decision by reselling six of its 14 A380 aircraft. Reactions are noticed on several levels that sometimes interact with each other, as the dispute between Airbus SE and the German government illustrates. Attention needs to be paid to the fact that reactions might create new issues which could lead to further destabilization or even termination. This chapter elaborated the structure of the case analyzed data and showed how intertwined the aspects of the discontinuation of the A380 product line are. Also, political and economic influences had effects on the process of discontinuation. Chapter four showed the chronological order of events and decision making processes, as well as it analyzed the structure of the case, identified the relationships between codes and categories, and elaborated five phases in order to file the process. The case analysis is the basis for the conceptual analysis that follows in the next chapter.

# 5. Conceptual Analysis

The following chapter aims at applying specific aspects of the discussed theoretical approaches from chapter 2, as well as to adjust these approaches to the specific case of the Airbus A380 discontinuation process. Furthermore, the conceptual analysis aims at “improving the understanding of the nature, scope, and function“ (Furner, 2004) of the discontinuation of the Airbus A380 product line. This chapter not only leads to answering the research questions, but also targets at creating a new pathway for a discontinuing socio-technical system.

In the first part of the chapter, the levels of transformation according to MLP by Geels (2004) are analyzed. The second part deals with the identified five phases of discontinuation and how they fit in the theoretical framework including the identified dimensions of the socio-technical regime in the process of discontinuation of the A380 product line inspired by Geels (2002). In the third part of the chapter, the existence of the niche level, according to Geels (2004), is scrutinized.

## 5.1. Levels of Transformation

According to Geels (2004), in MLP there are different levels of transformation. He distinguishes between the three levels discussed in chapter two. Geels (2004) sees the landscape developments as broader contextual developments that are non-influential which means that there is not exerted direct influence by any actor. However, the landscape level pressurizes the other levels of transformation and needs to be seen as a system of external events. The meaning for the A380 discontinuation process almost remains the same. There is still no direct influence by the identified actors that are further analyzed in the next part. The landscape development level in the context of aviation and air traffic should be seen as a system existing of the environment and the economy. The increased consciousness of environmental and climate protection can be seen as an influence of the landscape level, exerting pressure on the socio-technical regime. According to an article in The Guardian (2016), the International Civil Aviation Organisation (ICAO) discussed proposals that “would force makers of the world’s largest passenger jets to upgrade or stop producing certain models as early as 2023“ (The Guardian, 2016). Ever since the aspects of environmental and climate protection were discussed they have been a challenge for aircraft manufacturers. As the Guardian stated “the proposals could revive pressure on European plane maker Airbus to upgrade the world’s largest passenger jet, the A380 superjumbo, with new engines“ (The Guardian, 2016). Not only is this a challenge for aircraft manufacturers, but also increases the pressure on the socio-technical regime with all involved actors, exerted by the environmental landscape development. A feature that is described by Geels (2004), becomes visible here as well: the landscape level interacts with the other levels of transformation. Although Airbus SE itself stated that its A380 aircraft is environmentally ‘green‘, meaning eco-friendly in comparison to other aircraft, airlines had and still have the problem to fly with a full aircraft which then is not environmentally- friendly any more (see Goldstein, 2019). According to a representative of Lufthansa, only during the main season, three months in summer, the aircraft was used

efficiently because it was fully booked. However, in general, it is considered to be inefficient because of too high operating, purchase and maintenance costs. This forms the economic landscape that also exerts pressure on the other levels of transformation.

The second level of transformation, according to Geels (2002) is the socio-technical regime level. With this level, Geels (2002) refers to structures and practices characterized by rules, actors, institutions and technologies. For the discontinuation process of the A380 product line, the regime level should be seen as a constellation of actors including economic and technical structures. Geels (2002) proposes seven dimensions of the regime level: technology, user practices and application domains, symbolic meaning of technology, infrastructure, policy, and techno-scientific knowledge. These dimensions are believed to best describe the socio-technical regime for a technical transition. Varied and adjusted, the A380 case shows that five of the dimensions also play a role for the socio-technical regime in the process of discontinuation. The order of the identified dimensions that are applied to the case study are presented in the order of importance. There are three main actors and two minor dimensions. These actors were identified during the first analysis which also showed that some dimensions presented by Geels (2002) cannot be applied to the A380 case study. The table below gives an overview of the five actors and what actors are main actors, as well as what actors are minor actors:

| **Dimension** | **Actor** | **Importance** |
|---|---|---|
| Technology | Airbus SE & A380 product line | Main actor |
| Policy | German government | Main actor |
| Market/ User | Customer German Airline Deutsche Lufthansa AG | Main actor |
| Symbolic meaning | Europe (prestige) | Minor actor |
| Industry | Suppliers | Minor actor |

**Table 1**: The five dimensions of the socio-technical regime in the process of the discontinuation of the A380 product line (© Kesore, 2019).

