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Evaluation of Customer Bad-Will in Service Business

A study of Service Operations & Technology at Volvo Group

Master's thesis in Quality and Operations Management

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Abstract

This thesis examines how customer bad-will is represented in Volvo Group's total cost model for spare parts planning. In the current model, bad-will is intended to capture the customer-related consequences of spare parts shortages and to influence service level decisions. However, the parameter has not been substantially revised for many years, and its current design is based mainly on static part-related attributes. This raises the question of whether the model reflects how customers actually experience service failures in today's aftermarket context.

The study was conducted as a qualitative case study at Volvo Group Service Operations & Technology. It combined a literature review, internal interviews and document analysis, and semi-structured interviews with dealer-facing actors in European markets. The purpose was to map how the current bad-will parameter is defined and used and to identify which factors are perceived to drive bad-will in practice. The findings show that Volvo's current bad-will parameter primarily reflects spare part attributes such as criticality and life cycle phase, but underrepresents several important drivers of customer dissatisfaction. In particular, the results highlight the importance of time sensitivity, ETA (Estimated Time of Arrival) transparency, communication quality, market conditions, and internal escalation capability to handle shortages effectively and efficiently. The study further suggests that these drivers differ in how suitable they are for inclusion in the model. Some factors, such as more granular criticality and lead-time-related proxies, appear implementable as model refinements. Others are strategically relevant for service prioritization but do not represent customer bad-will in a strict sense. A third group, including ETA quality and communication during shortage situations, is better understood as organizational and process-related capabilities than as stable model parameters.

The thesis concludes that the gap between the current bad-will parameter and customer reality cannot be closed through parameter refinement alone. Improving the representation of bad-will in the total cost model may increase decision quality, but some of the most important opportunities to reduce bad-will lie in process improvements outside the model.

Keywords: Customer bad-will, spare parts planning, total cost model, service level, aftermarket, servitization

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Carl Görling & Filip Stenberg, Gothenburg, May 2026

List of Acronyms

Below is the list of acronyms that have been used throughout this thesis listed in alphabetical order:

BO	Back Order
CDC	Central Distribution Centre
DIM	Dealer Inventory Management
DIP	Demand & Inventory Planning
ETA	Estimated Time of Arrival
LPA	Logistics Planning Agreement
LT	Lead Time
RDC	Regional Distribution Centre
SDC	Support Distribution Centre
TSL	Target Service Level

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1

Introduction

This chapter introduces spare parts availability and aftermarket service performance within the broader role that transportation plays in society and the economy. The chapter also presents the current spare parts planning approach and defines the problem addressed in this thesis. It explains how mobility and logistics enable essential societal functions such as commerce, work, healthcare, and infrastructure development, while the transport sector simultaneously faces growing pressure to transform in response to climate goals and changing customer expectations. In this context, uptime and operational reliability become central values, not only for end users, but also for industrial actors whose competitiveness depends on keeping vehicles and machines running. As industrial firms increasingly shift toward servitization, delivering high-quality services becomes a central part of the customer offering and an important source of competitive advantage. For Volvo Group, this reinforces the strategic importance of aftermarket performance and therefore also the relevance of this thesis.

1.1 Background

The transportation function serves as a fundamental part of society, acting as the backbone of the global economy, enabling the flow of goods, services, and people throughout the world (World Bank, 2025). Enabling complex supply chain and access to vital societal functions such as healthcare, education, and work, proves that a reliable transport infrastructure is a necessity for societal development. Furthermore, the sector of transportation is under constant transformation, where major actors such as Volvo Group are responsible for driving change in order to address one of the biggest challenges of our generation: climate change. With the transport sector accounting for one fourth of the green house gas emissions (European Environment Agency, 2023), there is immense regulatory and social pressure to decarbonize, particularly regarding the heavy-duty vehicles that are responsible for a large portion of the road transportation emissions (International Energy Agency, 2024). In addition, a growing global population, urbanization, and e-commerce bring an increased demand for sustainable solutions and infrastructure. In parallel, the industry increasingly shifts toward service-based value creation for their customers, where companies complement product offerings with services and solutions, making good service an important driver of competitiveness (Kindström et al., 2013; Grönroos, 2015).

1.1.1 Volvo Group and Service Operations & Technology

Volvo Group, referred to as Volvo in the remainder of this report, is a global industrial company with a broad portfolio of brands, including Volvo Trucks, Volvo Buses, Volvo Construction Equipment, Volvo Penta, Renault Trucks and Mack Trucks (Volvo Group, 2026). Across these businesses, the company not only offers vehicles and machines, but also a value proposition centred on uptime and reliable operation for transport and industrial activities. Ensuring that trucks, construction equipment, and engines remain operational is therefore fundamental to Volvo's offering and strongly influences how customers experience and interact with the company. Within this context, Service Operations & Technology (SO&T) is responsible for managing the global aftermarket system. This includes securing the availability and distribution of spare parts across all brands. Volvo Parts operates within SO&T and plays a key role in enabling this system by ensuring the global supply of spare parts. SO&T connects suppliers, central and regional warehouses, and the dealer network, coordinating the flow of components to ensure that the right parts are available at the right place and time. In practice, this function is central to enabling after-sales services and maintaining uptime, while also influencing both operational performance and cost efficiency across markets.

1.1.2 Aftermarket Services and Distribution Network

Strong aftermarket and service performance are closely linked to customer satisfaction, loyalty, and long-term profitability (Cohen et al., 2006). Cohen et al. (2006) implies that high service quality and reliable support contribute to customer loyalty and improved financial results, while highlighting that the aftermarket can be a major source of revenue and competitive advantage. For Volvo Group and its brands, this means that the way spare parts are planned and prioritized is strategically important, because it directly affects customers perceptions of reliability and support in different segments and markets.

However the importance of aftermarket, spare parts and aftermarket services are difficult to provide because demand is often unexpected, irregular and closely tied to breakdowns and unplanned maintenance rather than stable usage patterns (Cohen et al., 2006). This makes forecasting challenging and increases the risk of either excess inventory or stockouts, especially for low volume parts. When a failure occurs, the supplier, warehouse, and planners must act quickly, since each hour of downtime can have direct operational and financial consequences for the customer. Bijvank and Vis (2012) highlight that in many inventory settings, stockouts lead to lost sales rather than simply delayed demand which underlines the importance of having parts available when failures occur. If the customer's problem is not solved, they will take their business somewhere else. At the same time, the service literature shows that customers evaluate not only whether the service is eventually delivered, but also the timeliness and reliability of that delivery. Parasuraman et al. (1985) describe reliability and responsiveness as central in perceived service quality. Both the difficulties in supplying spare parts and after-sales services and the potential impact it could have on customers, explains why it's so operationally demanding, both

in planning and supplying. Suppliers, warehouses, and dealers must manage highly uncertain demand while still reacting quickly enough to avoid downtime and protect the customer's perception of the provided service quality. This is also mentioned by Grönroos (2015), who points out the need be responsive to uncertain fluctuations in demand in order to ensure a good perception of service quality.

To succeed with providing this quality of service, Volvo Group operates a multi-stage distribution hierarchy, as illustrated in figure 1.1. This simplified demonstration is not always accurate for all unique spare parts, but rather aims at understanding the relationships between the different distribution centres in the context of Volvo.

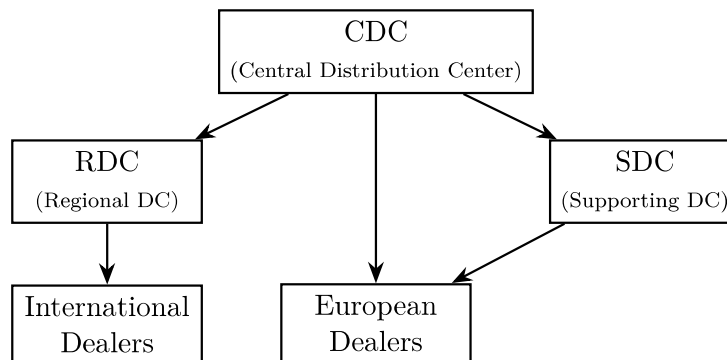


Figure 1.1: Hierarchy in flow of parts within Volvo Group's spare parts distribution network

1.2 Total Cost Model for Spare Parts

To set an optimal theoretical service level (TSL) for each spare part, the total cost model employs a comparative analysis between the costs of stocking the part and the costs of not having the part stocked. In this context, the theoretical service level is the expected percentage of orders fulfilled, i.e if a spare part has a TSL of 90%, 9 out of 10 orders would be fulfilled. The overstocking cost of the model includes direct costs associated with overstocking, such as retention, holding, handling, obsolescence (scrapping), and return costs to the Central Distribution Center (CDC) at spare part level. The understocking costs are associated to the costs of shortage. These are costs such as the probability and incremental cost of expedited freight (i.e flying the part, sending a truck that is not fully packed or expediting a delivery), potential lost sales, and overhead costs, alongside a bad-will component, which is an estimated cost of negative customer experience. This component is similar to the "shortage and delay costs" in Jonsson and Mattsson (2005) description of the total cost model where they include lost sales, late fees and express deliveries but also a part on the customers perception which can include customers going to competitors or gaining a negative view of the company.

Every single spare part is included in a segment which is based on many factors such as demand, price, and criticality. This segmentation is furthermore a factor that is taken into account when optimizing the service level for the individual spare

parts. All spare parts that is sold have a TSL (Chopra and Meindl, 2007) which is gained by evaluating the total cost of each part by using the total cost model. The model used to calculate the total cost for the spare part is similar to a lot of the models used in literature (Jonsson and Mattsson, 2005; Stock and Lambert, 1987; Abrahamsson and Aronsson, 1999; Christopher, 2011; Ekdahl et al., 2021). Increasing the service level, as illustrated in figure 1.2, typically increases revenue, but it also increases inventory and service related costs such as inventory holding, handling, and scrapping of parts. By combining these effects, the model identifies the service level at which expected profit is maximized and this level is set as the TSL for that part.

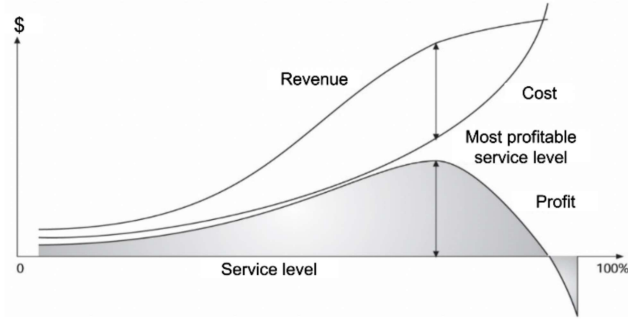


Figure 1.2: Illustration on the trade-off between service level and profit, adapted from Ekdahl et al. (2021)

1.3 Aim

The aim of this study is to analyse how service-related consequences of spare parts distribution are represented in the bad-will parameter in Volvo Group’s total cost model for spare parts. Today, Volvo rely on a total cost model to optimize what service level segments of spare part should have by using a set of different parameters. In this model, one of the parameters is called bad-will and represents the estimated cost of negative customer experience associated with spare parts being out of stock. The study also aims to assess whether this representation reflects customer-perceived service outcomes as described in literature and by customers themselves. Furthermore, the aim is to map and visualize the bad-will parameter internally in order to address the apparent lack of understanding about the use and formulation, potentially affecting the effectiveness of service related decisions.

1.4 Problem Definition and Research Questions

The total cost model described in the current planning approach includes a component intended to account for customer-related consequences of spare parts service performance, called bad-will. While the inclusion of such consequences is consistent with established theory, the way they are defined and applied within the model is

less clear than for other cost components in the model. Additionally, it appears that knowledge about how the bad-will parameter is set, why it is set in a way as such, and what it represents is limited throughout the organisation.

It is not specified which service-related consequences are captured by this component and how these consequences are translated into a monetary value over time, unlike components such as inventory holding, transport, or handling costs, which are explicitly known or can be calculated. Customer-related consequences are more difficult to quantify and may depend on perceptions, expectations, and contextual factors. This creates uncertainty regarding what the model actually represents when this component is applied in the total cost model.

Additionally, this bad-will component has not been evaluated for at least a decade, which creates a possibility of the model not being up to date in an environment where the industry is increasingly moving to servitization (Kindström et al., 2013). Furthermore, customer responses to service performance may vary depending on customer, market, and brand. Without a clear understanding of how this variation is reflected in the model, it is difficult to assess whether the representation of customer related consequences is actually modelled with how service outcomes are perceived in practice. In addition, customer related consequences of service performance should not be understood solely in terms of negative effects following service shortfalls. Service interactions may also give rise to positive customer responses when performance meets or exceeds expectations, such as increased trust, tolerance toward future disruptions, or strengthened long-term relationships. These positive responses are not necessarily the direct opposite of negative ones and may follow different mechanisms. Treating customer related consequences as a single negative construct therefore risks oversimplifying how customers respond to service outcomes. A more nuanced understanding is needed in order to assess whether the current representation of customer related consequences in the total cost model captures the full range of customer responses associated with spare parts service performance. From an operational perspective, uncertainty regarding what customer related costs represent and how they are calculated may affect how optimization results are interpreted and used in spare parts service level decisions.

- **RQ1:** How is customer *bad-will* currently defined within Volvo Group’s total cost model?
- **RQ2:** Which factors are perceived by customers as the primary drivers of *bad-will*, and how do these relate to existing literature?

1.5 Limitations

This study is limited at only evaluating the brand Volvo Trucks, and the findings may therefore not be transferable to other brands within Volvo Group with different service structures, customer relationships, or market conditions.

The study focuses on the representation and understanding of customer related consequences within the existing total cost model for spare parts distribution. Both negative and positive customer responses to service performance are considered conceptually. However, the evaluation is limited to the current bad-will parameter, as this is the only customer related parameter explicitly included in the model. The study may assess how this parameter could be refined or reinterpreted to better capture the full range of customer responses, including positive effects that are not necessarily the direct opposite of negative ones. All other parameters in the total cost model, such as inventory, transport, handling, and scrapping costs, are not evaluated or modified.

Furthermore, the study is limited to be carried out in a European context due to time constraints and the practical challenges of performing a globally representative investigation. Assessing a global context would require a large scale data collection and by focusing on European dealers, the study can ensure a higher level of detail within given time-frame.

2

Methodology

The methodology chapter explains how the study was designed and carried out to answer the research questions. A qualitative single-case study approach was used to investigate how customer bad-will is represented in Volvo Group's total cost model and how it is perceived in practice. The chapter also outlines the literature review, Volvo pre-study, interview process, and analysis approach that formed the basis of the study.

2.1 Research Design and Approach

Östermark (2010) explains the research approach as the way research is built upon. It is a comprehensive approach that includes how the research is carried out, how the questions are formulated, and how the data is gathered and analysed. The research approach dictates the framework for the study, from design to method of choice, and also affect the analysis of the results of gathered data. This thesis was conducted as a qualitative single-case study at Volvo Group Service Operations & Technology. The case study design was chosen because the study investigates how customer bad-will is represented within a real-life organizational setting, where bad-will cannot be separated from its operational, organizational, and market context. The study focuses on one case, but examines it through several perspectives: internal experts working with the model and its parameters, dealer-facing internal roles, and market-facing actors connected to the dealer network. The case is limited to Volvo Trucks spare parts planning in a European context, with a specific focus on the current bad-will parameter in the total cost model. The purpose is not to redesign the full planning system, but to evaluate how customer-related consequences are currently represented and how this relates to dealer-facing perceptions of service failure.

In this context, it was necessary to investigate what approach is ideal for the following project. Flick (2018) emphasizes that an inductive approach is ideal for exploring new and uncharted territory. This enables the researchers to discover new patterns and theories that are grounded in reality. However, Flick (2018) also claims there is weaknesses with a purely inductive approach, and points out that it can be difficult to explain the mechanisms and reasons for patterns. A deductive approach on the other hand allows, according to Bell et al. (2022), researchers to base the research on theoretical frameworks and ideas within the area. Therefore an abductive approach was the most valid in this research, to enable a better interplay between existing

theory and gathered empiricism. This abductive logic was operationalised through a qualitative research design. The choice of this design is motivated by the nature of the research problem, which mainly involves an existing analytical model and customer perceptions of service outcomes that are not fully observable or defined. In the context of this study on understanding how customer- and service-related consequences are represented in the total cost model used by Volvo and how these representations are related to customer perceptions, a qualitative methodological approach is a suitable method to capture all nuances.

Firstly, the pre-study established a clear understanding of the current representation of customer- and service-related consequences within the total cost model for spare parts distribution, shown as in figure 2.1. This structured understanding was necessary in order to formulate relevant and theoretically grounded questions for the following qualitative investigation. In parallel to the pre-study the literature review was done to form a theoretical base to find out what the current model could theoretically be missing and to give a gap between model and theory, which was the basis for the interviews to understand what actually mattered.

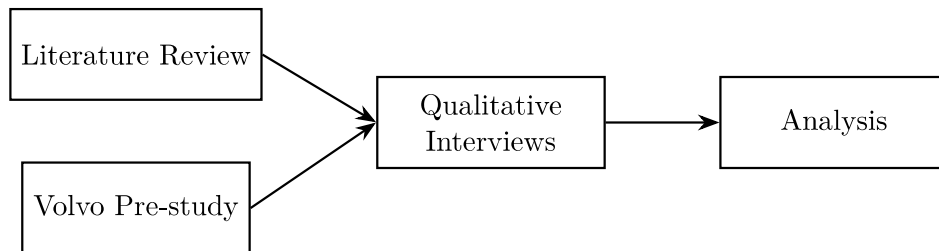


Figure 2.1: Methodology Overview

In this study, the qualitative part was used to explore both the research area within Volvo and how dealer-facing and market-facing actors perceive and describe the consequences of spare parts service failures in practice. This phase allowed important service related consequences to emerge without being restricted to predefined categories only found in literature or the current total cost model. This made it possible to identify patterns such as differences between customer segments, regions, or service contexts, and to identify patterns in which consequences were perceived as most significant within the studied case. The study's abductive nature was reflected in how it combines these elements, the deductive foundation ensured alignment with established theories, while the exploratory qualitative phase allowed for the inductive discovery of new dimensions. This ensured that the final analysis was not only grounded in literature but also kept the ability to incorporate perceptions that may be used in practice but is not covered in theory.

2.2 Literature Review

The literature review aimed at study existing theory and frameworks in the researched area. The literature review was performed in the order seen in figure 2.2. Firstly, trends and shifts in supply chain management and design were reviewed to understand the context and trends that are affecting the organisation. Then the market landscape was investigated to better understand the dynamics of the aftermarket supply chain. Furthermore, the operations in supply chain, which is mechanisms of demand planning, logistics distribution, and risk mitigation was examined in order to understand what dictates real-time part availability. Lastly, theory on customer bad-will was investigated, which generates an understanding of what the bad-will parameter means and its function within cost calculation. The literature review was the first step of the qualitative research design, parallel with the Volvo pre-study. According to Snyder (2019), a study needs to be grounded in already existing research in order to bring any value. This resulted in interviews that are not just based on guesses and interpretation, but rather a systematic mapping and understanding of the subject. Yin (2018) argues that a researcher that starts off with interviews without a literature base run the risk of collecting huge amount of irrelevant data that is not applicable for the study. Additionally, both Yin (2018) and Snyder (2019) argue that the literature is essential for the operationalization of research variables. Operationalization refers to the process of translating theoretical concepts into measurable indicators or questions. Therefore, the research started off by studying trends and shifts in the supply chain in order to properly map and understand how the Volvo's supply chain was affected by these in order to perform a valuable research. Furthermore, the review continued by looking at the market landscape and its operations to properly understand the context of Volvo's supply chain. The literature review finished off by investigating the bad-will parameter; how it is defined and what factors that influence the evaluation of the parameter.

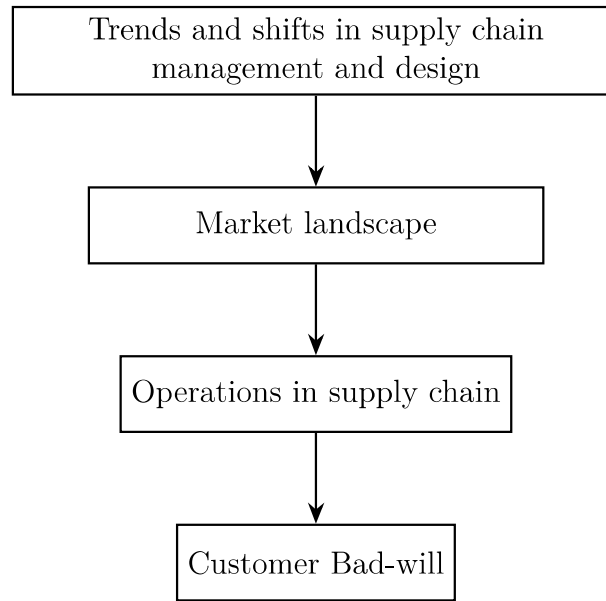


Figure 2.2: Flow of literature review.

2.3 Volvo Pre-Study

This part of the study focused on describing and mapping how customer- and service-related consequences are currently represented in Volvo Group's total cost model for spare parts distribution. The purpose was to develop a structured understanding of how such consequences are defined, operationalized, and used within the model, and to compare this representation with established theories on total cost models presented in the literature review. This mapping provided an analytical foundation for the following parts of the study.

Methodologically, this part was designed as a descriptive pre-study of the current application of the total cost model within Volvo Group. According to Bell et al. (2022), these studies are appropriate when the objective is to gain an in-depth understanding of a phenomenon within its real-life context. In this study, the total cost model was examined as it is used in practice rather than as a purely theoretical construction, making a pre-study approach suitable. The pre-study relied on qualitative data collection methods, specifically semi-structured interviews with people that has knowledge on the subject and complemented with internal document analysis. Two phases of semi-structured interviews were conducted with individuals who work with the total cost model and its parameters and selected to provide a more accurate evaluation of the bad-will parameter. The first phase of interviews had questions that are broad and open ended to gain a basic understanding of the current total cost model and the use and definition of bad-will, as shown in appendix A. The second phase interviews aimed at gathering required knowledge in order to perform a mapping of dealer-facing aftermarket structure. The questions in the second phase of interviews were completely open ended in order to get the full perspective of the dealer network structure meanwhile having no prerequisites.

This interview format allowed the researcher to follow a predefined structure while remaining flexible to explore issues that emerged during the interviews. Bell et al. (2022) notes that semi-structured interviews are particularly useful when the researcher seeks detailed insights into processes, interpretations, and how decisions are made by people that work closely with the investigated area. In addition to interviews, internal documentation related to the total cost model and its parameters was analysed. The document analysis provided access to definitions, assumptions, and intended uses of the model and allowed the authors complementing insights obtained through interviews. Bell et al. (2022) emphasize that combining interviews with document analysis strengthens the credibility of the study research by enabling data triangulation.

The interviews and document analysis together enabled a systematic description of how the total cost model currently incorporates customer- and service-related consequences. This approach supported a comparison between the model's practical application and theoretical perspectives on total cost models, while ensuring that the analysis is grounded in both formal documentation and practitioner knowledge.

2.4 Qualitative Data Collection

Building on the mapping of Volvo's internal model and literature, this phase of the study employed a qualitative approach to explore the nuances of customer-perceived service outcomes. The primary objective was to investigate the concept of bad-will from the perspective of both customers and customer-facing roles, moving beyond the parameters currently defined in the total cost model. Additionally, good-will was analysed and set in comparison to the bad-will component to investigate the relation between the concepts.

2.4.1 Qualitative Interview Strategy

To capture the complexity of service perceptions, semi-structured interviews was conducted. According to Bell et al. (2022), this format is ideal when the researcher has a clear focus but still allows the respondents to challenge existing assumptions and introduce new dimensions of the data collection. By using an interview guide with open-ended questions, the study could ensure consistency across different interviews while still being responsive to the unique experiences of the participants.

2.4.2 Sampling and Participant Selection

The study utilized a purposive sampling strategy, which Bell et al. (2022) describes as a non-probability sampling method where participants are selected based on their relevance to the research questions. To ensure a holistic view of the "service encounter" participants was selected from three main categories:

Internal Experts on Total Cost Model: Roles that interact and implement the total cost model and its parameters.

Internal Customer-Facing Roles: Roles such as Operational Refiller, Dealer Inventory Management (DIM), who act as intermediaries and has knowledge of customer pain points.

External Perspectives: Dealers and roles at the Regional Market Companies who directly experience or interact with the consequences of spare part availability and downtime.

This diverse sampling aimed to achieve triangulation, enhancing the credibility of the findings by comparing perspectives from different levels of the distribution hierarchy (Bell et al., 2022).

2.4.3 Participant Overview

This section provides a detailed summary of the primary data sources utilized throughout the three rounds of qualitative data collection. To ensure a comprehensive evaluation of customer bad-will, participants were selected from a diverse range of roles across the supply chain, moving from internal functions to external market actors. In accordance with ethical research standards, all participants have been anonymized. Each interviewee is assigned a unique identifier (e.g., P1.1) that denotes their specific interview round and the order of their interview.

The initial round of interviews was conducted during the Volvo pre-study phase to establish a baseline of the organization’s current planning approach and use. Participants were purposively selected based on their direct involvement in the maintenance and digital implementation of the total cost model (TCM). These experts provided the necessary context to identify the structural gaps in the existing bad-will parameter, and the participants are presented shown in table 2.1.

Table 2.1: Round 1 Participants: Internal Experts (Volvo Pre-Study)

ID	Role	Research Interaction	Duration
P1.1	Supply Chain Data Modelling Expert	Expert on Total Cost Model	60 min
P1.2	Supply Chain and Analytics Expert	Expert on Total Cost Model	60 min
P1.3	Manager Advanced Analytics	Total Cost Model	60 min
P1.4	Digital Developer	Implementing TCM in ERP-system	60 min

The second round interviews, presented in Table 2.2, targeted market intermediaries who has knowledge of dealer behaviours and logistical pain points. These customer-facing roles were selected as they act as the primary link between Volvo’s service operations and the market. These participants provided insights into how service

failures are communicated, escalated, and managed within different European segments, offering a broader view of customer satisfaction and dissatisfaction.

Table 2.2: Round 2 Participants

ID	Role	Research Interaction	Duration
P2.1	DIM Coach Penta	Customer-facing role	60 min
P2.2	DIM Coach Trucks	Customer-facing role	60 min
P2.3	Operational Refiller 1	Order Handling	60 min
P2.4	Operational Refiller 2	Order Handling	60 min
P2.5	Flow & Digitalization Developer	Mapping Quality Issues from Dealers	60 min
P2.6	Parts Logistics Manager 1	Dealer Role	60 min
P2.7	Parts Logistics Manager 1*	Spare Part Criticality	60 min

*Follow up interview, same interviewee as P2.6.

The final round of interviews included actors such as dealers and roles working closely with the dealers. These participants were selected to provide direct evidence regarding the operational and financial consequences of spare part stockouts. Their data was used for validating the analytical framework against real-world drivers of bad-will.

Table 2.3: Round 3 Participants

ID	Role	Region	Duration
P3.1	Manager Spare Parts Sales	Northern Europe	90 min
P3.2	Business Logistics Manager	Northern Europe	90 min
P3.3	Workshop Manager	Eastern Europe	45 min
P3.4	Manager Parts Support	Central Europe	60 min
P3.5	Workshop Manager	Eastern Europe	45 min

2.4.4 Thematic Coding

Following the data collection, the material was analysed using thematic analysis inspired by Bell et al. (2022) and Vila-Henninger et al. (2024). As Bell et al. (2022) suggest, this involves a systematic process of coding the transcripts to identify reoccurring patterns and themes. These themes were then mapped against the theoretical framework that was conceptualized from the literature review, and the parameters identified in Volvo pre-study.

2.5 Analysis

After the empirical data had been collected, the interview notes, transcripts, and internal documents were organized and reviewed in relation to the purpose of the

study and the two research questions. The analysis was conducted as a structured qualitative interpretation of the material, where the aim was to identify patterns relevant to how bad-will is currently represented in the total cost model and how service failures are perceived in practice. The analysis was carried out iteratively rather than a strict linear procedure.

First, the internal material from the Volvo pre-study, including interviews and internal documentation, was reviewed in order to map the current total cost model and the existing bad-will parameter. This material formed the basis for Chapter 4 and answering the first research questions. Secondly, the interview material from the dealer and market-facing actors was reviewed and grouped thematically. The analytical framework presented in Chapter 3 served as a guiding structure in this phase, meaning that the material was examined in relation to the themes in the analytical framework. At the same time, the analysis remained open to relevant observations that did not fit into the categories, which is why an additional category of other themes was also included. This material forms the basis for chapter 5.

The final stage of the analysis consisted of comparing the different empirical sources with each other and with the theoretical frame of reference. More specifically, the internal mapping of Volvo's current bad-will parameter was compared with the dealer-facing interview insights and the concepts identified in the literature review. This comparative process made it possible to identify where Volvo's current model aligns with practice and theory, and where important drivers of bad-will appear to be under-represented. This forms the basis for the analysis in Chapter 6 and the discussion in Chapter 7.

2.6 Research Quality and Trustworthiness

When it comes to research quality, Lincoln and Guba (1985) propose *trustworthiness* as a criteria for evaluating qualitative research, consisting of four dimensions: credibility, transferability, dependability, and confirmability. This study is evaluated according to these four dimensions.

2.6.1 Credibility

Credibility refers to how trustworthy the findings of the study are, which is whether the results are reliable given the data and the context in which the study was conducted (Bell et al., 2022). Through the use of semi-structured interviews, recordings, and transcriptions the credibility was increased. This choice of method made it possible to engage with the empirical material during the analysis back and fourth. Data collection followed a multi-phase approach, beginning with a literature review and a pre-study at Volvo and followed by in-depth interviews. This design made it possible to dive deeper into the topic and to compare perspectives across different phases. In the third round of interviews, respondents received the questions in advance, which allowed for more relevant responses. Interview notes and transcripts were reviewed immediately after each session in order to minimise recall bias, and

questions were not phrased in a leading manner, which Lee et al. (2022) note is important for reducing bias.

2.6.2 Transferability

Transferability refers to how applicable the findings may be in other contexts. Instead of relying on statistics, qualitative research supports transferability through more thorough descriptions that allows readers to decide whether the findings may transfer to other settings (Bell et al., 2022). This study also supports transferability through a single-case study design focusing on the internal functions within Volvo. By clearly describing the organisational context and the definition of the bad-will parameter, the study provides the contextual detail that enables readers to assess whether the findings may be relevant in other contexts.

2.6.3 Dependability

Dependability concerns the consistency and transparency of the research process over time (Bell et al., 2022). Lincoln and Guba (1985) suggest that dependability can be enhanced through the use of an audit approach, in which the researchers keep records of all phases of the research process. In this study, dependability was supported by systematic documentation of the research design, the sampling logic, the interview procedure, and the analytical approach. Interview guides were prepared before each session, and the decision to record and transcribe the interviews provided a stable and reviewable data base for the analysis. The involvement of two researchers throughout the entire process, including the analysis, further supported a consistent process and reduced the risk of relying on a single subjective interpretation.

2.6.4 Confirmability

Confirmability concerns the degree to which the findings reflect the data itself rather than the researchers' own values or preferences (Bell et al., 2022). It is not assumed that complete objectivity is reached, however, confirmability can be strengthened by showing that the study was conducted with good intentions but also grounded in the data (Bell et al., 2022). Confirmability was in this study enhanced by keep and present the different stages of the data collection. The audio recordings and transcripts made it clear and comprehensible to what data the analysis were relying on. The study also distinguishes between primary data, collected by the researchers through the interviews, and secondary data, consisting of internal documentation provided by Volvo, since acknowledging the characteristics of the data strengthens this grounding (Bell et al., 2022). In addition, informed consent and confidentiality helped participants speak openly, which improved the quality of the data underpinning the interpretations.

2.7 Ethics

Ethical aspects were considered throughout the study. A central concern was obtaining consent for the use of responses from the interview participants. All participants have been, and will remain, anonymous, which the respondents were informed of at the beginning of each session, and consent to record was requested at the start of every recorded interview. Other sensitive information was removed, and names, cities, and countries that could identify a respondent were anonymised. The transcripts and recordings were deleted once the study was completed.

2.8 AI

To ensure that the data remained in the organization and was able to be deleted after the study, the internal AI GptVolvo was used. The use of AI during the creation of this thesis has been limited to three purposes. The first purpose was to transcribe the audio-recording from the third round interviews. In order to ensure the output of the transcriptions, the transcriptions was checked against the recording, and by that validating that the generated output was correct. The second purpose of use of AI was to identify deficiencies of the language throughout the report in order for the authors to identify areas for improvement. The final purpose was to generate LaTeX and TikZ code relating figures and tables in this study.

3

Theoretical Frame of Reference

This chapter presents the concepts that frame this study. Sequentially, the theoretical frame of reference addresses trends and shifts in supply chain management and design, market landscape, operations in supply chain, and customer bad-will. The frame of reference is structured as such in order to provide a comprehensive overview of each domain, thereby building the foundational knowledge required to understand the subject of the study.

3.1 Trends and Shifts in Supply Chain management and Design

This section outlines trends that have shaped modern supply chains and the demands that is put on the organization. It focuses on shifts that are relevant for firms operating in global and service-intensive markets, including increasing globalization, the growing importance of servitization, the strategic role of the aftermarket, and evolving approaches to supply chain design. Together, these trends provide the contextual background for understanding how spare parts distribution and service performance have become central elements of competitive advantage, and why customer-related consequences of service outcomes are increasingly important in supply chain decision-making.

3.1.1 Globalisation

Many companies that operates as a global brand with business activities across all populated continents are competing in a global market. This places specific demands on the companies both as a brand and as an organization, especially in terms of coordination, efficiency, and service performance (Ivanov and Dolgui, 2020). Over the past two decades, there has been a clear trend toward gathering products and services under unified organizational structures (Christopher, 2011).

This shift from locally organized operations to globally integrated supply chains introduces several challenges. Global markets are non-homogeneous, requiring firms to manage varying customer expectations, differences in regulation, and uneven demand. This balance between central global coordination and local market differences shows a main challenge, that is illustrated in Figure 3.1 through the Integration Responsiveness framework (Doz and Prahalad, 1991).



Figure 3.1: Integration Responsiveness framework adapted from Doz and Prahalad (1991)

Global integration through unified structures allows a company to use economies of scales. However, this must be balanced with the need for high local responsiveness to meet the specific needs of the local customer (Hout et al., 1982; Doz and Prahalad, 1991; Christopher, 2011). At the same time, global supply chains demand high levels of coordination to manage complex logistics networks that are associated with increased costs and longer lead times (Christopher, 2011). As supply chains grow in scale and complexity, they also become more vulnerable to disruptions, where a disturbance at a single node can trigger ripple effects that spreads through the network and across national borders (Dolgui et al., 2018). If the global system fails to provide local responsiveness during a vehicle breakdown, the customer does not view it as a logistical ripple but rather as a local failure of the promised service.

This perception of failure can be because of lack of alignment between global strategy and local expectations. The concept of institutional distance helps explain why achieving the necessary balance is so difficult. Institutional distance is defined as the difference or similarity between the regulatory, cognitive, and normative institutions of the home country and the country of the customer (Kostova and Zaheer, 1999). This distance creates a significant challenge because it affects the difficulty of understanding and correctly interpreting local requirements. For a transnational enterprise, establishing organizational legitimacy, which is the acceptance of the organization by its local environment, is a complex process that operates primarily at the level of the local subunit (Kostova and Zaheer, 1999). This implies that meeting the needs of the customer and securing legitimacy must happen locally rather than centrally.