Main actors are the actors who are involved throughout the whole process of discontinuation and have a direct impact on the decision whereas minor actors do not appear in every single phase.

In order to better understand the dimensions and with them the involved actors, each dimension is explained briefly. Beginning with the main dimension that was identified as the center of research in the network map in chapter four, it can be said that the technology dimension, meaning Airbus SE and its A380 aircraft is the central issue for the conceptual analysis, too. This dimension forms the object of research and, therefore, is on top of the table. The second dimension is the policy dimension. This dimension is another major and very important one as it represents several actors of the German government who were identified in the case analysis and in the data. On the one hand, there is the BMWi as a representative body of the German

government. On the other hand, there are the parties AfD, FDP, and DIE LINKE. The market dimension is the third important dimension and includes the customer of Airbus SE, the German airline Deutsche Lufthansa AG. As the research focuses on the interplay between German public policy and Airbus SE, the German airline Deutsche Lufthansa AG, on the one hand, represents the biggest airline in Europe. On the other hand, Lufthansa is a customer to Airbus. The airline owns fourteen A380 aircraft (see Lufthansa 2016) and, therefore, is the third biggest customer of Airbus as a whole. This underlines the importance and relevance of Lufthansa as one of the dimensions in the socio-technical system. As regards the minor actors, one of them is the symbolic meaning, that was identified to be Europe or the European prestige. The data showed the importance of the symbolic meaning of the aircraft A380 as the code “Europe“ was used more than 70 times throughout the different kinds of documents.

Not only did online newspapers state that the A380 was seen as the European answer to the biggest competition Boeing with its 747 aircraft. Also the interviewees highlighted the importance of Europe because of reasons such as competitiveness, technological success, employment for European citizens, development of the company Airbus itself (Schubert, 2019). The last dimension that could be identified within the discontinuation process of the A380 product line is the industry, which means the suppliers. This minor segment of the dimensions as a whole alludes to the suppliers that manufacture products that are needed for the production of the A380. The close dependence of the suppliers, such as Rolls Royce that produces aircraft engines, and Airbus and its technology of the A380 is obvious. Due to the fact that the research does not primarily focus on this relationship and its processes, the industry dimensions is a minor dimension and appears in the process of discontinuation only within some identified phases. As Geels (2002) initially names seven dimensions, in this bachelor thesis the dimensions industry structure and infrastructure cannot be applied to the discontinuation process. According to Geels (2002), the dimension industry structure would be the competitor to Airbus SE which is Boeing. As Boeing is an American company and the thesis focuses on Germany, this dimension is not part of the analysis. Furthermore, due to the analyzed data, the dimension of infrastructure has been neglected for this research.

## 5.2. The five Phases of the Discontinuation Process

With the help of the data in chapter four, five phases of the discontinuation process of the A380 were identified from a scientific perspective: (1) hints for termination, (2) reasons for termination, (3) decision-making process, (4) consequences of the termination, and (5) reaction on the termination. This is a long process that, additionally, includes the actual production termination as well as the termination of the maintenance services. The phases are applied to the five identified dimensions that represent the involved actors. However, a closer analysis shows that “hints for the termination“ and “reasons for termination“ should be combined because the distinction is very blurred when considering the five dimensions of the socio-technical regime. The hints are the precursor of the reasons and lead to these. The forth and fifth phases might be seen as similarly

blurred, as both phases, to some extent, derive from the actual decision-making. However, these two phases should not be seen as a merged process as the actors can be assigned to each phase separately and more clearly than the first and second phases. Moreover, it is important to mention that not every phase fits to every dimension. This is why the single boxes (see table below) cannot be considered on its own. The dimensions and phases are interconnected and interact with one another. This seems to be a reasonable explanation for the emergence of termination. The table below shows a scheme that was followed in order to reconstruct and analyze the discontinuation process of the A380.