3.1.2 Servitization

The term servitization was coined in 1988 to describe the trend of adding value to firms core offerings by adding services to enhance corporate competitiveness, turnover, and market power (Vandermerwe and Rada, 1988). Vandermerwe and Rada (1988) viewed servitization as the evolution where firms go from seeing their business as "goods or services", to "goods and services", and finally to "goods, services, support, knowledge, and self-service". This shift in view has a monumental effect on the way of making business, moving away from traditional "sell-sell" mentality and moving towards a relational approach by doing value-adding services to solve customer problems. Vandermerwe and Rada (1988) further mentions that in a globalized market, a total fixation on the product itself is easily copied, while focusing on creating more value for customers through increasing value-added services is the way to stay ahead of its competitors.

According to Baines et al. (2009) servitization can be divided into 5 different academic research communities. Every single one if them can be seen as a unique part of the servitization trend/shift and together they form a completing perspective on how and why companies/firms are moving more and more towards service models. **Services marketing** address the shift from distribution of physical products to handling of customer relations through services. Earlier research defined services as intangible, heterogenous, inseparable and perishable while the latter, known as service-dominant logic, defines that value is created through co-creation with customers through processes, knowledge, and skills. Secondly, Baines et al. (2009) identify **service management** which focuses on organizational culture and the growth of service-oriented societies, meaning that focus is no longer solely on production but rather in a service society. The third community is **operations management**, which is the most productive community within servitization, focusing on creating strategies of delivering integrated combinations of products and services. It emphasizes the weight of the manufacturer to innovate its processes to sell "desired outcomes" rather than just physical products. **Product-service systems** emphasizes the idea of selling the fuction of a product, rather than just the product itself, and focuses on the sustainability and environmental aspect. The last community that is pointed out by Baines et al. (2009) is **Service Science, Management, and Engineering** which aims to cover different areas that integrate computer science, engineering, and management to create a multidisciplinary foundation for service systems. This community see services as complex systems where people, technology, and organizations interact to co-create value by focusing on the systematic engineering of services, data and information technology usage to optimize service delivery. By applying a systems-thinking approach, it seeks to bridge the gap between technical innovation and business logic, providing manufacturers with the tools to manage the high level of complexity inherent in advanced service-oriented business models.

Furthermore, the transition toward servitization comes with a reconfiguration of the underlying supply chain structure. This is described by as the product-service system continuum, where the manufacturers responsibility is extended from the point

of sales to the entire product life cycle. In this context, it forces the supply chain to adapt to a closed-loop system capable of managing reverse logistics. However, this transition is not without risks. Theory often highlight the Servitization Paradox, where firms struggle to translate service-oriented strategies into financial returns due to the increased operational complexity and the need for new organizational capabilities (Gebauer et al., 2005).

3.2 Market Landscape

This section gives the knowledge foundation required to analyse the dynamics of the aftermarket supply chain. To generate a thorough understanding, the framework follows a funnel based structure, going from broad market perspective to the specific mechanisms of service failure.

3.2.1 Aftermarket

The aftermarket consists of activities that happen after the initial delivery of what is offered (Cohen et al., 2006). In many cases it includes maintenance, repair, and providing spare parts. In a lot of business contexts these activities account for a large portion of value created and plays a very important role in competitiveness. Strong aftermarket performance is closely linked with recurring revenues, closer relationships and customer loyalty, and differentiation beyond the core offering (Reinartz and Ulaga, 2008; Cohen et al., 2006).

A key challenge in aftermarket operations is the unique nature of spare parts demand. Unlike planned supply, such as manufacturing, where demand often follows stable production schedules, spare parts demand is typically classified as intermittent or lumpy (Cohen et al., 2006). This means that demand is irregular and difficult to predict, as it is closely tied to unpredictable machine breakdowns and unplanned maintenance rather than stable usage patterns. When a breakdown happens, the supplier, warehouse, and planners must act quickly, since each hour of downtime has direct operational and financial consequences for the customer (Cohen et al., 2006). If the supply chain fails to provide the required part, the resulting stockout can trigger specific behavioural responses. Literature on customer response to stockouts suggests that a failure leads to three possible outcomes: the customer may delay the repair, substitute the part with a competitor, or leave the brand entirely (Zinn and Liu, 2001).

The behavioral risks identified by Zinn and Liu (2001) underscore why time is the primary competitive currency when addressing the challenges of unpredictable and lumpy demand. It is therefore unsurprising that time is of the utmost importance when addressing customer needs when a breakdown has happened or the need for service (Cohen et al., 2006). Consequently, time becomes one of the most critical aspects of competition when managing irregular demand patterns (Christopher, 2000). According to Christopher (2000), time is the primary competitive currency in modern markets, where the ability to respond rapidly to customer needs is more

important than pure cost efficiency. This means the distribution network must be designed to minimize the lead time gap, which represents the difference between the time required to deliver a spare part and the window of time the customer is willing to wait during a breakdown (Christopher, 2000).

The importance of speed is further increased that customer dissatisfaction is not static during a delay, it increases as more time passes by (Christopher, 2000; Echeverri and Skålén, 2011). This time pressure creates the conditions necessary for co-destruction, which is the collaborative process that occurs when a service interaction between a provider and a customer results in a decline in the well-being of the system or a loss of trust (Echeverri and Skålén, 2011). Traditional theories focuses mostly on value co-creation where both parties work together to create a positive outcome, co-destruction explains how certain interactions can actively destroy existing relational value (Echeverri and Skålén, 2011). When a necessary part is not in stock and the lead time gap extends beyond what the customer can tolerate, the interaction is no longer a simple delay but becomes a failure of the promise from the brand. The longer a customer waits for a part, the deeper the loss of trust and relational value.

3.2.2 Impact of Spare Parts Attributes on Customer Reaction

The classification and management of spare parts in the aftermarket are increasingly influenced by the specific attributes of the components, as these characteristics significantly moderate the customer's behavioral response to service failures. Within the framework of servitization, the spare part is no longer viewed solely as a product but as a offering in a broader product-service mix (Gaiardelli et al., 2007). The transition from a product-centric to a service-centric view needs to evaluate how part-specific variables influence the perceived service quality from the customer.

The logistical management of maintenance spare parts is fundamentally distinct from other categories due to high service requirements and the potentially severe financial consequences of stockouts (Huiskonen, 2001). Huiskonen (2001) identifies four primary control characteristics that define these requirements: criticality, specificity, demand pattern, and value. Among these, criticality acts as the dominant driver of customer dissatisfaction. The author distinguishes between process criticality, referring to the immediate interruption of revenue-generating operations, and control criticality, which relates to the availability of substitutes or the ease of procurement. When a part exhibits high process criticality, the penalty cost of a stockout is often multiple times higher than the part's commercial value. This disparity creates a high-stakes environment where any lead-time gap is perceived as a significant failure in the brand's service delivery (Huiskonen, 2001).

Furthermore, the specificity of the part dictates the customers dependancy on the provider. While standard parts may have lower control criticality due to market availability, specialized or specific parts tie the customer to a single supply source

(Huiskonen, 2001). In these instances, the unavailability of a specific part is not only a logistical delay but a disruption of the strategic role that the after-sales service plays in maintaining the customer's physical and organizational configuration (Gaiardelli et al., 2007).

According to Gaiardelli et al. (2007) and Cohen et al. (2006), after-sales service functions as a key differentiator and a primary profit source in competitive markets. Gaiardelli et al. (2007) argues that because the aftermarket is characterized by long-term customer relationships, the service performance must account for how different part categories contribute to the overall product-service mix. When a service failure occurs, the customer's evaluation is influenced by the must-be requirements of certain components. If a failure involves a part that the customer considers essential for uptime, the brand is judged not only on the stockout itself but on its ability to provide an integrated recovery solution.

3.2.3 Business Relationships

In industrial markets, the perceived service quality and interaction of service service encounters are closely linked to the history and structure of the relationship between the service provider and customer. Within the interaction approach, a single event, such as a successful delivery or service failure, is not viewed as just an isolated incident but rather it is filtered through the "atmosphere" of the relationship (Håkansson, 1982). What Håkansson (1982) calls the atmosphere, comprises elements of trust, power balance, and expectations in both the service provider and receiver. It acts as a mediator for how a customer evaluates the interaction. In a relationship that is characterized by high levels of cooperation and shared history, a service failure is often perceived as a common problem requiring team work to solve the issue instead of a reason to terminate the partnership (Håkansson, 1982). The degree of involvement between the two parties interacting dictates how resilient the service perception is. High-involvement relationships require substantially more resources to foster, but this also necessitates mutual adaptations that increase the complexity and "cost" of the relationship (Gadde and Snehota, 2000). However, these adaptations and costs create a buffer due to the heavy resources invested and the long-term benefits of the relationship this means that the actors are more committed to maintaining the relationship despite individual service failures. In this context, service success is not the opposite of a service failure or the absence of failure, but the continued strategic benefits of the high-involvement relationship and that the benefits outweigh the resources invested in keeping the relationship (Gadde and Snehota, 2000).

The development of "actor bonds" within business networks significantly influences how service quality is perceived. These bonds represent the social and professional ties that shape how actors perceive each others intentions and identities (Håkansson and Snehota, 1995). Consequently, when a failure occurs, the existing bonds between the provider and receiver mitigate the effects and consequences of a service failure as the receiver is more likely to see it as an anomaly or isolated incident

rather than a systemic lack of capability (Håkansson and Snehota, 1995). On the other hand, relationships with weak actor bonds, the perceived service quality is much more transactional and failures are more likely to trigger "fight" behaviours such as brand switching och bad-mouthing the brand. When there are weak actor bonds, there are fewer social or organisational ties to stabilise the interaction after the service failure (Håkansson and Snehota, 1995).

3.2.4 Regional Differences

A major challenge in adapting service operations to local customer needs is that service quality is not evaluated against a single universal standard. It is rather evaluated in relation to expectations, norms, and operating conditions of the local market (Donthu and Yoo, 1998; Zhang et al., 2008). For a global company, this creates a tension between maintaining a consistent brand promise and responding to differences in how service performance is evaluated across regions (Wong, 2004; Zhang et al., 2008). From this perspective, knowing regional differences are important because customers in different markets may not evaluate the same service in the same way. Expectations regarding acceptable lead times, communication quality, transparency, and service recovery can therefore vary between regions. This means that a shortage situation may generate different levels of dissatisfaction depending on the market in which the service failure happens. Some customers may place high emphasis on speed and predictability while others may value continuous communication and visible recovery efforts from the provider (Mattila, 1999; Wong, 2004; Zhang et al., 2008).

The regional differences do not only concern how customers evaluate service, but also the operating conditions under which service is delivered. In a European context, these differences may also arise from whether a market operates inside or outside the EU customs area, which affects exposure to customs procedures and border formalities. Regulation (EU) No 952/2013 establishes that goods brought into the customs territory of the Union are subject to customs supervision and customs control (Europaparlamentet och rådet, 2013). The regional conditions may also affect the consequences of a service failure once the vehicle is already in operation. Within the EU, according to Directive 2014/45/EU vehicles used on public roads are subject to periodic roadworthiness requirements, and according to Directive 2014/47/EU, commercial vehicles circulating in the Union may also be subject to roadside technical inspections (Europaparlamentet och rådet, 2014a,b). The latter further states that a vehicle with deficiencies representing a direct and immediate risk to road safety may be prohibited from being used on public roads until those deficiencies have been solved. This implies that the consequences of spare parts unavailability may extend beyond repair delay alone, since the absence of certain components may affect whether the vehicle can continue operating legally.

3.3 Operations in Supply Chain

This section transitions from the strategic architecture of the supply chain to its daily functional execution. While previous chapters established the global landscape of the aftermarket, Operations represents the "front line" where the brand's service promise is either realized or broken. By examining the mechanics of demand planning, logistics distribution, and risk mitigation, this chapter outlines the specific activities that dictate real-time part availability.

The operational process relies on the seamless integration of three core functions: demand planning to anticipate market requirements, logistics and distribution to manage physical fulfillment, and risk management to ensure system resilience against unforeseen disruptions. Central to these operations is a continuous balancing act: the trade-off between achieving high cost-efficiency and maintaining the service responsiveness necessary to prevent customer dissatisfaction. In the context of this study, these operational layers form the primary drivers of the service failures that ultimately trigger a bad-will reaction.

3.3.1 Supply Chain Design

The design of the supply chain is an vital part of the strategic positioning of a company. Where a more traditional way of supply chain design would be based on the premises of the flow of products with the focus on cost effective supply chain design and economies of scale. However, even though these view is very valid still today, the shift of supply chain design is increasingly depending on the servitization. This means that the supply chain is more focused on being responsive in order to be fast and decrease downtime. Since the aftermarket has a unpredictable and irregular demand, the design must prioritize availability over transport costs to some degree (Saccani et al., 2007). Further Saccani et al. (2007) mentions that there is no best configuration of the supply chain design for all companies, but rather that it depends on some specific drivers and that it is usual that successful companies adapt different types of configurations depending on products and markets. These drivers could be the attractiveness of the aftermarket to the company, product attributes, and customer service level requirements. The strategic use of CDC, RDC, and SDC is a structure necessary in order to balance global effectiveness against local responsiveness, especially when the goal is to ensure high uptime for customers. Chopra and Meindl (2007) describes the framework for the network design and emphasizes that the choice of the amount of distributional centres is dependent upon the balance between the costs of inventory, transports, and responsiveness. One way to decrease response time is for the inventory to be located closer to the customers, while having more distributions centres will increase costs, which showcase the complex trade offs between costs and responsiveness. Cohen et al. (2006) mentions that the aftermarket is a "different animal" and that it is necessary to accept inherent structural inefficiencies within the networks design, such as having high operational costs of RDCs, in order to guarantee uptime, where failure to ensure such availability carries the risk of loosing the customer to a competitor.

Chopra and Meindl (2007) argues that vital decision points within the network design is regarding amount of facilities, the location, capacity, allocation, and structure of flow. These decisions is needed to address in order to reach the goals of costs, responsiveness, and service. Responsiveness is necessary to decrease downtime for customer, in order to increase service quality but this comes at increased costs. The target level of responsiveness and service should therefore be set through an explicit trade-off between the cost of increased responsiveness (e.g., more facilities, higher inventory, and faster transportation) and the service consequences of longer response times in the aftermarket context (Chopra and Meindl, 2007). According to Simchi-Levi et al. (2008), spare parts networks are often organized as multi-echelon systems, i.e., inventory is positioned across multiple stocking levels (e.g., central, regional, and local). Such a structure enables coordinated inventory planning across echelons to improve service while controlling total cost. CDC acts as the primary hub for centralized risk pooling, allowing for a assortment breadth and cover a higher geographical reach and, consequently, longer lead times. RDC are strategically positioned to enhance regional responsiveness and balance inventory investments against the necessity for reduced lead times within certain geographical areas. SDCs represent the highest localized responsiveness for high-prioritized and critical parts and minimizes downtime through high availability, it comes with the highest cost per stock keeping unit.

3.3.2 Demand Planning and Forecasting

Demand forecasts form the basis of all supply chain planning. Pull processes are performed in response to customer demand, where push processes are performed in anticipation of what the demand is going to be. These push processes requires a planning of the demand in order to ensure appropriate production, transportation, and other activities (Chopra and Meindl, 2007). By applying different models and theories to perform forecasts, companies can better plan to better meet future demand, but also better handle disruptions and fluctuations in demand that may cause disturbances for the organisation. By having accurate forecast and demand planning, the organisation can avoid costly overstocking, in terms of holding cost, scrapping cost, and tied up capital, and also avoid costly understocking, in terms of revenue loss, reputational damage, and customer dissatisfaction. According to Chopra and Meindl (2007), forecasting can be divided into four different types; Qualitative, Causal, Simulation, and Time Series and further argues that the latter is the most appropriate one when future demand is related to historical demand, growth patterns, and any seasonal patterns. The authors also mentions that studies indicates that using multiple forecasting tools to create a combined forecast is more appropriate than using a single one only. Furthermore, any observed demand can be broken down into two components, a systematic component and a random component, where systematic measures the expected value of demand and the random components corresponds to the part that deviates from the systematic part (Chopra and Meindl, 2007). A company should not forecast the direction of the random component but they should predict the size and variability which provides a measure of

the forecast error.

A higher variability in demand will then require a higher safety stock in order to maintain the targeted service level which subsequently will increase costs. In the same way, if the variability is underestimated, it runs an increased risk of stockouts which leads creates customer dissatisfaction and what is in this report referred to as bad-will.

There is different types of demand that is defined through 2 parameters; average demand interval and coefficient of variation (Syntetos and Boylan, 2005). Smooth demand is the types that has frequent demand and the variation is low, and this type is generally highly predictable and are at low risk of stockout. Intermittent demand is a demand type that is infrequent but but when it occurs, the quantities are the same (low variation). The main challenge for this type of demand is the timing of the demand and can generate stockouts when the system fails to predict when a part is needed even though the quantity is known. Erratic demand occurs frequently while the quantities vary significantly (high variation). The high variation in demand entails difficulties in maintaining the targeted service level. Lumpy demand is characterized by high variation in quantity and infrequent demand. This combination makes it the most difficult to forecast accurately, often leading to stock-outs, which can lead to service failures (Syntetos and Boylan, 2005).

Additionally, all different stages of the supply chain often have their own forecast which cause the phenomena of bullwhip effect. According to Chopra and Meindl (2007) this means that minor fluctuations in demand downstream can amplify into substantial oscillations upstream. This is problematic when there is little or no information sharing between the different stages of the supply chain, generating substantial imbalances in the network. Conversely, these oscillations can be mitigated through information transparency and a proactive collaborative approach. By sharing real-time data across different parts of the supply chain, the network can increase synchronisation and thereby reduce the risk of shortages (Chopra and Meindl, 2007).

3.3.3 Logistics and Distribution

Logistics and distribution operations are the activities that turn a supply chain design into a provided service or product (Christopher, 2011). While the design of the network defines where parts are held, the operations define how fast and reliably they reach the customer. In this context, the primary goal of logistics is to provide high logistics service quality, which is defined as the ability to deliver the right part to the right place at the right time (Mentzer et al., 1989). A central aspect in these operations is balance between costs and service level. Increasing the service level, such as reducing lead times due to using expedited delivery or increasing stock levels much higher than needed to meet demand, leads to higher costs. On the other hand, minimizing warehouse and transportation costs often results in a lower service level and higher lead time for the customer (Chopra and Meindl, 2007; Christopher, 2011).

When a customer requires a spare part that is currently not in stock, utilizing more costly transport modes such as air freight serves as an example of service recovery in action (Hart et al., 1990). Service recovery encompasses the specific operational efforts an organization undertakes to identify, address, and resolve a service failure to restore customer satisfaction (Hart et al., 1990). According to Grönroos (2015) the way a firm responds to such a failure is often more critical for maintaining long term loyalty than the original service encounter itself. Operationally, this requires the coordination of resources to solve urgent stockouts through mechanisms such as expedited freight or emergency shipments. Although these recovery operations significantly increase the total logistics cost, they are essential to prevent the active destruction of value that occurs when a customer is dissatisfied with the provided service (Hart et al., 1990; Echeverri and Skålén, 2011).

3.3.4 Risk Management and Mitigation

Risk associated with forecast error must be addressed when performing demand planning, and these errors can cause a drastic misallocation of resources in inventory, facilities, transportation, sourcing, pricing, and information (Chopra and Meindl, 2007). There are many frequent and infrequent factors that affect the accuracy of forecasts performed, where long lead times, seasonality, and short life cycles decrease the reliability of the forecast and increase error (Chopra and Meindl, 2007). Chopra and Meindl (2007) further mentions two strategies to mitigate forecast risks, which is to increase responsiveness of the supply chain and utilizing opportunities for pooling of demand. Once again, these strategies come at the price of higher cost. Another way to manage risk in the supply chain is to build in resilience into systems according to Guo et al. (2025). The authors define resilience as the chain's capacity to *persist*, *adapt* and *transform* when facing interruptions. This serves the purpose of minimizing economic damage and product shortages caused by sudden demand surges or supply interruptions. These risk management strategies intend to minimize the random demand component in order to create as accurate forecast as possible.

Another major risk, specifically in multi-echelon networks, is that each node, meaning CDC, RDC, and SDC, may optimize inventory independently which may foster the bullwhip effect. This phenomenon is known as the disjointed method and is best addressed by the sharing of information through the nodes, upstream and downstream (Guo et al., 2025). Furthermore, global distribution networks are particularly vulnerable to the ripple effect. The ripple effect is a disruption taking place in a single node that affects the entire hierarchy and eventually impacts the end-customer, demonstrating the issues taking place upstream have an effect downstream and turn into a service failure. These issues are often mitigated through expedited freight to decrease lead times and downtime. The concept of service recovery becomes vital, referring to organizations' capabilities to resolve a service failure quickly in order to restore customer relationship.

Ultimately, by creating risk mitigation through responsiveness and redundancy means higher operational costs, and the challenge lies in determining the values of these investments; how much is the service failure prevention valued, and does this stand in comparison to the resulting customer dissatisfaction? This creates continual trade-off and is something that a total cost model aims to evaluate by balancing tangible costs against the intangible cost of service failure, such as the bad-will component.

3.4 Customer Bad-will

Within the context of logistics planning and inventory management, total cost models is used to find the most profitable service level by balancing costs of keeping stock against the costs that emerges when in shortages. The costs of overstocking is easier to quantify and can be calculated as a specific number, while costs of understocking is more difficult to quantify. More specifically, the intangible component of customer bad-will, i.e., goodwill erosion, is complex to quantify. The costs of understocking can be divided into the tangible costs, such as costs of express freights, administrative costs of express freights as well as the cost of lost sales, and the intangible costs that represent the estimated monetary value of a negative customer experience which compasses the risks of future customer defection to competitors as well as the potential for brand erosion through the spread of a negative corporate image (Jonsson and Mattsson, 2005). The cost of the bad-will is not a single cost but instead emerges in the gap between customers expectancy and the actual service delivered.

Customer goodwill, on the other hand, refers to the accumulated trust and relationship value created through consistently reliable service (e.g., high availability, short response times, and effective problem resolution). While goodwill is built gradually through repeated positive experiences, bad-will may arise abruptly when customer expectations are not met, and it typically manifests through increased switching propensity, reduced future purchases, and negative word-of-mouth. The customers reaction of a shortage is according to Campo et al. (2005) defined as three different types of perceived costs.

- **Substitution costs:** The diminished utility experienced by the customer when compelled to opt for a sub-optimal alternative or incur a higher purchase price.
- **Transaction costs:** The temporal and cognitive effort required for the customer to identify a replacement product or transition to an alternative supplier.
- **Opportunity costs:** The loss of utility or potential gain realized by the customer when the consumption of a product is restricted or entirely foregone.

These represents the basis for the reaction of the customer, which in turn creates the bad-will for the company.

3.4.1 Components of Customer Bad-will

The customer bad-will component can be broken down into more specific and factors the all contribute to the component and in turn affect the company's long term profitability.

The first one is the *loss of future sales* and represents the costs related to when a single shortages can lead to the customer reevaluate its loyalty to the company. If the customer perceives a supplier as not reliable, this increases the risk of a customer changing brand to the next big investment or purchase. In addition to this, Campo et al. (2005) mentions that there is certain circumstances that affect the negative consequences of a shortage in terms of loss of sales. The effect is mentioned to be dependent on whether the product is a planned order or not. If a planned order is not fulfilled, it tends to result in more dissatisfaction and negative reaction compared to a "impulse purchase". Important products is also heavily affecting the reactions, since the opportunity costs is higher for products that the customer view as important, which in turn increases the risks of change of supplier to competitors and furthermore miss out on potential sales.

The second component is identified as *value co-destruction* and refers to when the relational value between the customer and supplier is actively destroyed when a promised service is not provided. Here the lead time is essential and the longer wait for the promised service, the bigger loss of reliability from customer to supplier. The downtime does not only imply missed service, but it also creates high transaction costs in terms of time and mental effort for the customer to search for alternatives. Extended lead time heighten the risk for the customer experience a total loss of consumption, which is identified by Campo et al. (2005) as the primary driver for terminating relationships or changing to an alternative supplier. Additionally, stockouts should not be seen as a binary event but instead as a gradual, sub-optimal realization of value. As the customer's time and capital are increasingly drained by extended lead time, the customer utility decreases and eventually reaches a point of total consumption loss (Campo et al., 2005). Further on, the author mentions that such a situation starts a chain of reaction in which every negativ point of interaction, such as insufficient update on delivery, will move the position closer to total destruction. Other drivers of this component, as identified by Echeverri and Skålén (2011), include practice misalignment, resource management, the dual nature of value destruction, and underlying structural factors. In the context of spare parts logistics, misalignments in practices often appears by conflicting procedures and understanding between the supplier and customer regarding service availability. The value destruction appears when the parties are not well-coordinated in terms of procedures, when there is discrepancy in understanding situational urgency of orders, and commitment to solving the issues Echeverri and Skålén (2011). This is related to resource-based drivers, where the misuse or loss of resources, such as time and capital during a breakdown, directly results in diminished well-being for the customer. Furthermore, the authors describe value destruction as both an interactional process and an outcome. This implies that a stockout is a dynamic decline in value caused by deficient communication or imbalances of power within the supply chain.

The third component is identified as the *Word-of-Mouth and Image-damage*. In today's globalised market, negative information is spread much faster. Through social networks and digital platforms negative experience can be spread and reached by thousands of people in a short time. This require companies to be extremely reactive because a small mismatch locally can lead to issues globally.

In order to minimize these components of bad-will, companies must address service recovery after a failed service. According to Smith et al. (1999) the perceived service recovery consists of three dimensions which highly reflects the customers satisfaction.

- **Distributive justice:** This refers to the material compensation that has been carried out in comparison to what losses they have been exposed for. The customer evaluate this with regard to what discounts, refunds, or coupons that has been offered to compensate for the actual service or product.
- **Procedural justice:** This relates to the customer's evaluation of protocols and procedures that is used when a stockout occurs. The assessment depend on the processes are perceived as agile and responsive or a heavily administrative burden for the customer, and if the latter it will increase customer dissatisfaction.
- **Interactional justice:** This refers to the interaction between customer and provider of the service, and the quality of the interpersonal treatment and communication. In high context cultures, intangible signals, such as empathy, transparency, and apologies can be more valuable than financial remuneration.

Smith et al. (1999) also mentions the concept of service recovery paradox, that a customer can actually increase loyalty toward a company when the company is addressing a stockout in an exceptionally good manner. This shows that the service recovery is not just an inevitable costs, but also an critical point where the right action can turn a cost into a future profit.

3.5 Analytical Framework

The analytical framework presented in this section represents a conceptual synthesis derived from the integration of established academic literature. This framework serves as the structural foundation for the study, providing the necessary thematic categories to formulate the qualitative interview guides and acting as the primary lens through which the empirical findings are analyzed. By establishing this theoretical baseline, the research can systematically evaluate the discrepancies between standardized operational metrics and the multi-dimensional process of customer evaluation during service. The framework is structured as a sequential appraisal process, where a single service failure event serves as the primary trigger that initiates the customer's entire evaluation journey.

The foundational layer of how the customer will react is the operational impact

this service failure will have for the customer, while the unavailability of non-critical components may generate minor inconvenience, failures that put revenue-generating equipment out of use result in an immediate and sharp escalation of bad-will. This impact is compounded by the duration of the delay, as dissatisfaction is not a static cost but an variable that grows more severe as downtime extends beyond the customer's operational tolerance (Christopher, 2000). The customer's evaluation is further influenced by the specific characteristics of the component (Cohen et al., 2006; Gaiardelli et al., 2007; Huiskonen, 2001). Attributes such as the part's life cycle phase, price, its scarcity in the market, and its historical demand frequency influence the customer's perceived "fairness" of the stockout. For instance, a failure regarding a high-frequency, modern component is often judged more harshly than a stockout for an obsolete or highly specialized part. Beyond the technical and operational characteristics of the stockout, the service interaction between the customer and the company also plays an important role in shaping the customer's response. During a service failure, the way in which the company communicates and manages the situation can either mitigate or amplify customer dissatisfaction (Grönroos, 2015; Hart et al., 1990). Clear and transparent communication regarding the reason for the stockout, expected delivery times, and potential alternative solutions can help reduce frustration and maintain customer trust. Conversely, poor communication, lack of updates, or insufficient efforts to support the customer may worsen the perceived severity of the service failure.

The framework also incorporates the competitive environment in which the service failure occurs. In markets where customers have access to multiple alternative brands or suppliers offering similar solutions, the consequences of a stockout may be more severe. Customers who can easily switch to competing brands may be less tolerant of service disruptions, increasing the risk that dissatisfaction translates into lost sales or long-term damage to the customer relationship. In contrast, in markets with limited alternatives or higher switching costs, customers may be more likely to tolerate temporary disruptions. Another factor influencing how a service failure is perceived is the existing business relationship between the customer and the service provider. In industrial markets, service encounters are typically evaluated in the context of the broader relationship rather than as isolated events (Håkansson, 1982; Håkansson and Snehota, 1995). The history of interaction, the level of cooperation, and the degree of mutual adaptation in the relationship between the actors can therefore influence how a service is interpreted (Gadde and Snehota, 2000; Håkansson and Snehota, 1995). In long-term and highly involved relationships, customers may be more inclined to view service failures as temporary issues to be resolved collaboratively, rather than as reasons to reconsider the relationship. Conversely, in more transactional relationships with weaker ties, individual service failures may have a greater impact on customer perceptions and increase the likelihood of negative reactions such as dissatisfaction, brand switching, or negative word-of-mouth. The strength and nature of the business relationship can therefore act as an important moderating factor in determining the perceived service quality.

The final layer of the framework represents the regional conditions of the market in which the customer operates. Service quality is not judged against a single universal standard, but in relation to the expectations and operating conditions of the local market (Zhang et al., 2008; Wong, 2004). Customers in different regions may therefore have varying expectations regarding response times, transparency, communication, and acceptable service levels. In addition, regional conditions may influence how service is delivered in practice, since factors such as geographic location, border conditions, and regulatory environments can affect lead times, predictability, and the feasibility of service recovery. These conditions shape both how service failures are experienced and how strongly customers react to them.

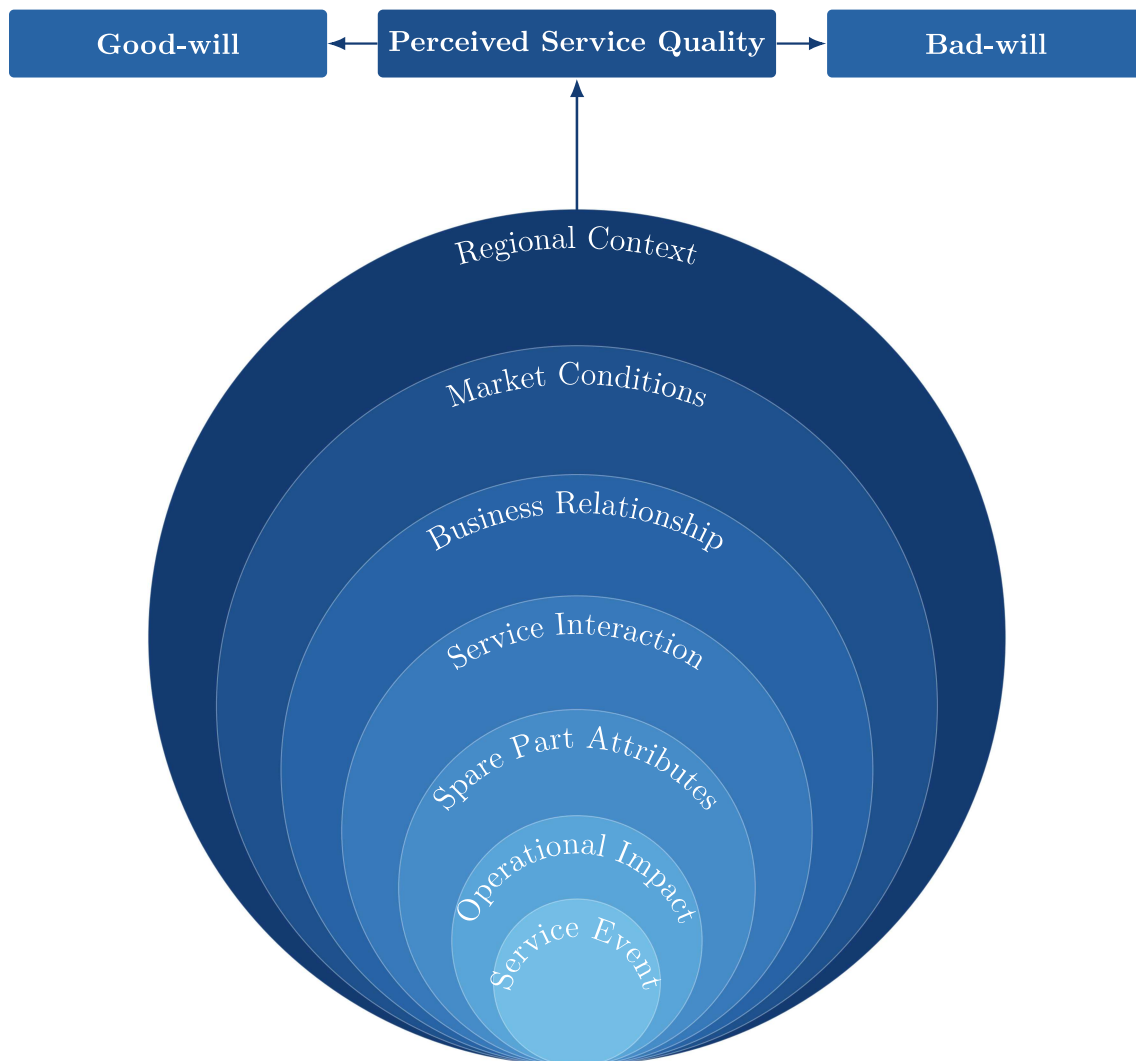


Figure 3.2: Analytical framework on perceived service quality.

4

Description of Total Cost Model at Volvo Service Operations & Technology

This chapter presents the findings from the initial mapping of Volvo Service Operations & Technology's current bad-will parameter within total cost framework for spare parts. The results are from semi-structured interviews with internal stakeholders and an analysis of internal documentation regarding the management of spare parts distribution.

4.1 First Round Interview Results

This section presents the findings and results from the first round of interviews and internal document and process analyses, where the distribution network and the flow of spare parts from planning all the way to end customer through the dealers is presented. How the total cost model is used in the planning phase and the definition of the bad-will cost parameter used in the total cost model. The aim of this section is to provide understanding how the bad-will parameter affects the downstream flow of parts to dealers, how the parameter is built/defined/used, and what different drivers affect the bad-will cost in the current version of the parameter.

4.1.1 Distribution Network Structure of Spare Parts in Europe

The spare parts distribution networks is structured as a multi-stage distribution network where parts are stored at different warehouses before reaching the dealer and lastly the end customer. At a general level, the network include a Central Distribution Center (CDC) that acts as the main hub with a large assortment of spare parts, Regional Distribution Centers (RDCs) that supply large geographical regions outside of Europe, and Supporting Distribution Centers (SDCs) that complement the hub by positioning stock closer to dealers to reduce lead times. However, in the European geographical context the distribution setup solely uses the CDC and the SDCs, while RDCs are used to support markets outside Europe. Figure 4.1 shows an illustration of the multi-stage distribution network.



Figure 4.1: Illustration of the distribution network of spare parts.