<table>
<tr><th>Time (phases)<br>Dimension in socio-technical regime</th><th>I. Hints<br>II. Reasons for termination</th><th>III. Decision making process</th><th>IV. Consequences of the termination</th><th>V. Reaction to termination</th></tr>
<tr><td>1. Technology</td><td colspan="4" rowspan="5">The boxes cannot be analyzed on their own.<br>The analysis focuses on the phases and then describes/interprets each dimension by considering the mentioned interactions and connections.</td></tr>
<tr><td>2. Policy</td></tr>
<tr><td>3. Market</td></tr>
<tr><td>4. Symbolic Meaning</td></tr>
<tr><td>5. Industry</td></tr>
</table>

**Table 2**: Conceptual analysis scheme for the discontinuation process of the A380 product line combining the dimensions of the socio-technical regime with the four identified phases of discontinuation (© Kesore, 2019).

Before starting to interpret and describe each phase while considering the involved actors, a general timeline provides a rough overview on how the A380 program was developed. In 1993, the development of the A380 aircraft started as a new project in order to make Airbus more competitive to Boeing (BBC News, 2006). Seven years later, in 2000, the A380 was commercially launched on the market. In 2004, Airbus SE started the proaction of the A380. In April 2005, the aircraft completed its maiden flight lasting nearly four hours (BBC News, 2006).

### 5.2.1. Hints for Termination

The *first phase* starts when the hints and reasons for the termination are given. The analysis indicates that the first hint for problems in the production appears in June 2005: Airbus delays the initial deliveries of the A380 by six months (Cutler, 2010). The reason for this delay is said to be small changes that are very usual for a newly produced aircraft. The problems with the actual production last until June 2006, when the delivery is delayed by another seven months (EADS, 2006). Due to these complications, which affect the market and technology dimensions primarily, a crisis meeting in Berlin is scheduled on 5th October 2006. This is when the BMWi on the policy dimension gets involved. The BMWi urges Streiff, who was the Airbus CEO at that time, to ensure the compliance of commitments referring to the development and production of A380. The technology level and the policy level clearly interact with one another and one can see how complex the issue becomes. As a consequence to the delivery problems, Streiff steps back on 8th

October 2006. Considering the mentioned pressures and influences that emerge during interactions, the high pressure from the dimensions of market and policy led to a change in the technology dimension. In the end, the deliveries were delayed by about eighteen months, which is why some airlines asked for compensation (Schlappig, 2019). Further, the market dimension, which means the airlines, claims that the operating, purchase, and maintenance costs are too high. Again, additional pressure is exerted on the technology dimension. Airbus SE not only has to justify the delays in delivery, but also needs to explain, justify, and negotiate the costs (Tagesschau, 2018; Spiegel Online, 2019). While some hints and reasons can be pointed out by a specific date, some ongoing processes were present continuously: on the policy dimension it is said that public funds by the governments traditionally support Airbus as a European company in order to stay competitive on the global market (Schubert, 2019). Furthermore, the already identified decline of production per year due to cracks in the wings, was noticed in 2010 for the first time (N-tv, 2012). In 2012, the same problems occurred. As the market dimension directly reacts on this, the decline of orders for the A380 aircraft also leads to a decline in deliveries. The interplay between the policy dimension, the technology dimension and the market dimension is highly visible during the first phase of discontinuation. The main dimensions of the regime continuously interact with and exert influence on each other. Due to meetings on a regular basis with both, Airbus and BMWi, as well as Airbus and Lufthansa, hints and reasons for the termination should have be seen quite early. Lufthansa ordered its last A380 aircraft in 2015. This is exactly the time when the BMWi officially knew about problems with the program development (BT-Drucks. 19/9481). So, one can see that especially the hints for the termination came from different actors and became visible for each of them. The first phase continues as in 2009, supplier problems, which build the industry dimension, arose: Singapore Airlines was forced to turn back to Paris with its A380 after one of its four Rolls-Royce engines failed (Cutler, 2010). The technology dimension is closely connected to the industry and, once more, gives substance to the comply interconnection. In 2017, the BMWi revealed that a program termination was discussed (BT-Drucks. 19/8665). Although Airbus SE experienced a little success when Emirates ordered 36 A380 aircraft in February 2018, the decrease in orders as a whole could be balanced. The program termination was not sufficiently counteracted. This can be seen in the decision of Emirates cancelling the order of 36 A380 due to unsuccessful negotiations with the supplier Rolls Royce (BT-Drucks. 19/8665). Again, the industry dimensions seems to play an important role in the first phase of termination as it interacts with the other dimensions every now and then, with the technology and policy dimensions. In summary, the major dimensions, and therefore, actors become visible as the MLP theoretical approach by Geels (2002; 2004) is applied in a varied way. The technology dimension, Airbus SE, the policy dimension, BMWi, and the market dimension, Lufthansa, are strongly connected with each other. They exert influence and pressure on one another and are sometimes intertwined within the process of discontinuation. All three actors have been interviewed which seems to provide additional, valuable information, especially for the last phase of discontinuation, the reaction on termination.

### 5.2.2. Decision Making Process

The *second phase* of termination is the decision making process. In order to restructure this process, the date of publication of the decision is the central starting point. On 14th February 2019 Airbus SE announced the production stop of the A380. The main trigger for the decision to be made on that date is the decision of Emirates to cancel its order of 36 aircraft because of the unsuccessful negotiations with Rolls Royce (BT-Drucks. 19/8665). As the market dimension is affecting the technology dimension, one can see the economic influence exerted by Emirates on Airbus SE. The German government was informed about the possibility of a short-term decision of a termination of the A380 project on 4th February 2019, which highlights the interplay between the German government and Airbus SE, as well as the complexity of the discontinuation process. Airbus SE had to inform the German government in advance, as well as its suppliers. On the one hand, Airbus SE has a reporting obligation towards the German government, on the other hand, suppliers, who build the industry dimension here, need to be informed in advance because of the lead-time for production. The interconnection between industry and technology seems to be important for the decision-making process here. On 11th February 2019, Airbus SE and Emirates sign an agreement, determining the withdrawal of the 36 A380-order by Emirates, after one year of unsuccessful negotiations with Rolls Royce. The market dimension interacts with the industry and technology. To sum up, it can be seen that negotiations take place more often than the public gets to know. Due to the buyer-seller relationship, meaning airlines (Lufthansa) and Airbus SE, which is seen as a market-technology interaction, as well as due to the reporting obligations of Airbus SE towards the German government because of state loan and the German government being shareholder, one can say that these interconnections and interactions show the possibility to exert influence politically and economically on Airbus SE.

### 5.2.3. Consequences of the Termination

The *third phase* of termination is the consequences of the termination. The most visible and easily understandable consequence is the actual termination of the product line. Airbus SE needs to adopt the production of the A380, which will have its last delivery in 2021, according to the decision to stop the production (Airbus VI, 2019). This process needs to be seen as a *fading out*. The technology (technical system) does not disappear from one day to another. It will still be seen in thirty years as the life cycle of an A380 aircraft is about twenty-five to fourty years (Steinke, 2015). What happens after the last A380 disappears from the market, is unclear. Currently there is no successor that can carry as many people as the A380 does, which was and still is a special strength of the aircraft. In other words: in the niche-level there is no replacement for the A380. At first, a vacuum, as described by Geels & Schot (2007), emerges. Another consequence is the possible job loss of employees, as explained in chapter four. This is a consequence that the technology dimension, as well as the policy dimension will need to deal with in the near future (Airbus VII, 2019). For the policy dimension, not only the employment plays a role but also the state subsidy of 943 million Euros which has not been fully paid back by Airbus SE, as the