Spare parts planning and replenishment for the European distribution structure are managed centrally within Volvo by the division SO&T, with responsibilities divided between planning, operational work, and ensuring the supply to dealers. DIP (Demand & Inventory Planning) does the planning by translating expected demand into forecasts and inventory targets. This includes setting and maintaining parameters such as safety stocks and reorder settings to achieve required service levels while controlling inventory cost and capital tied up in stock. Using this planning as foundation, OP Refill (Operational Planning & Refill) carries the operational responsibility for replenishing the RDCs and SDCs. The role can be described as ensuring that replenishment actions are carried out in line with the targets defined by planning, and that deviations are handled in day-to-day operations. This includes monitoring availability and replenishment signals, placing or releasing orders, and managing exceptions such as supply constraints, delayed inbound flows, or abnormal demand spikes.

While DIP and OP Refill address what is stocked and replenished at the RDCs and SDCs level, DIM (Dealer Inventory Management) is responsible for the ordering from these distribution centers alongside the CDC to the dealer network. The purpose is to ensure that dealers can obtain the parts they need to support end-customers, and that the flow works as intended in terms of spare parts availability.

To support these responsibilities and ensure that planning and replenishment decisions are coordinated across all stocking points, Volvo applies a total cost model in

the distribution center planning process. The model provides a common decision basis for translating demand and service requirements into inventory targets and replenishment actions, while balancing the trade-offs between inventory carrying costs and shortage costs. By evaluating the combined cost impact across the distribution network, such as capital tied up in inventory, handling and warehousing, transportation, and shortage related effects, the total cost model optimises the highest service level for the least cost. This model and its role in spare parts planning are described in detail in the next subchapter.

4.1.2 Overview of Total Cost Model

According to the first round of interviews and internal document analysis, the total cost model utilized by Volvo serves as a strategic balancing tool to optimize the target service level of spare parts by weighing the costs of carrying inventory against the costs incurred during a shortage. The model is designed to reach a balanced state where the sum of logistical expenses and the impact of part unavailability is minimized. Within the current configuration, four primary parameters define the cost of a service failure (i.e. understocking): rush transport costs, rush order handling, loss of sales, and bad-will.

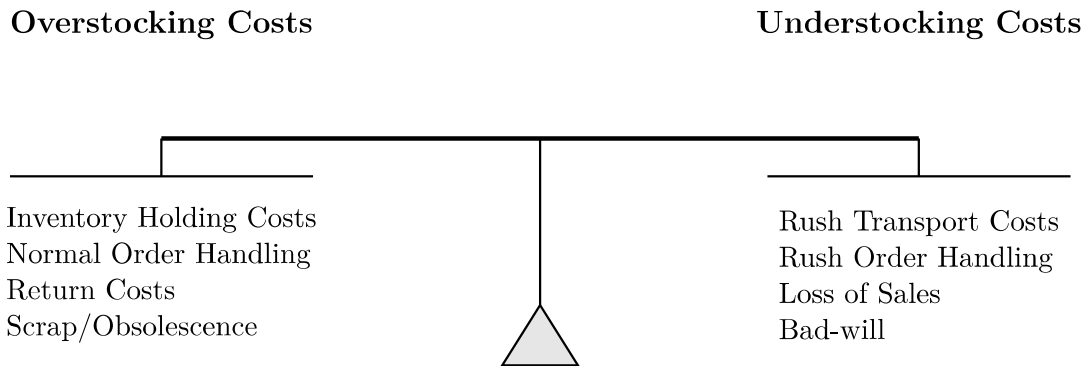


Figure 4.2: Illustration of the Total Cost Model: Weighing the costs of inventory against the logistical and relational costs of shortage, adapted from Volvo internal documentation.

Rush transport represents the expedited freight costs required to resolve a stockout, while rush order handling accounts for the internal administrative resources consumed by emergency orders. Loss of sales is calculated as a product of probability and price, estimating the risk of a customer opting for a competitor's part. The bad-will parameter is specifically included to "internalize customer impact" within the supply chain, acting as a proxy for the intangible damage to the brand relationship when a promised service is not fulfilled.

4.1.2.1 Definition of Bad-Will

The bad-will parameter currently lacks a formal definition and is instead treated as a steering tool to justify specific inventory investment levels and internalize intangible

customer impact. It is mathematically integrated into the total cost model through a multiplicative formula:

$$\text{Bad-will Cost} = \text{Base Bad-will} \times \text{Criticality} \times \text{Life Cycle} \times \text{Brand} \quad (4.1)$$

The base bad-will value is determined by the segment of the spare part. During the interviews two different formulas emerged on how to calculate that bad-will cost, but they result in the same final result. A critical article is assigned a base value of C_{high} SEK, while a non-critical article is valued at C_{low} SEK. This base value is then modified by two secondary factors: a life cycle multiplier consisting of three steps, which adjusts the cost based on the part's current phase in its commercial life and while brand is a factor in the calculation, it is currently implemented to have no impact on the final cost as it is set to 1 for all brands. If the calculated bad-will cost is high, the model permits higher inventory holding costs to maintain the targeted service level.

4.1.2.2 Historical Context

The bad-will parameter was implemented at the time of the initial total cost model implementation approximately 15-20 years ago. Since the introduction of the model, the bad-will parameter has remained unchanged and have not been adjusted to account for inflation or the industries shift towards servitization.

4.1.2.3 Criticality

According to internal documents and expert interviews, criticality is the first factor in how the bad-will cost is calculated, and it is divided into two main categories: uptime criticality and non-uptime criticality. Uptime criticality is a technical classification defined by engineers to determine if a vehicle can operate without a specific part. If an uptime-critical part is missing, the truck is considered "off-road," which causes immediate problems for the customer because their revenue-generating asset is no longer working and therefore infers a higher bad-will cost compared to non-uptime critical parts. This situation leads to higher bad-will costs compared to non-critical parts.

4.1.2.4 Life Cycle Phase

The lifecycle phase of a spare part is the second factor used to calculate the bad-will multiplier by considering the maturity of the vehicle model. This classification system adjusts the estimated cost of a parts shortage based on where the spare part sits in its lifespan. The results identify four specific stages for this multiplier, starting with the initial phase. This phase is defined by new vehicle launches and the introduction of emerging technologies, and it is assigned the highest multiplier.

Once a vehicle model is fully established in the market and reaches its peak usage, it is categorized under the prime phase. For parts in this stage, the multiplier is set 60% of the value of the initial phase as the spare part is still expected by the customer to be available. As the spare part transition into the decline phase, the multiplier is reduced to 20% of the initial phase value. The final stage is the phase-out phase, which occurs when the specific spare part are mostly retired from active use. This stage is assigned the lowest multiplier value of 5% of the initial phase value.

4.1.2.5 Brand

The current total cost model applies the same bad-will cost to all brand offerings. In its present form, the model does not make a distinction between different brands, which means the specific brand identity or market position does not affect the calculation of bad-will cost.

4.2 Second Round Interview Results

Round 2 interviews map the dealer-facing aftermarket system and how shortages are handled, to build a foundation for analyzing bad-will drivers later.

4.2.1 Dealer-facing Aftermarket Structure

spare parts planning and replenishment for the European distribution centers (CDC and SDC) are managed centrally within Volvo Parts (SO&T), while the downstream flow to dealers is handled through DIM and the Service Center, in coordination with Volvo Trucks and the market companies (illustrated in Figure 4.3). Within SO&T, DIP translates expected demand into forecasts and inventory targets, while OP Re-fill (Operational Planning & Refill) executes the replenishment of the distribution centers by placing orders and managing day-to-day deviations in supply and inbound flows. Once parts are available in the CDC and SDC structure, the downstream flow to the dealer network is managed by DIM (Dealer Inventory Management). DIM is responsible for ensuring that dealers can access the parts required to serve end customers. For dealers connected to Volvo's automatic replenishment setup, orders are generated and refilled automatically based on the replenishment logic and available data.

In parallel to this standard flow, Service Center withing SO&T functions as a key interface for exceptions and urgent needs. It supports dealers with manual ordering and case handling when the normal replenishment process is insufficient, for example in VOR situations (Vehicle Off Road), where a truck is immobilized and rapid recovery is critical. On the brand side, Volvo Trucks provides strategic direction for aftermarket availability. This includes prioritization for parts that are important for uptime and competitiveness, but also for parts that are strategically important for the brand's development and revenue objectives. This strategic layer interacts with SO&T to align central planning priorities with dealer and customer needs. Finally,

Regional Market Companies operate closest to the dealer network and serve as the primary support interface in daily operations. They assist dealers in navigating the broader organization, coordinating communication and escalation toward the SO&T functions and Volvo Trucks when needed.

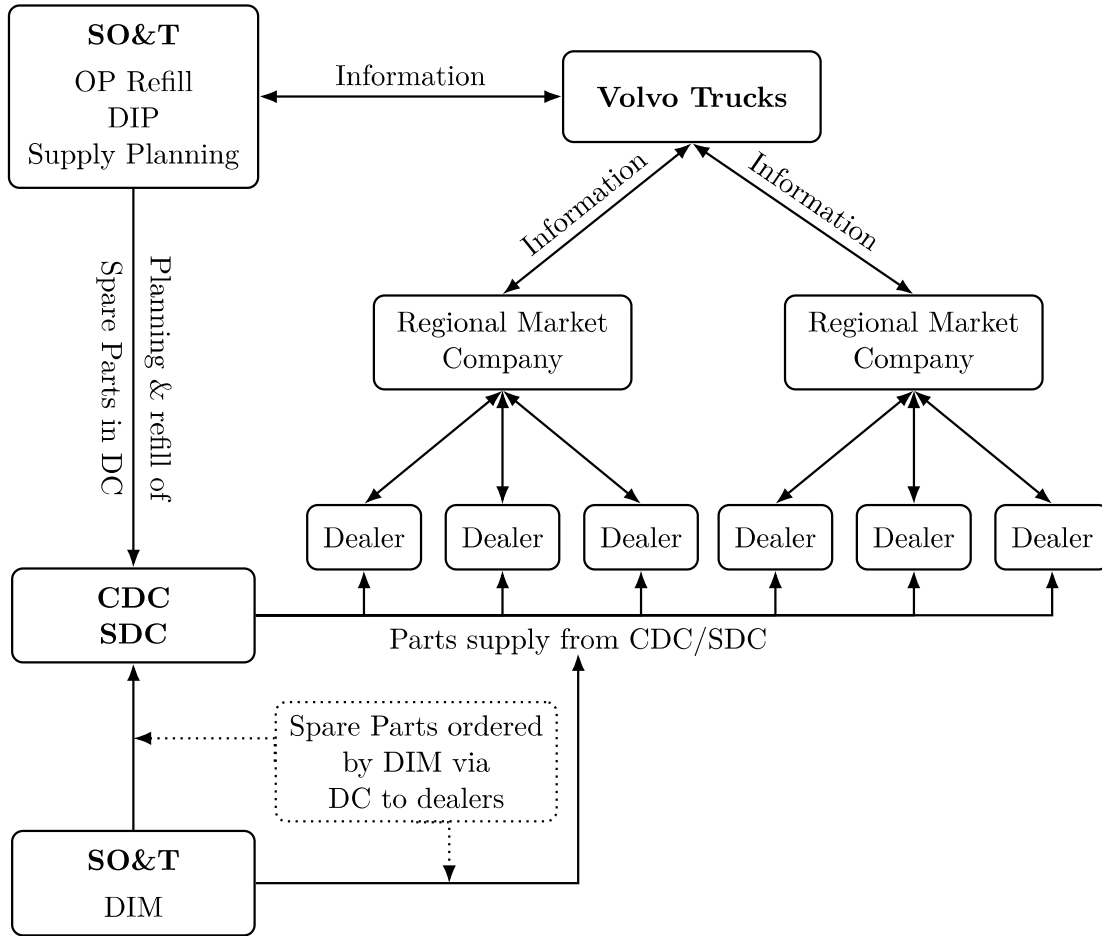


Figure 4.3: Overview of SO&T flow to CDC/SDC and DIM, and Volvo Trucks interface to Regional Market Companies and dealers.

4.2.1.1 Key Actors and Responsibilities

Table 4.1 summarizes the main actors in the dealer-facing spare parts service system, their responsibilities, and their relevance for dealer-perceived bad-will. It shows that the dealer experience is shaped by several interconnected functions rather than by a single organizational unit. Upstream functions mainly influence physical availability, while dealer-facing support functions play a central role in communication, escalation, and recovery when shortages occur. This means that bad-will is influenced not only by whether a part is available, but also by how effectively the wider support structure responds when the normal flow is disrupted.

4. Description of Total Cost Model at Volvo Service Operations & Technology

Actor	Responsibility (ownership)	Dealer interface and relevance for bad-will
SO&T DIP	Forecast and set inventory targets for CDC/SDCs	Drives upstream availability; planning errors propagate to dealers as backorders and lead-time gaps.
SO&T OP Refill	Execute DC replenishment and handle deviations	Converts plan into stock; shortages increase manual handling and urgent cases downstream.
SO&T Service Center	Exception handling and recovery	Main touchpoint in failures; ETA quality and updates shape perceived service.
SO&T DIM	Manage dealer replenishment and auto-refill setups	Controls refill logic for dealers; directly impacts dealer service degree.
Volvo Trucks	Strategic prioritisation and sourcing focus	Defines business/strategic/uptime critical focus influencing what gets attention.
Regional Market Company	Local support and escalation coordination	Dealer's primary support channel; reduces resolution time and improves communication.

Table 4.1: Actor ownership and dealer-facing relevance in the spare parts service system.

4.2.2 Dealer Ownership and Operating Models

Dealers in the Volvo network can be either privately owned, both as individual dealers or as a grouping of dealers, or Volvo owned. In all cases they act as customers in the spare parts relationship by purchasing parts from Volvo and reselling them to end users. Affiliation with the Volvo brand also implies compliance with defined standards for service quality, customer handling, competence, and brand representation, since customers experience the dealer as an extension of Volvo itself. It also implies that Volvo's ability to secure a uniform customer experience depends not only on standards but on how these are monitored and supported through training, audits, and operational follow-up. In addition, the scale of the truck dealer network can create operational advantages, such as higher parts volumes and broader coverage, but it can also increase complexity in coordination and standardization.

4.2.2.1 Volvo Owned Dealers

In some markets, a share of the dealers is Volvo-owned. In one of the interviews it was described as approximately one third of the retail points are owned by Volvo in that country, with the largest dealers in the metropolitan areas. From an operating-model perspective, this ownership structure influences incentives and behaviour in the supplier-customer relationship within the network. One interview insight was that when the dealer is part of the same corporate structure, there can be a tendency towards greater tolerance or reduced formal pressure when service levels deteriorate. The same situation, if caused by an external supplier, would likely result in stricter demands and more explicit escalation.

At the same time, the operational impact at the customer interface remains unchanged. Volvo-owned dealers still face the consequences of parts shortages in the workshop: blocked service bays, reduced billable hours, and dissatisfied customers. The interviews provided several concrete illustrations of this impact. A commonly cited benchmark was that each time a required part is missing, the workshop can lose several minutes of billable time due to having to change what truck to work on. In practice, these conditions mean that Volvo-owned dealers depend on the same two capabilities as privately owned dealers: high physical availability of parts, and high information availability when physical availability fails. The ability to quickly provide an ETA and to offer temporary recovery solutions (such as goodwill-based support or replacement vehicles within contract terms) becomes central to maintaining customer trust and protecting the brand in high-expectation segments.

4.2.3 Market Conditions

The competitive environment for spare parts and aftermarket services differs substantially between countries and regions, and the interviews indicate that these differences shape both customer expectations and the consequences of stocked out parts. Three drivers that are frequently mentioned throughout the interviews are:

1. Availability and easy of competition spare parts.
2. Local industries served.
3. Local truck population served.

The first dimension concerns how easily customers can source alternative spare parts outside of the Volvo networks. Several interviewees indicate that competitive pressure has increased over the last decade, thus making it easier for customers to obtain non-OEM parts or counterfeit Volvo parts. In highly competitive settings the competitors focus on fast moving articles which means that standard wear and maintenance parts are often easily replaceable or substitutable via competitors.

The second dimension concerns local industry characteristics and the cost of downtime for the customers, which influence how strongly shortages translate into dissatisfaction. In regions with uptime-critical operations, such as heavy industry and mining, even low-volume parts can have disproportionate impact if they prevent operation. Interviewees also highlighted that the criticality is not necessarily tied to part price. Low-cost items can still be decisive if they are required for safe or legal driving, for example mirrors or camera-related components. This implies that the competitive consequences of unavailability depend not only on market competition but also on the customer base's operational profile.

The final dimension concerns structural market differences that affect inventory complexity, for example variation in vehicle population and configuration mix between countries. Markets with higher diversity in drivelines and applications require broader assortments to maintain comparable service levels, which can increase the difficulty of achieving high availability across the full range. In such contexts, com-

petitive performance is shaped not only by the service ambition, but also by the underlying complexity of what must be supported.

4.2.4 Spare Part Categories Used In Practice

Across the interviews, dealer offering is described as a deliberate mix of “what must be on the shelf” to protect uptime and workshop execution, and “what should be on the shelf” to protect Volvo’s parts business and strategic priorities. In practice, several part segments coexist at the dealer, and they map to different strategic roles for Volvo Trucks. The primary segment, as previously discussed in section 4.1.2.3, is uptime-critical parts, defined by engineers and used in planning as parts required for the truck to function. Interviewees emphasise that these parts are strategically important because they protect customer uptime and therefore Volvo’s credibility in operations-critical transport. At the same time, the interviews point out a practical challenge: many uptime-critical items are expensive and slow-moving, for example major driveline components, which makes the difficult to balance from a pure inventory cost perspective. A second segment can be condensed to service, maintenance, and wear parts. These are repeatedly described as the baseline expectation in the dealer channel, meaning that customers have low tolerance when a standard filter, brake-related items, or similar routine part are missing. In this sense, dealer availability in this segment primarily drives Volvo’s competitive position as a service provider where the dealers stock the must-have items.

The interviews also introduced two overlay segments that are important to connect to Volvo’s strategic role but are not purely technical categories. The first is business-critical parts, where a small number of part numbers generate a large share of revenue and are therefore highlighted for planners to ensure are always in stock. The second overlay is strategic parts, defined as parts connected to technology and product areas with strategic focus, currently described in the interviews as LNG and BEV. Availability here supports Volvo’s strategic role in enabling adoption and trust in new technologies, since weak aftermarket support can undermine customer willingness to invest in emerging drivetrains.

4.2.5 Order and Distribution Logic

The spare parts distribution to dealers is organised as a combination of automated centrally ordered parts is the dealer is connected via LPA (Logistics Purchasing Agreement) and manually placed orders by the dealers. The purpose of the setup is to ensure high service availability at the dealer while keeping inventory costs lower while still enabling prioritisation when central supply capacity is constrained or if there are urgent needs for spare parts. A key feature of this setup described in interviews is that dealers generally do not decide what items to stock and to what service level. Instead this is done centrally withing SO&T by DIM.

4.2.5.1 Automatic Orders

Automatic ordering is the default mechanism used to replenish dealer inventories. The interviews describe it as a “supermarket-like” refill logic where stock is replenished based on predefined settings, with the aim of maintaining a target service level at the dealer. This logic is intended to cover the majority of demand without requiring manual intervention, thereby ensuring predictable replenishment, lower administrative effort, and stable material flow. In practice, the effectiveness of automatic orders depends on upstream availability in the CDC or SDCs. Interviewees noted that if central availability is insufficient, the automatic refill system cannot replenish dealers as planned. This is particularly visible in performance measurements where high service levels on urgent orders can coexist with poor performance on stock replenishment, indicating that urgent ordering is compensating for a refill system that is not functioning as designed.

4.2.5.2 Manual Orders

Manual orders are used when the standard replenishment logic does not meet the need, for example when a customer case is time-critical or when a part is missing and must be actively chased. In such situations, the dealer or market support functions place higher-priority orders and initiate manual follow-up through established support channels. The interviews describe that this shift increases internal workload and cost because more actors become involved and orders must be monitored and escalated. Ordering prioritisation is structured through order classes, where more urgent orders are handled before lower-priority stock replenishment. Interviewees specifically described that urgent order classes (for example Vehicle Off Road and day orders) are prioritised, while stock replenishment is treated as the lowest priority.

A consequence is that when central availability is constrained, stock orders are the first to be deprioritised. Dealers then respond by placing more urgent orders to secure supply for ongoing repairs, which improves short-term fulfilment for those cases but reinforces a more reactive and resource-intensive way of working. The interviews further indicate that manual ordering and escalation are closely linked to the availability of delivery information. When parts are not available, the dealer’s ability to manage the customer dialogue depends heavily on receiving a credible estimated time of arrival (ETA). If no ETA is available, the case is more likely to escalate, increasing both operational effort and the perceived service failure. In this sense, the order and distribution logic is not only a physical flow design but also an information flow design, where ETA quality becomes an integral part of service performance when replenishment cannot meet demand.

4.2.6 Communication and Escalation Paths

The interviews described that the first way dealers solve stocked out parts are first handled through local, pragmatic workarounds before they become formal escalation cases. One example from an interview is that dealers actively check availability within the dealer network and, when necessary, arrange rapid transfers between

sites to fulfil urgent customer needs. In practice, this can include organised same-day “dealer-to-dealer” transport solutions, where a part is picked up from a colleague dealer and delivered directly to the requesting dealer to enable the repair to be completed the same day.

The interviews also describe communication and escalation as a service recovery mechanism that becomes critical when the standard ordering and replenishment flow does not work. A consistent finding is that the estimated time of arrival (ETA) is the key piece of information for dealers when a part is missing. Interviewees emphasised that customers can accept that some parts are occasionally unavailable, but they do not accept uncertainty about when the truck can be repaired and returned to operation. When ETA information is missing, unclear, or outdated, the situation escalates faster because the dealer cannot plan workshop capacity or give a credible commitment to the customer.

A further interview-based theme is that progress updates are almost as important as the final answer. Interviewees explained that even when a solution cannot be provided immediately, frequent status updates and clear remarks in the case reduce frustration because they signal ownership and activity. In contrast, lack of updates was described as creating the perception that nothing is happening, which increases pressure on the dealer and drives additional escalation.

4.3 Scenario Based Sensitivity Analysis

The scenario based sensitivity analysis was done using three bad-will cost scenarios. The baseline scenario applies the same bad-will costs as the current model uses and is used as the reference for comparison. The low scenario represents a 25% reduction in the bad-will base costs, while the high scenario represents a 38% increase in the bad-will base costs, corresponding to estimated inflation since the parameter was last revised approximately 15 years ago. The analysis was carried out for one uptime-critical segment comprising 136 parts and one non-uptime-critical segment comprising 1300 parts. The results are presented in terms of theoretical service level, total cost relative to the baseline scenario, and the share of each cost component in total cost under the respective bad-will scenarios.

4.3.1 Effect on Theoretical Service Level and Total Cost

Figure 4.4 shows that the theoretical service level vary across the three scenarios for both segment types. For the uptime-critical segment, the optimal theoretical service level is 95.0% in the low scenario, 96.5% in the baseline scenario, and 97.0% in the high scenario. The total variation is 2.0 percentage points. For the non-uptime-critical segment, the optimal theoretical service level is 89.0% in the low scenario, 90.5% in the baseline scenario, and 95.5% in the high scenario, which is a total variation of 6.5 percentage points.

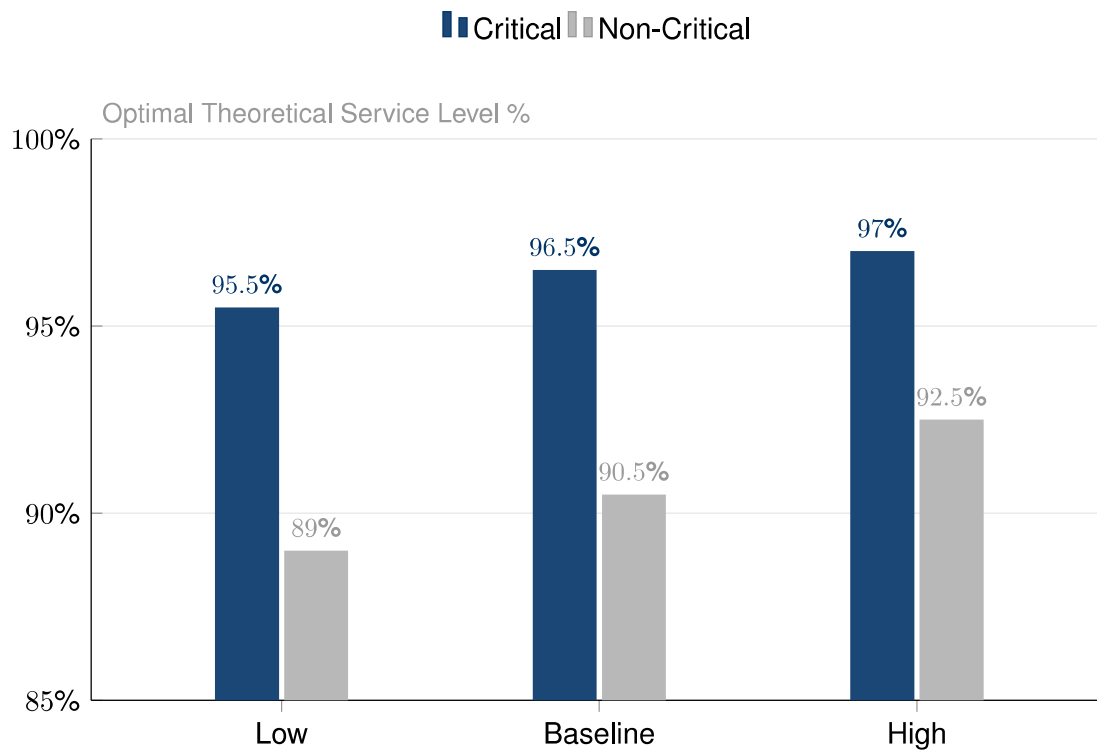


Figure 4.4: Optimal Theoretical Service Level per segment according to the three different bad-will cost scenarios.

Figure 4.5 presents total cost as a percentage of the baseline scenario. For the uptime-critical segment, total cost is 87% of baseline in the low scenario, 100% in the baseline scenario, and 110% in the high scenario. For the non-uptime critical segment, total cost is 99% of baseline in the low scenario, 100% in the baseline scenario, and approximately 101% in the high scenario. The variation in total cost is higher in the non-uptime-critical segment than in the uptime-critical segment.

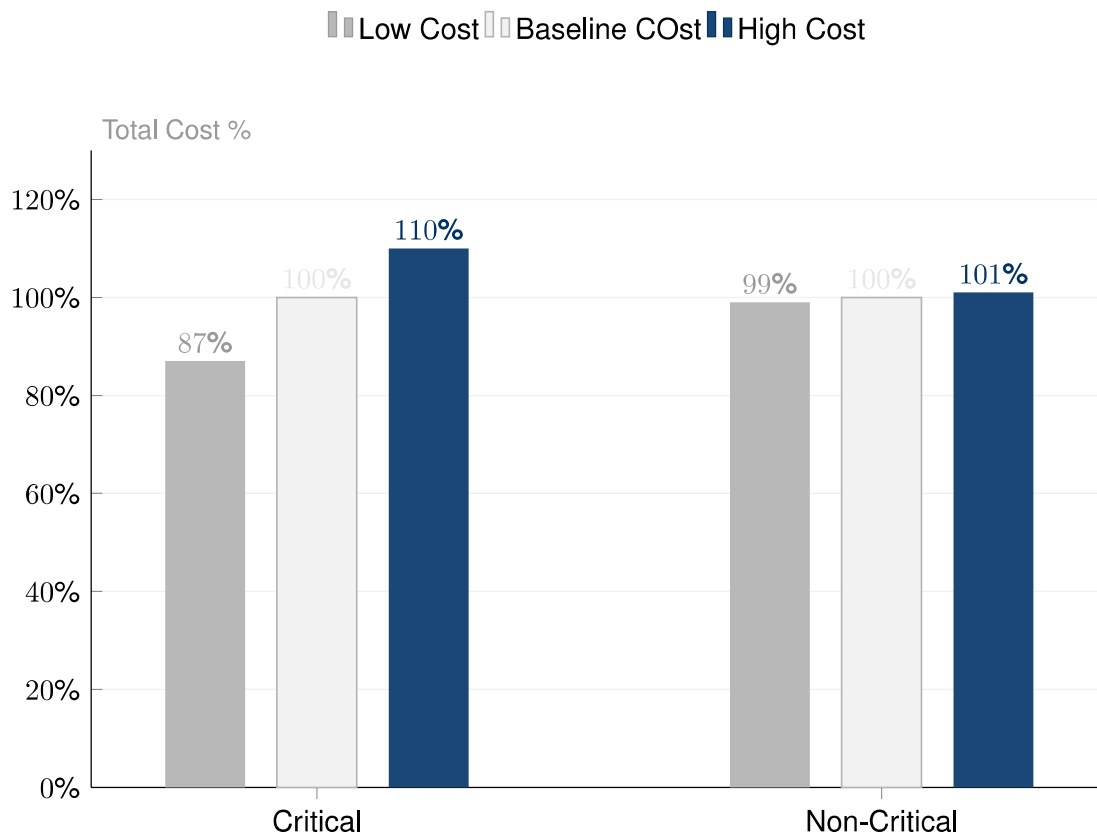


Figure 4.5: Mapping how the two different segments change compared to baseline with higher and lower bad-will cost.§

4.3.2 Uptime Critical Segment

Figure 4.6 shows the cost for each cost-parameter for the uptime-critical segment under the low, baseline, and high bad-will scenarios. Normal transport has the largest share of total cost in all three scenarios, accounting for 49.9% in the low scenario, 51.7% in the baseline scenario, and 51.2% in the high scenario. Inventory cost is the second-largest cost component, at 30.9% in the low scenario, 30.0% in the baseline scenario, and 29.9% in the high scenario. Normal Order handling also varies only marginally, with shares of 5.8%, 6.0%, and 5.9%, respectively. The bad-will share increases from 9.2% in the low scenario to 9.5% in the baseline scenario and 11.0% in the high scenario. Lost sales increasing from 2.3% to 2.7% and 3.5%. Rush order handling and rush transport remain limited in all three scenarios. Rush order handling amounts to 0.07%, 0.08%, and 0.11%, while rush transport accounts for 0.11%, 0.13%, and 0.17%.

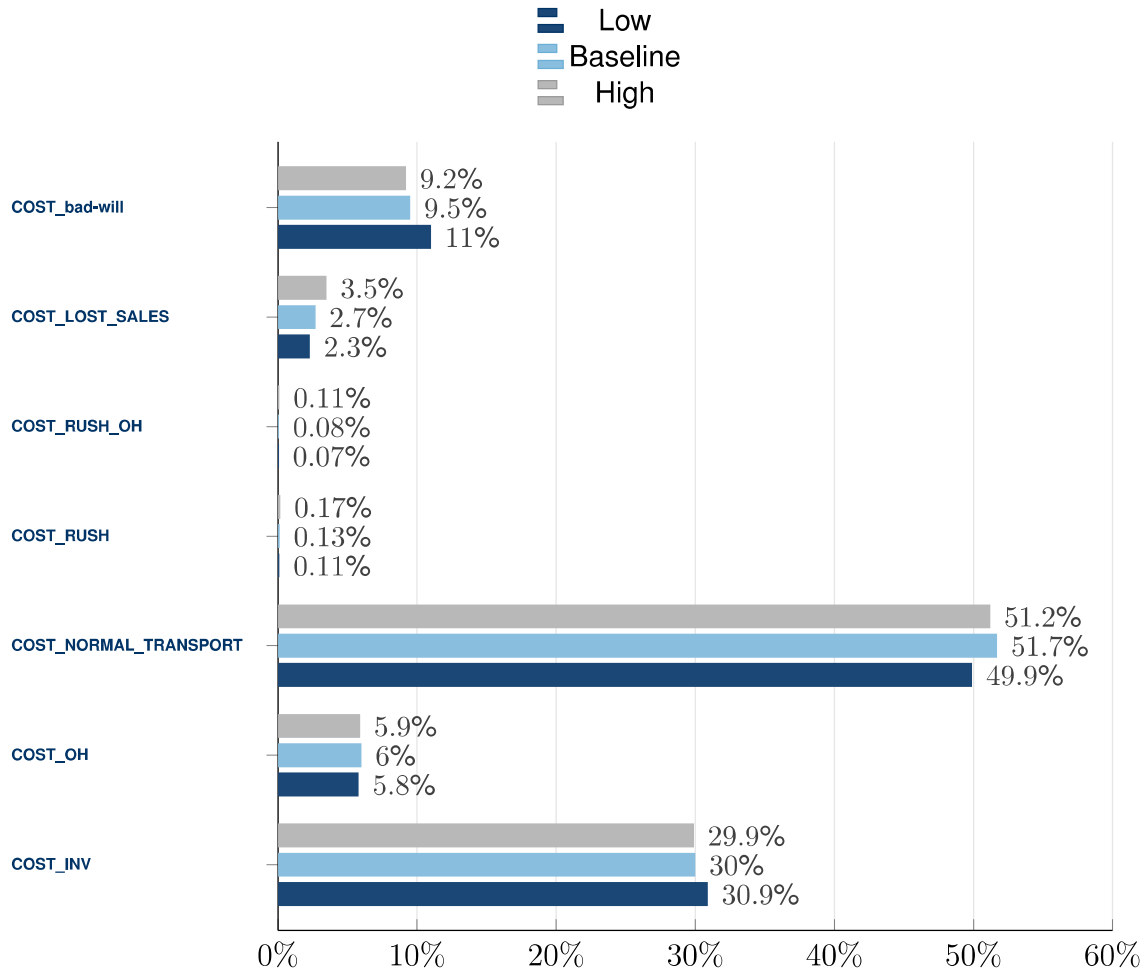


Figure 4.6: Ratio of cost of each cost-parameter for the uptime-critical segment

4.3.3 Non-Uptime Critical Segment

Figure 4.7 presents the cost composition for the non-uptime-critical segment. Normal transport is the dominant cost component in all three scenarios, representing 65.9% in the low scenario, 66.8% in the baseline scenario, and 67.2% in the high scenario. Inventory cost is lower than in the uptime-critical segment and decreases slightly across the scenarios, from 15.9% in the low scenario to 14.4% in the baseline scenario and 14.0% in the high scenario. Order handling remains stable at 3.3% in the low scenario and 3.4% in both the baseline and high scenarios. Lost sales increases from 4.2% in the low scenario to 5.3% in the baseline scenario and 6.2% in the high scenario. Rush order handling increases from 0.26% to 0.33% and 0.39%, while rush transport increases from 0.49% to 0.63% and 0.73%. The bad-will share is 10.0% in the low scenario, 9.2% in the baseline scenario, and 8.0% in the high scenario.