repayment is connected to the successful delivery of the A380. Airbus SE now argues that it does not pay back the remaining 630 million Euros, because there will not be any new deliveries after 2021. The conflict between the German government, policy dimension, and Airbus SE, technology dimension, becomes even bigger when considering that the German government, that currently is negotiating with Airbus SE about the unpaid subsidies, not only is shareholder and financier, but also customer to Airbus SE. On the one hand, the German government gives a state loan to Airbus SE in order to support the European market in aviation industry as well as to secure jobs for German citizens. This shows that Airbus SE is dependent on the state loan so that the company stays competitive. On the other hand, the German government is dependent on Airbus SE as the aircraft manufacturer also produces military aircraft. Therefore, Germany also is dependent and Airbus SE. For the industry, the discontinuation means an economic disadvantage because they have one order less. The market has to face capacity balancing, but as they continue to have the A380 aircraft for the next two or three years, they still have some time to figure out how to handle this minor issue. There is no drastic and sudden change due to the *fading out* process of discontinuation. Moreover, the symbolic meaning dimension has to face consequences. According to a lot of data the decision of the A380 termination is regarded as a “failure“ of Airbus SE (Thomas, 2019). As a consequence, it is aimed at finding and developing new projects in order to stay competitive and successful with a European company. These new projects refer to the niche-level. While the actors themselves interact with each other, the different levels of transformation show interconnections, too. In summary, one can say that the major consequence established by the decision about the discontinuation is on the intertwined dimensions of technology and policy, which is about the state loan and repayment. The identified third phase helped to analyze the discontinuation process of the A380 product line as a fading out process. The socio-technical regime stays more or less stable as no sudden consequences appear due to regular negotiations and meetings.

### 5.2.4. Reactions to Termination

The *forth phase* in the discontinuation process is the phase of the reaction to termination. The reaction to the termination differs from the consequence as reactions can be influenced and guided. Although the technology dimension is the dimension that sets the hare running, Airbus SE acts calmly, shows careful consideration, but also optimism as the company highlights how well other productions are ordered and sold. This optimism can be seen as an economic strategy of Airbus SE in order to stabilize the socio-technical system, which is the contrary to Turnheim and Geels (2012) as they see an economic strategy as a method to destabilize an existing regime. The policy dimension shows a reaction on the termination in two ways. First, the dispute between the German government and Airbus SE about the state loan became a public discussion. One reason might be that especially the German government tries to be as transparent as possible. Dealing with this industrial policy process seems to be different from other involved countries, such as

France or Spain. Second, the mentioned public discussion is stimulated by the German parties FDP, AfD and DIE LINKE who raised minor inquiries to the German government. The minor inquiries deal with the state loan and the repayment issue. The market's (Lufthansa's) reaction on the termination is the resale of six of the fourteen A380 aircraft to Airbus SE, as Lufthansa decided to order new aircraft from other production lines instead of spending money on too high maintenance costs for the six A380 aircraft. Conclusively, one can look at a small linguistic analysis. It emphasized the different angels of opinions of the regime actors. The BMWi reacts restrained in stating a clear position towards the public, showing understanding to the decision of Airbus SE, but still trying to negotiate with the company with regard to the outstanding repayment of the state loan. Lufthansa reacts in a way that shows that the decision about the termination of the A380 is no big deal as such. Finally, the main actor and dimension of the discontinuation process, Airbus SE reacts sadly, but optimistically that other aircraft become better and that the company will stay competitive to Boeing.

The last part of the conceptual analysis deals with the third level of termination: the niche-level. According to Geels (2004) the niche-level means novelties and innovations that are seen as the reason for changes in the socio-technical regime and in the landscape. The meaning for the discontinuation process of the A380 product line needs to be adjusted. For the case of the A380, transformation is not caused by novelties or innovation. The niche-level does exist, but it should be seen as a perspective that generally does not interact with the other perspectives (landscape & regime) at first. It develops on its own and might integrate into the existing regime one day, trying to supersede existing technologies, or existing as an additional technology. One example of this is the consideration of Airbus SE to bring the world's first hybrid electric commercial aircraft to market (Süddeutsche Zeitung, 2019). This also refers to the landscape level – to be more specific: to the economic and climate protection. Airbus SE puts effort into reducing the pressure by developing and inventing new, more effective and more environmentally-friendly technologies. This might eventually lead to a change of the socio-technical regimes as well as a landscape transformation.

All identified phases form a specific discontinuation pathway. Inspired by the transition pathways by Geels and Schot (2007), a new pathway could be elaborated that does not focus on transition primarily, but highlights the discontinuation process of a technology. As the A380 case is a very special case of discontinuation, a pathway of a fade-out process was developed. The figure below shows the model of this newly elaborated discontinuation fade-out pathway:

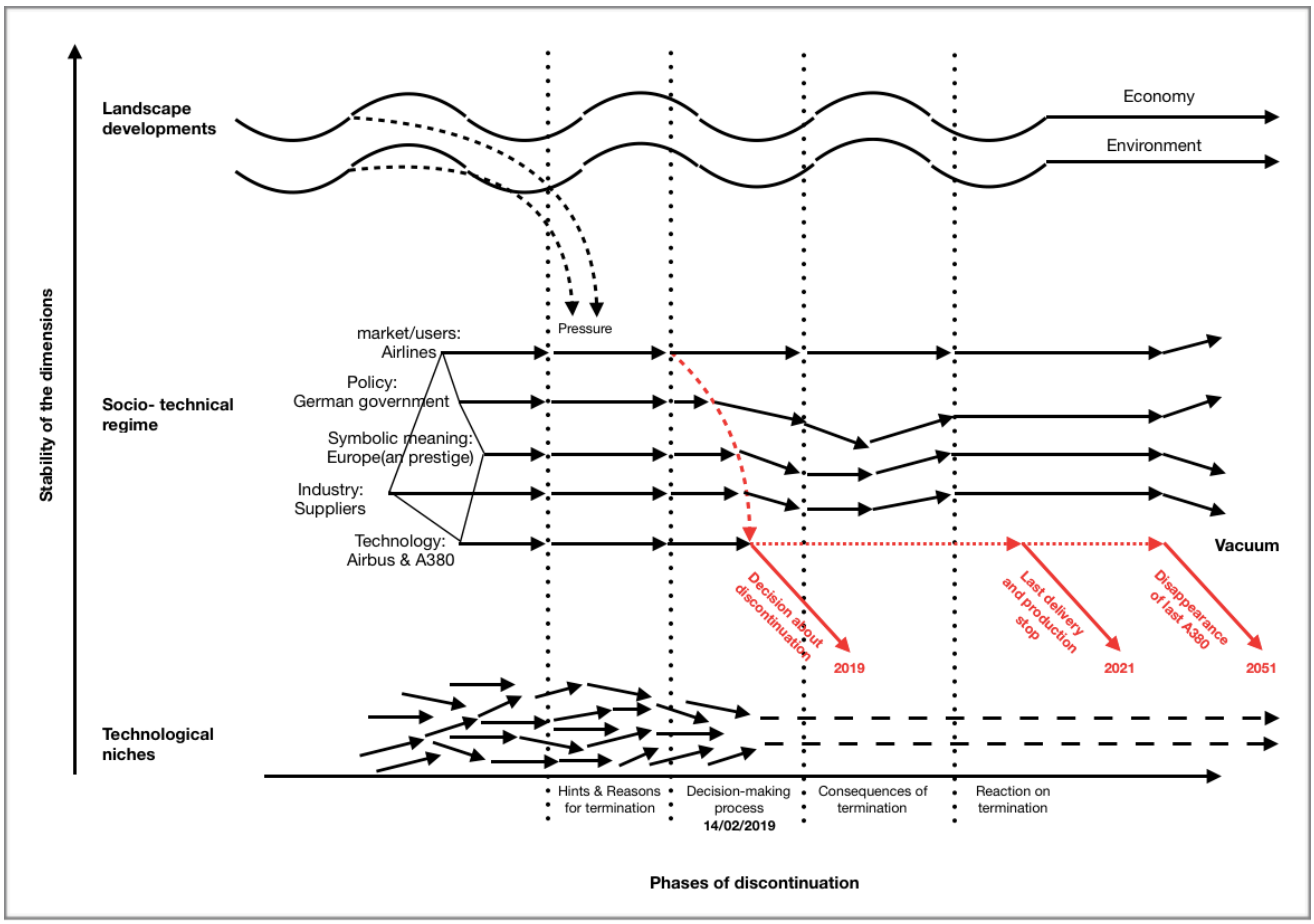


**Figure 4:** Gradual termination (fade-out) of a socio-technical system (© Kesore, 2019; inspired by Geels and Schot, 2007).