4. Description of Total Cost Model at Volvo Service Operations & Technology

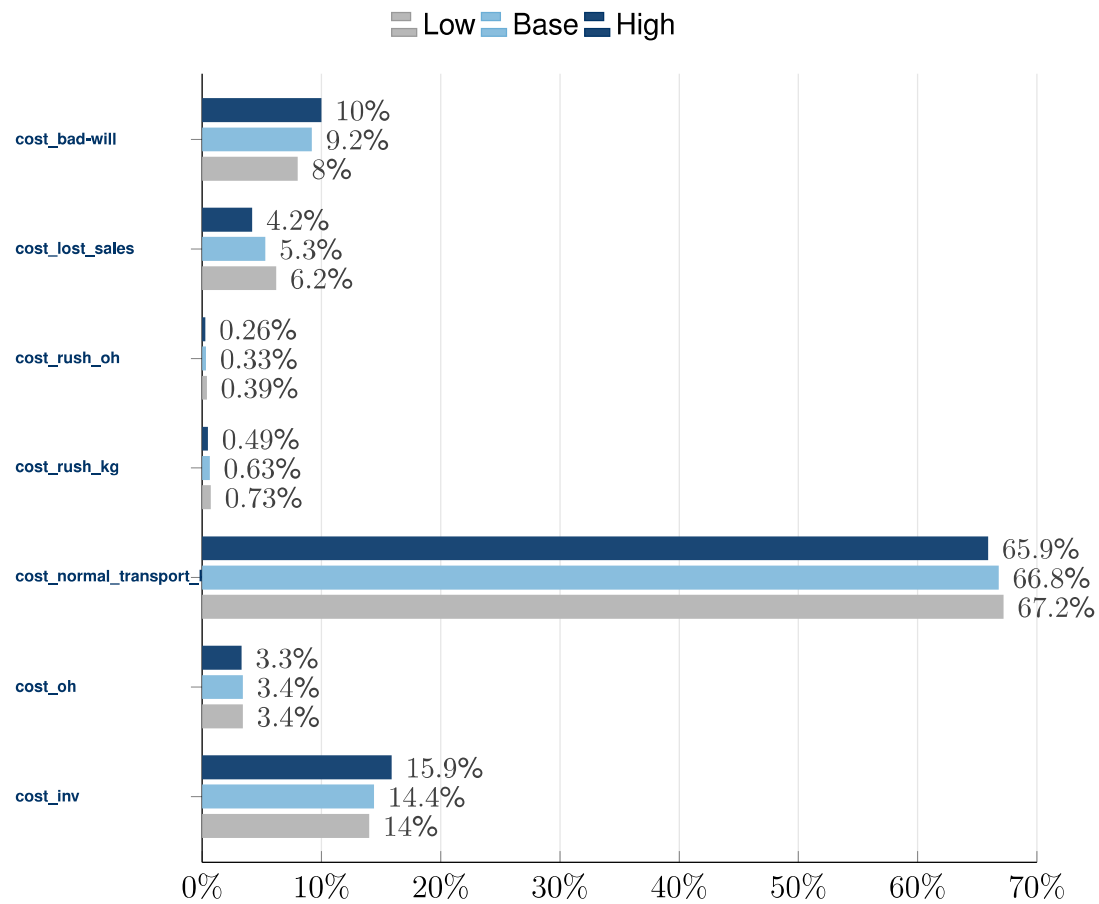


Figure 4.7: Mapping how to individual cost drivers change when bad-will cost is changed.

4. Description of Total Cost Model at Volvo Service Operations & Technology

5

Empirical Insights of Dealer Network

This chapter aims at present the interviewed persons followed by the results from the interviews. The interviewed persons have been anonymized and referred to as **P** followed by the number in which order they have been interviewed, i.e. interview 1 is referred to as **P1**. The official role can vary, but the all interviewed candidates have great transparency within the investigated subject in order to be able to answer the interview questions. Table 2.3 shows the participants that has been interviewed that later forms the foundation for the thematic presentation of results.

5.1 Thematic Presentation of Results

In this chapter, the information given from all dealer interviews will be presented. The information is presented through different codes according to chosen methodology. Every section represents one layer in the analytical framework. Different quotes from the interviews has been given a primary code that is reflected in one of the layers in figure 3.2, and if not reflected in either of the layers of mentioned figured it is given primary code "other themes". Table 5.1 highlights the frequency and ratio of each primary code.

Table 5.1: Overview of the thematic coding frequency from the third round interviews, ordered according to the analytical framework.

Primary Code	Frequency	Ratio (%)
Operational Impact	6	10,0%
Spare Parts Attributes	11	18,3%
Service Interaction	10	16,7%
Business Relationship	14	23,3%
Market Conditions	8	13,4%
Regional Conditions	8	13,3%
Other themes	3	5,0%
Total Frequency	60	100,0%

5.1.1 Operational Impact

Operational Impact describes the tangible consequences for a service failure that affects the customers business. The result are divided into the subthemes: **Direct Consequences**, **Legal Requirements**, **Indirect Service Costs**.

All respondents account for the difficulties of establishing a value for the daily costs of downtime and revenue losses for the end customers. Respondent **P3.1** highlights the extreme scale of these, noting that it could be up to 50-100k SEK per day. Respondent **P3.3** mentions that for some customers, even a single missed trip can lead to direct loss of 5000-6000 SEK in earnings.

Legal Requirements refers to the requirements that the trucks must be in fully compliant and functional in order to operate, especially when the trucks route is crossing EU borders. Respondent **P3.3** states that the consequences arising when authorities stops trucks when entering EU due to mechanical issues, generates "*very big problems*". Furthermore, respondent **P3.4** notes that being able to provide an ETA of when a part is back in stock and when service will be performed is very crucial. Not providing an ETA to customers will limit the customers possibilities of planning the routes and possibly losing sales and potential revenue.

The final subtheme describes the the indirect costs of service delays. Respondent **P3.1** highlights the specific operational effect of the dealers own efficiency. Every time a part is missing on the shelf or cannot be found, it results in at least 20 minutes of non-billable time for the dealer. This is further increased by more administrative work needed to be done to be able to locate and order the wanted part. This "hidden" cost is further affecting the dealership efficiency and profitability as well.

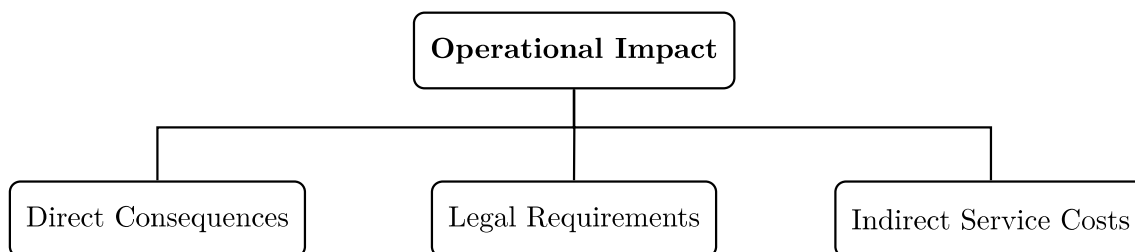


Figure 5.1: Subthemes for Operational Impact.

5.1.2 Spare Parts Attributes

Spare Parts Attributes emerged as the second to most frequent theme during the coding of the third round interviews, accounting for 18,3% of the primary themes. These results are divided into three main subthemes that represent the the views expressed; **Functional & Regulatory Criticality**, **Lifecycle Phase**, and **Sourcing Complexity**.

All respondents states that the most important parts to be stocked in order to keep

satisfied customers are uptime critical parts. If these are not stocked, a customer will be dissatisfied and respondent **P3.5** mentions that *"we can't afford to have no brake pads"* saying that brake pads is an uptime critical part. "Legal parts", parts required to not be prohibited on the road, are also seen as uptime critical parts. According to respondent **P3.2** parts can be of high criticality *"even though it can be cheap"*.

Parts that are essential to when a new model is launched is also of high importance to keep customers satisfied. Respondent **P3.3** mentions that *"when a new model is coming, then we usually make a list of headlamps, mirrors, and such things that are crucial"*. Respondent **P3.4** states that dealers *"cannot imagine the warehouse saying: No, we don't have an after-sales contract for this part yet"*. Respondent **P3.5** mentions the similar case for a part not being in stock for a truck with warranty is more sensitive, and further emphasising that the most dissatisfaction from the customer side is related to the young vehicles covered by warranty.

This subtheme address the systematic and technical complexity that comes with providing the right part at the right time. Respondent **P3.1** mentions that the increasing amount of drivelines creates challenges in stocking the right parts locally. Respondent **3.4** also mentions that sometimes after-sales contracts are missing for parts of new vehicles which can create dissatisfaction for the end customer.

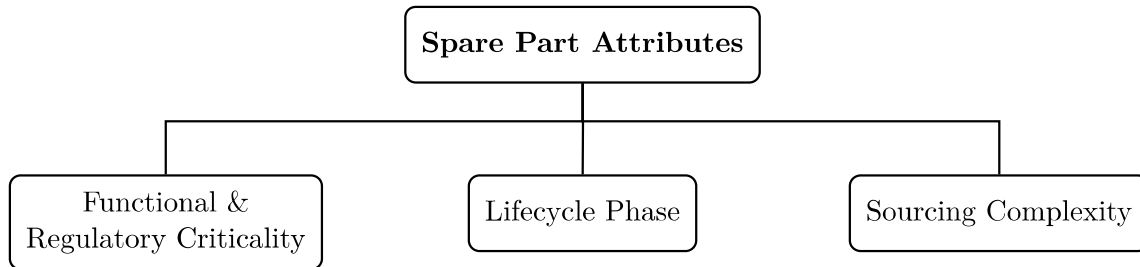


Figure 5.2: Subthemes for Spare Part Attributes.

5.1.3 Service Interaction

Service Interaction emerged as the third to most frequent theme during the coding of the third round interviews, accounting for 16,7% of the primary themes. These results are divided into three main subthemes that represent the the views expressed; **Information Transparency & Communication, Reactive & Proactive Recovery Efforts, and Contractual & Situational Service Expectations.**

Service Interaction was consistently described as a decisive factor for how customers perceive a stock out situation. Across the interviews the core was not only the parts physical availability but also whether the dealer can provide the customer with reliable information and show that the cast is actively managed. This was particularly emphasized through how respondents described customer tolerance: shortages can be accepted, but uncertainty and lack of communication quickly generate dissatisfaction. As interviewee **P3.4** expressed it, *"Every customer knows that sometimes*

a part is not available, but it's crucial that the information is there regarding when the part will be there. Parts availability has to be good, but if it's not, the communication must be very good. That gives a lot of bad feelings for customers if we don't share enough about when the uptime is ready." The results further show that a main point of service interaction is that customer priorities in the interaction are dominated by getting information about service progress and expected vehicle uptime. **P3.3** highlighted that while price is a frequent question, the key concern was operational recovery and communicating progress in service: *"They already know the price; that's the first question. [...] The main question is always, 'When can we have it? When can we get the truck back on the road?'"*

The interviews also indicate a structural challenge in the information flow behind the dealer, where actors further away from the end customer do not always recognize the urgency of providing the dealer with answers. **P3.4** described this gap as follows: *"Communication is crucial. Sometimes we are very bad at it. The further you are from the customer, the less the pressure is on you and the less you think about them. Sometimes even the warehouses [CDC and SDCs] or the helpdesk functions are not aware that the dealer has to answer his customer. When he [the dealer] doesn't get answers, he's stuck."* This implies that service interaction is not only a dealer to customer issue, but also depends on internal responsiveness and awareness in support functions, since a dealer's ability to communicate externally is constrained by what information they receive internally.

In addition to transparency and communication, the interviews show that service interaction also includes visible service recovery actions that can be communicated to the customer as proof of effort and urgency, and possibly decreasing the time from part being out of stock until truck is on the road again. One such practice is actively searching within the local dealer network to source the needed part instead of waiting for a replenishment from the warehouses. As **P3.5** described it: *"If we don't have some parts, we are checking if they [other regional dealers] have it. If they have it, we are going by our company car and take it in, let's say, one or two hours we have that part on our stock."* This type of recovery effort is further reinforced by solutions that enable rapid transport between dealers when the customer need is urgent. As **P3.4** explained: *"If the customer really needs his part on the day, we also have 'dealer-to-dealer taxis'. They can use taxis to get a part from a colleague dealer directly. We do all these things for loyal customers who are coming into the workshop."* Taken together, these statements imply that service interaction is partly shaped by how effectively the dealer can mobilize alternative sourcing and expedited transport, and that demonstrating such actions is an important mechanism for maintaining a positive service perception during stock out situations.

Dealers described that, in addition to searching for alternative sourcing solutions, they also try to reduce customer downtime through proactive ordering when they

have early indications of what will be needed. This was described as particularly relevant when the issue is identified while the truck is still operational and expected to return to the dealer's market for service, enabling the dealer to secure the part before the vehicle arrives. As **P3.5** explained, *"If we are pretty sure we'll need that part and the truck will be able to drive here, we may immediately order [from CDC/SDC] it if we don't have it on stock. That helps a lot in fast response to the customer."*

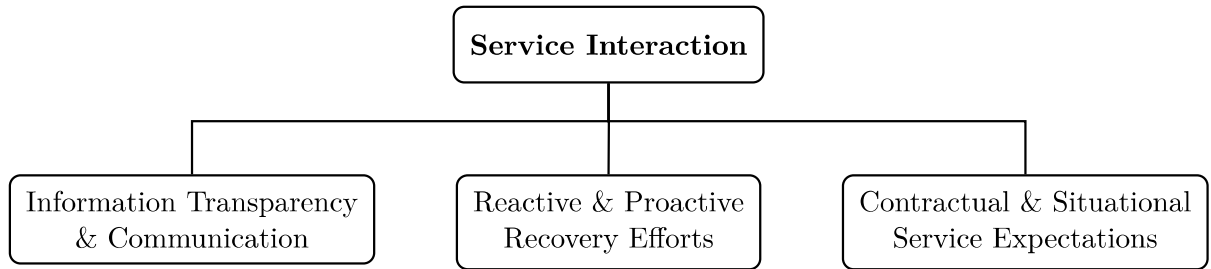


Figure 5.3: Subthemes for Service Interaction.

5.1.4 Business Relationship

As illustrated in table 5.1, Business Relationship emerged as the most frequent theme during the coding of the third round interviews, accounting for 23,3% of the primary themes. This underscores the themes role as the primary moderator in how bad-will are perceived within the dealer network. These results are divided into three main subthemes that represent the the views expressed; **Formal Bonds**, **Relational Integrity & Trust**, and **Informative Transparency & Recovery**.

All respondents answered that LPA (Logistics Planning Agreement) is a successful that creates trust for Volvo because the LPA helps the dealers perform better than they can perform themselves internally. **P3.1** mentions that *"maintenance part are doing excellent since we have GDS and LPA"*, putting emphasis on that *"it takes good care of that"*. Gold contracts is also frequently mentioned. According to **P3.4**, *"if you have a gold contract, then you have loyalty directly"*, highlighting that *"you can still have an unsatisfied customer, but he can't go nowhere because that costs him money"*. Further on the gold contracts comes with a responsibility for Volvo to pay fines or penalties to customer if a service is not done in time according to the gold contract. According to **P3.5** the compensation from the gold contract generates less dissatisfaction compared to a customer without a gold contract because they know they will at least get compensated for the wait, even though **P3.3** witness the compensation of a gold contract *"more like an act of partnership"* than compensating for the loss of revenue.

Relational Integrity & Trust describes the soft factors and the long-term atmosphere of the relationship that act as a buffer during service failures. Respondent **P3.3** states that the long-lasting relationships with customers are the most impor-

tant to sustain in order to ensure trust to Volvo. Respondent **P3.5** mentions that by offering discounts on specific services, contingent upon situational factors such as the age of the vehicle, the dealer can build up goodwill that act as a buffer for keeping the relationship intact with the end customer. Respondent **P3.1** states that the Volvo-owned dealerships might not have as high requirements as external dealerships, due to being part of the same organisation.

Respondent **P3.3** emphasises that trust is nurtured by informative transparency because *"the main thing in this job is transparency"*, talking about price and ETAs on deliveries of parts not in stock. Most respondents mentions that giving the customer an ETA is of high importance, and according to **P3.5** "if you cannot provide an ETA of when this is going to be fixed, what does that make with the customer, is that something that makes them extra dissatisfied".

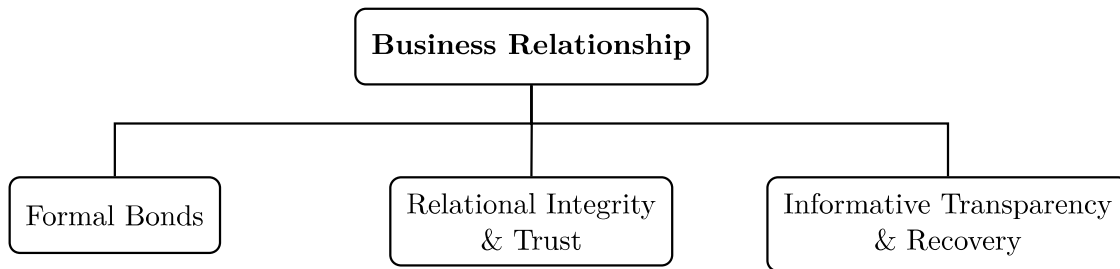


Figure 5.4: Subthemes for Business Relationship.

5.1.5 Market Conditions

Market Conditions emerged as a frequent theme during the coding of the third round interviews, accounting for 13,4% of the primary themes. These results are divided into three main subthemes that represent the the views expressed; **Alternative Sourcing**, **Economic Sensitivity**, **Market Density**.

The subtheme Alternative Sourcing describes the geographical and structural availability of both official and non-official parts. Respondent **P3.1** mentions that it is easier today than 20 years ago for customers to find alternative parts. Respondent **P3.3** also mentions that customers go directly looking for alternative parts since it is extremely expensive for the truck to wait, while also stating that some alternative can also be Renault parts. Respondent **P3.4** mentions that the competitive environment in which they navigate is extremely high, leading to easiness for the customer to change supplier for parts and/or services. Respondents **P3.3** and **P3.5** also mentions that neighbouring countries offer parts that are much cheaper than themselves can offer, but these parts are lacking international warranty. Respondent **P3.5** also mentions that the easiness for customers to change supplier of parts and/or service is higher when the truck or part is not covered by warranty, because then they have more options at their disposal.

Economic Sensitivity refers to the economic threshold where the perceived value of the relationship is challenged by price disparities. Respondent **P3.5** highlights

that for some of their customers, price is main deciding factor rather than trust and relationship, and particularly when facing a backorder. The willingness to pay for Volvo-original parts drastically diminishes as some customer prioritize immediate cost savings over long-term trust of the deal relationship. Respondent **P3.3** witness that some parts are having huge price differences from non-official parts, *"For a suspension, ball joints, shock absorbers—ours are three to four times more expensive"*.