The general structure by Geels and Schot (2007) was maintained. However, the identified phases now divide the process of discontinuation clearer as well as the actual fade-out of the technology – in this case the A380 aircraft – is a whole new feature that was not considered before. The A380 has a service life of twenty-five to forty years (Steinke, 2015). The model above applied the average service life of 30 years. This means, that after the last delivery, which is announced to take place in 2021, the aircraft will still exist and be in use until 2051 at least. Nevertheless, aircraft delivered before, will be out of use earlier which actually shows a continuous discontinuation of the A380 throughout the next few decades. This slow fade-out of the aircraft is presented with the red arrows as well as with the red dashed arrows that show that the aircraft is still in use until the last A380 “dies“ and disappears. Another feature that is different from existing pathways and models is the niche-level. Within the niche-level there are ongoing developments and innovations, but none of them seems to replace the A380 in the foreseeable future. On the downside, one example of an innovation in this level is the consideration of Airbus SE to produce the world’s first hybrid electric commercial aircraft (Süddeutsche Zeitung, 2019). Yet, it is questionable to what extent this would supersede the world’s biggest aircraft. The arrows belonging to the niche-level present in an exemplary way that novelties could emerge and might supervene to the existing regime. Existing pathways of Geels and Schot (2007) might be applied to these events then, although such novelties and innovations that replace the A380 are unknown at this point of time.

## 6. Conclusion

The analysis conducted focused on the purposeful discontinuation of the Airbus A380 product line. It is worth noting that the research was limited to the German context. Through the exploratory research of the A380 case this work contributes to a better understanding of the technical discontinuation with focus on the gradual termination. Or, in other words: the research helps to comprehensively understand the fading-out discontinuation process while considering the niche-level as a separate process not being decisive for the actual discontinuation. By means of the case analysis and the conceptual analysis this final chapter answers the research questions that guided the research. Furthermore, the last part of the chapter reflects on the limitation of the study and the case itself, ending with indications for further research.

The first sub-research question was: *Under which circumstances was the decision made to stop the A380 product line?*
Considering the detailed analyses of the discontinuation process of the A380 product line, the answer to this sub-research question can be formulated by referring to the landscape development level. On the one hand, the economy plays the fundamental role here as the main cause for the stop of the A380 product line is the lack of airlines demand for the A380 aircraft. If airlines do not demand this type of aircraft anymore and even cancel their orders, the aircraft manufacturer will adapt its supply to the changing demand accordingly by not producing the A380 anymore. On the other hand, the increased consciousness about environmental and climate protection from the general public can be seen as another motive for the stop. Only if the A380 is fully booked, will it be environmentally-friendly and economically viable. As this is the case only during the three-month peak season and not in the remaining months, operating the A380 aircraft is hence neither environmentally-friendly nor economically viable. The combination of the two factors economy and environment, have been the leading reasons for the decisions of many airlines to either cancel their orders, to just not order new A380 aircraft, or to resell A380 aircraft to the manufacturer.

The second sub-research question was: *Who are the main actors involved?*
The main actor involved within the process of discontinuation of the A380 product line is Airbus SE. It is also a multi-dimensional key player because it produces the A380 aircraft as well as it was responsible to decide about the stop of the production. This decision of Airbus SE is the consequence of the decision of the second main actor who are the customers. The customers of Airbus SE are airlines that do not demand the A380 anymore because for them, the aircraft simply is inefficient and other, smaller and more modern aircraft with the same range, are more beneficial. The third main actor identified is the German government, including the BMWi and German parties because the German government provided necessary subsidies to the A380 project. However, it is worth noting that the German government had very little effect on the discontinuation.

The third sub-research question was: *What consequences arose from the discontinuation?*

The answer to this research-question was detected in the analyses. As shown there, it is important to differentiate between the different consequences of the identified actors mentioned above in order to correctly answer the research question. Each actor bears its own consequences. One of the consequences for Airbus SE is the actual production stop and all business activities connected to this. The loss of a business field involves a decrease in revenue and profitability as well as a reduction of the market. Furthermore, Airbus SE has to deal with a significant job loss. This also effects its reputation in a competitive landscape. The same issue is a consequence for the German government as Airbus SE employs 1,100 to 1,200 employees who work in the production line for the A380 in Germany. Having a higher unemployment rate in case of no further employment by Airbus SE would be a financial burden to the government of the social market economy. Moreover, the German government has to face another problem that seems to be unsolved at this time. The state loan that Germany granted to Airbus SE in order to develop the program A380 is a performance-based loan which means that the repayment is dependent on the deliveries of the aircraft. A dispute arises between the Airbus SE company and the German government because after the last A380 delivery in 2021 there will be a sum of 630 million Euros left to be paid back to the German government. However, Airbus SE refers the German government to the terms of the loan agreement: the loan is bound to the performance, i.e. to the deliveries of the aircraft. Therefore, according to the loan agreement, after 2021 Airbus SE is not bound to continue to pay back the rest of the received loan. Dealing with this conflict is another consequence for both actors. The consequences for the very important actor, the airlines, are different. On the one hand, if Arlines have ordered A380 and want to cancel their order, they will be forced to pay cancellation fees. On the other hand, if they directly proceed to order modern, smaller planes, that are environmentally and economically more feasible, they will become more efficient. Airlines did not request the A380 any more due to high costs and inefficient use of the aircraft, both in economic and environmental terms. So, the consequence for airlines is that they become more efficient as all costs for operating and maintaining A380 aircraft cease to exist. The burden of the consequences for each actor is also dependent on the agreements and contracts which were in place during the normal functioning of the process. Discontinuation is an integral part of any existing system and process. However, if the actors can regulate upfront a discontinuation case in their contracts and agreements, the consequences could be less severe.

The main research-question was: *How are the key actors in Germany dealing with the stop of the Airbus A380 product line in the context of the German public policy role in the process of discontinuation?*

The stop of the Airbus A380 product line is dealt with differently according to each actor. As shown in figure 4 and stated in the answers to the sub-research questions, the different phases of the discontinuation process and the identified actors involved present the different ways of dealing with the stop of the A380 product line. While the socio-technical regime slightly becomes

unstable, especially the German government, all in all the regime including all actors does not show a collapse and remains stable throughout the actual process of discontinuation. Airbus SE is planning to offer new job positions in other product lines to the effected employees. The airlines order alternative small and modern aircraft allowing higher flexibility and efficiency in terms of economy and environment. The research focus on the German perspective could be best addressed in the fourth phase (reaction on termination). Because data were mainly found in relation to the German government and state loan, the focus was quite limited and did not reveal much about other countries. One of the interviewees highlighted the difference of dealing with industrial policy in different countries. The German government tries to be as transparent as possible whereas other governments negotiate in camera and only inform the public after having a result. While the reaction of the German government became clear, the legal situations and the final outcome of who will have to pay for the remaining 630 million Euros still is complicated and under negotiation. A concrete solution is not expected in the near future.

This research offers a relatively broad overview of the discontinuation of the A380 aircraft. The topic of the Airbus A380 termination is a very recent case. This highlights the limitation of publicly available useful data. However, the gained data already gave enough information to identify the main important actors and the discontinuation aspects. Furthermore, it was possible to develop a new model for the fading-out of a technical system. Limiting the research to the German perspective scope, the data collected could still be analyzed and interpreted differently to get a more detailed insight. As the case is a very recent one, long-term consequences and detailed developments in the niche-level could not be forecasted and, thus, fall out of the scope of this research. Nonetheless, two statements regarding the niche-level can be made. First, Airbus SE is not planning to replace the A380 aircraft by another aircraft that shows the same technical features and was improved regarding the economical and environmental problems. This view demonstrates a missing novelty and explains the existing vacuum shown in figure 4. Second, articles state that Airbus SE tries to bring the world's first hybrid electric commercial aircraft to market (Süddeutsche Zeitung, 2019). Also, in June 2019, the aircraft manufacturer revealed "the A321XLR, a long-haul version of the A321neo that competes with Boeing's grounded 737 Max" (Topham, 2019). This aircraft technically is able to fly long distances, just like the A380. Yet, the A321XLR does not have as much seats as the A380 and cannot be seen as direct replacement of the A380. Nevertheless, this development shows that smaller aircraft also can fly long distances nowadays. Therefore, it presents an adjusted solution to the request and demand of airlines. It would be highly interesting to conduct further research on these aspects in order to even better understand the discontinuation of the A380 product line. Also, the interpretations of the niche-level developments needs to be looked at in more detail and from a certain distance as long-term consequences seem to better explain the discontinuation of the A380 product line. Moreover, having created and provided a new model for the fading-out of a technology, it should be looked at to what extent this model is applicable to other cases of discontinuation, in other words, its validity.

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## 7.1. List of Figures



## 7.2. List of Tables