Market Density refers to the concentration of competitors and the structural barriers that either prevent or facilitate a customer's decision to switch providers. While the previous subthemes describe the availability of cheaper parts, market density addresses the actual ease of exiting the Volvo network. Respondent **P3.4** emphasizes that the competitive environment is extremely high, creating a situation where customers can effortlessly change suppliers for both parts and services if their expectations are not met. This ease of switching is, however, highly dependent on the vehicle's current status. Respondent **P3.5** notes that the easiness for a customer to act on these alternative options increases significantly once the truck or part is no longer covered by warranty. During the warranty period, the official service network maintains a degree of protection, but as **P3.5** explains, the expiration of this coverage provides the customer with *"more options at their disposal"*. Essentially, high market density turns the end of a warranty into a retention cliff where the accumulated frustrations from price and sourcing issues lead to immediate defection.

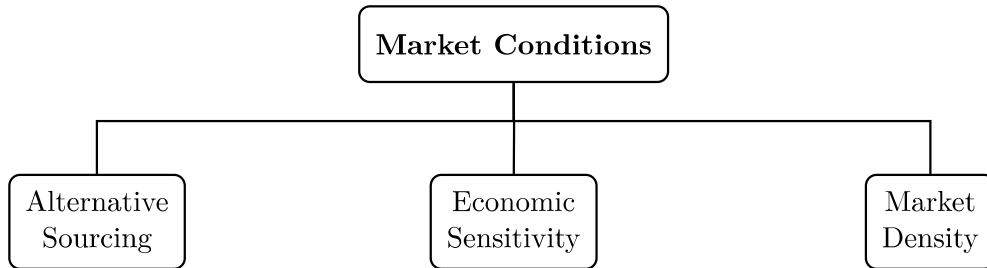


Figure 5.5: Subthemes for Market Conditions.

5.1.6 Regional Conditions

Regional Conditions also emerged as a frequent theme during the coding of the third round interviews, accounting for 13,3% of the primary themes. These results are divided into three main subthemes that represent the the views expressed; **Regulatory Constraints, Service Expectations, Geographic & Logistical Positioning**.

Regulatory Constraints refers to the legal barriers that arise from the dealers operating in different political regions. Respondent **P3.3** highlights that operating in a non-EU country is the biggest problem, as they have to calculate at least two extra days in deliveries due to custom clearance and border traffics. According to the same respondent, they are now *"used to a bit longer delivery times"*. Furthermore, respondent **P3.5** mentions that the border create big problems in being fast and responsive and that *"it would be much easier if we don't have those borders"*, stating

that the minimum delivery time from Vienna is two or three days, and the same from Ghent is five to seven days. Respondent **P3.5** also mentions that when a trucks is entering EU from a non-EU country, the authorities enforce strict roadworthiness standards, and if these are not met the owner poses a significant risk of substantial fines and prolonged vehicle downtime.

Service Expectations refers to how service level requirements vary between different national markets. Respondent **P3.2** mentions that their market, the ETA is a hygiene factor meaning that it is absolutely necessary to provide to avoid dissatisfaction. Respondent **P3.4** emphasizes that under their market conditions, the customers expect a high and responsive service.

The last subtheme refers to the distance from Volvo's distribution centres which respondents argue is of importance. Respondent **P3.4** describes it as *"a bit lucky"* because of the dealers proximity in that geographical market. In contrast, respondent **P3.5** describes the logistical disadvantages of being a bit further away from the distribution centres.

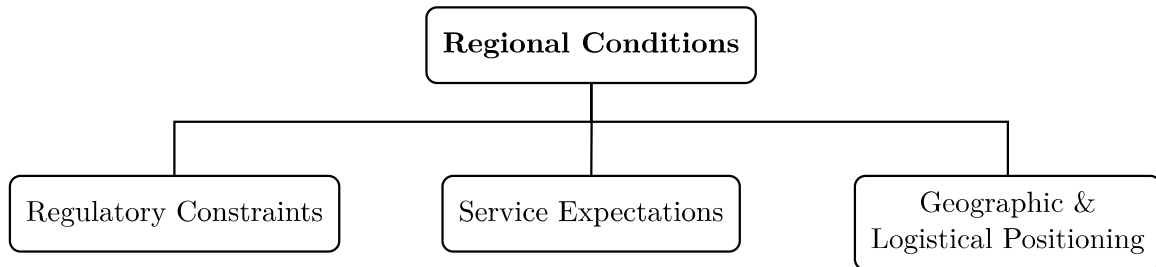


Figure 5.6: Subthemes for Regional Conditions.

5.1.7 Other Themes

Other themes are themes that is not placed within any of the other themes within the theoretical framework. These results are categorised into: **Structural & Organizational Proximity, Commercial Policy & Product Support, and Systemic Reliability & Tactical Recovery.**

The subtheme Structural & Organizational Proximity is addressing the organisations distance from central functions and the dealership. Respondent **P3.2** mentioned that the warehousing is often located too far from the customer, missing important understanding for each function. Furthermore, respondent **P3.1** identified a specific internal leniency, where dealer are physiologically less demanding regarding service levels because of belonging to the same organisation. According tp the respondent can mask some bad-will by lowering the performance requirements that otherwise be would be put on third party suppliers.

Commercial Policy & Product Support refers to bad-will arising when following business rules rather than technical failures. Respondent **P3.4** highlighted a source of frustration where parts are sold as a package rather than the parts for themselves,

forcing customers to pay for products they don't necessarily need to change.

Systematic Reliability refers to how the automated systems and recovery tools act as trust builders. Respondents **P3.3** and **P3.5** witness that the LPA and GDS have a great effect, not only as a great tool, but also as a trust builder and as a way to create stability at the dealership.

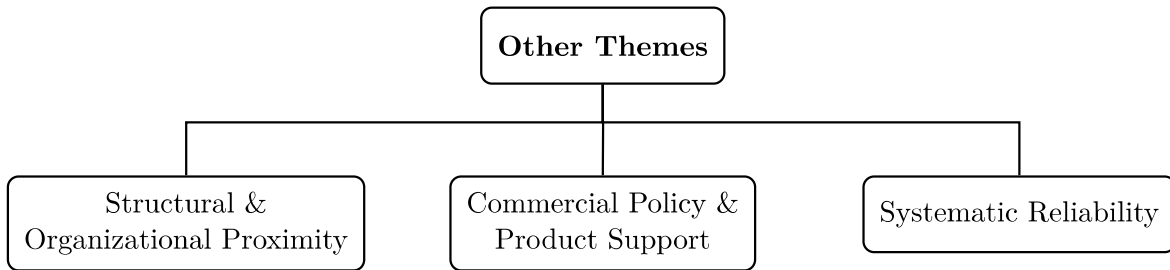


Figure 5.7: Subthemes for Other Themes.

6

Analysis

This chapter evaluates how well the parameters of the current total cost model reflect customer bad-will. Using data from the Volvo Group pre-study and dealer interviews, the analysis applies the analytical framework from Chapter 3 to examine how service failures are perceived in practice compared to theory. Comparing these empirical results with logistics and service management literature identifies structural gaps in the model, establishing the foundation for future recommendations.

6.1 Operational Impact

Operational impact is the primary trigger for the customers evaluation of service failure. While Volvo adapt a static cost component, theory suggest that there is some dynamic components that affects the operational impacts. In according to theories about servitization, manufacturer as Volvo has moved towards being responsible for the entire life cycle of their products. Baines et al. (2009) highlights the focus in modern business models to sell wanted outcomes rather than just selling physical products. In the case of Volvo, this comes with the responsibility of increasing uptime, and decrease downtime, for customers to minimize the negative operational impact. Volvo therefore must provide a quick and reliable after market service. The empirical evidence from respondent **P3.1** and **P3.3** highlights this servitization shift, stating that when a part is not in stock it interprets as a failure to the promised service outcome rather than a isolated logistic event. Cohen et al. (2006) further underlines the thesis of that the aftermarket is a critical source of competitiveness. When Volvo fails to provide a promised or expected service, delivering uptime for customers, the entire servitized value proposition is undermined.

One of the most frequent gap is identified in how the operational impact is monetised. Volvo's current model uses a base cost, either 200 or 1000 SEK, for bad-will as a proxy for the customers dissatisfaction. By looking into the actual costs for customers when standing still is by respondent **P3.3** conservatively estimated to 10 000 SEK a day, while more extreme cases could escalate up to 100 000 SEK a day depending on customer segment. Theory from Cohen et al. (2006) supports this by stating that every hour of downtime increases the direct financial costs.

The most critical gap might be the importance of time. Christopher (2000) describes time as the primary competitive currency and highlights that the customers dissatisfaction is increasing as more time pass by. Echeverri and Skålén (2011) points

out this phenomena as the process of value co-destruction, where limited responsiveness actively destroys relational value, in this case between Volvo and customers. Volvo's current model is time neutral, meaning that the financial cost in the model is not dependent upon any time factor adjusting the cost of bad-will. This is in contrast to what the empiric evidence, where all respondents agrees that time is one of the major factor to ensure satisfied customers. Without any time element in the bad-will parameter, Volvo run the risk of missing the exponential increase of dissatisfied customer when a stockout are prolonged and furthermore, as Campo et al. (2005) identifies as a critical factor for the customer to finish a relationship with their supplier.

6.2 Spare Parts Attributes

Volvo's bad-will parameter uses uptime criticality, lifecycle phase, and brand as spare part attributes to quantify bad-will. Both literature and the dealer interviews confirm that these attributes influence how strongly customers perceive a stockout. The interviews show that dissatisfaction is highest when the missing part determines whether operations can continue, but the sensitivity is not limited to formally uptime-critical parts. Respondents emphasize that customers also expect standard maintenance items to be available, and react strongly when "crucial" or "normal maintenance" parts are missing (**P3.4**, **P3.5**). This aligns with Huiskonen (2001), who argues that criticality dominates customer response and distinguishes between process criticality, i.e immediate interruption of operations and control criticality, i.e availability of substitutes.

The empirical material also indicates that criticality is regulatory as well as functional. Respondent **P3.4** highlights "legal parts" such as mirrors or cameras, noting that the truck is not allowed to drive without them. This supports the pre-study observation that low-cost parts can still create high bad-will if they are required for safe or legal operation. It further suggests that Volvo's current binary uptime-critical classification captures an important share of customer impact, but may under-represent cases where the truck is technically operable yet effectively "off-road" due to compliance requirements.

Lifecycle phase is repeatedly highlighted as increasing bad-will, especially for newly introduced parts tied to new truck models. Volvo already includes lifecycle phase as a multiplier where the initial phase is weighted highest, based on the logic that availability is expected early and shortages are more damaging to the relationship.

One mechanism described in the interviews is heightened early-lifecycle expectations that relevant spare parts should already be available at the dealer. Dealers respond by proactively preparing lists and pre-stocking "crucial" items for new models (**P3.3**). This supports the aftermarket view that spare parts availability is part of a broader product-service offering rather than a standalone transaction (Gaiardelli et al., 2007). A second mechanism is that early-lifecycle stockouts can be interpreted as avoidable organizational unpreparedness. Respondent **P3.4** describes cases where

aftermarket readiness is missing, such as lacking an after-sales contract for a new part, and notes that this is difficult to justify to customers and creates “*a lot of bad-will*.” Analytically, this implies lifecycle sensitivity is driven not only by forecasting difficulty but also by perceived preventability. This aligns with Cohen et al. (2006), who emphasize reliable aftermarket support as central for competitiveness and long-term customer outcomes. A third mechanism that amplifies early-lifecycle dissatisfaction is warranty. Respondent **P3.5** describes warranty cases as more sensitive because the dealer is obliged to use genuine parts, leaving the customer with no practical substitute and forcing them to wait. In analytical terms, this increases control criticality (Huiskonen, 2001) and raises opportunity and substitution costs as described by (Campo et al., 2005), making shortages more visible and frustrating during the early ownership years.

The current bad-will parameter already captures Spare Part Attributes through uptime criticality and lifecycle phase, and both the interviews and theory confirm these as relevant drivers. However, the findings suggest that the current binary view of criticality is too aggregated to reflect the different customer “difficulties” during a stockout, which risks misrepresenting bad-will across cases. Functional uptime criticality should remain central because it represents high process criticality, where a missing part immediately interrupts revenue-generating operations Huiskonen (2001). The interviews also indicate that the current definition does not fully capture non-technical uptime: “legal parts” such as mirrors or cameras can stop operation because the truck is not allowed to drive, and parts can be highly critical even if they are cheap. This motivates a separate regulatory criticality dimension, since the customer still faces immediate opportunity costs even though the mechanism is compliance rather than technical inability to drive Campo et al. (2005). Finally, the pre-study and empirical results indicate a practical “business” lens alongside technical criticality: business-critical parts are highlighted due to revenue importance, and easier alternative sourcing increases substitution and switching risk during shortages (Zinn and Liu, 2001; Campo et al., 2005). Overall, the results motivate a more granular criticality structure that distinguishes between functional uptime, regulatory, and business-oriented criticality, as each maps to different customer cost mechanisms that drive bad-will.

6.3 Service Interaction

While Volvo’s current Total Cost Model primarily represents bad-will through static spare part attributes, the interview results indicate that service interaction is a decisive factor of how bad-will is perceived or formed during a stockout. This supports the analytical framework from chapter 3, that customer evaluation is not only affected by the service outcome but also by the interaction process during the failure (Grönroos, 2015; Hart et al., 1990). Even when the physical shortage is unchanged, the perceived severity can change depending on communication quality and the perceived level of control and effort and ownership.

One common implication from the empirical material is that the lead time gap

is not only physical but also informational. Christopher (2000) defines the lead time gap as the difference between what the customer can tolerate and the actual delivery time. In stockout situations, the interviews show that lack of reliable information, especially being able to provide an ETA, increases perceived uncertainty and makes the disruption harder to manage. This aligns with Parasuraman et al. (1985), where reliability and responsiveness are core dimensions of perceived service quality. In this sense, ETA is not only information but part of the service performance itself. If information is missing or unreliable, the customer has an increased chance of perceiving higher bad-will. The interviews also show that service interaction quality is structurally dependent on internal responsiveness in the system. Dealers describe that when upstream actors do not provide timely answers, the dealer becomes “stuck” in the customer dialogue, which indicates that performance is affected across several organizational layers rather than being a purely dealer level capability. This matches Echeverri and Skålén (2011) view of value co-destruction as a dynamic decline triggered through interaction patterns and practice misalignment.

The interview results also indicate that service interaction also includes visible recovery behaviour, both reactive and proactive. From a theoretical perspective, these efforts are consistent with service recovery as an organizational capability to restore satisfaction after failure (Hart et al., 1990), and with Grönroos (2015) argument that the response to a failure may matter more than the initial service encounter. Proactive actions such as ordering parts as soon as a likely need is identified, can decrease the probability that the delay develops into a “total loss of consumption” situation (Campo et al., 2005). This suggests that service interaction can act as a mechanism to decrease or increase the perceived quality of a shortage by influencing the uncertainty, control and recovery speed.

These results demonstrate that bad-will depends on both the missing part and how the shortage is managed. The current model wrongly assumes a uniform customer experience for each part class. However dealers state that communication speed and responsiveness determine if a customer becomes dissatisfied. While interaction quality is difficult to quantify as a fixed cost parameter it remains strategically important. Providing dealers with fast and accurate information is therefore essential because customers judge the brand based on how well the dealer communicates during a breakdown.

6.4 Business Relationship

Business relationships influence how a service failure is evaluated and what consequences it creates. In industrial networks, single service encounters are not evaluated in isolation but filtered through the the relationship “atmosphere”, where prior interaction history and trust shape how the event is perceived (Håkansson and Snehota, 1995; Håkansson, 1982). This is made clear in the interviews where long-lasting relationships are described as central for sustaining trust during shortages. Transparency is also frequently mentioned as the main way to protect that trust when a stockout happens, supporting that the dealers wants to maintain their relation-

ships during service failures. From a relationship perspective, these effects can be understood as actor bonds and mutual expectations. Stronger actor bonds increase tolerance and make a disruption more likely to be treated as a shared problem to solve rather than a reason to defect (Håkansson and Snehota, 1995). On the other hand, if these bonds are weak, the stockout is more likely to trigger "fight" behaviours such as escalating the dissatisfaction and a more transactional evaluation of the capabilities of the service provided. From this perspective, the business relationship between dealer and customer acts as a moderator of bad-will by shaping how customer views the shortage, either as an exception or as evidence of unreliability as a service provider.

The empirical data further highlights formal relationship structures that primarily focuses on day-to-day service capability rather than directly influencing failure handling. In the interviews, LPA is consistently described as a successful set-up, as it improves the dealers operational performance compared to what they can do internally with manual replenishment. This is consistent with the pre-study description of LPA as a structural arrangement in which inventory parameters and replenishment decisions are largely managed centrally through DIM, indicating that the dealer's performance becomes more dependent on the central planning and support functions. From a relationship perspective, this redistribution of responsibility can be interpreted as a form of mutual adaptation that increases interdependence between actors (Gadde and Snehota, 2000), while also increasing the importance of trust in the central system since the dealer remains the primary interface toward the end customer. A second formal bond highlighted in the empirical material is service contracts such as Gold contracts. These contracts transform the relationship from a vehicle purchase into a longer-term relationship, and they alter customer expectations and the reasons for switching to competitors. In practice, this means that contractual customers are less likely to exit immediately during a shortage, but also evaluate service failures through a stronger expectation of accountability and compensation mechanisms embedded in the contract.

6.5 Market Conditions

The competitive environment is acting as a catalyst for bad-will whereas in an environment with high competitiveness a single service failure can lead to a permanent change of supplier meanwhile in less competitive environments there is a higher threshold for customers to change supplier. Christopher (2000) highlights that time is the primary competitive currency and that the ability to respond quickly to customer demand is more important than pure cost efficiency. The globalisation has allowed Volvo to take advantages of economies of scale, but it also comes with another type of competition where global market has increased the offerings for the customer and where local competitors often can offer higher local responsiveness.

According to Zinn and Liu (2001), a customer must navigate three potential courses of action during a stockout; wait, substitute the part with a competitors, or leave the brand entirely. The empirical findings show that the threshold to change supplier

has decreased drastically, where respondent **P3.3** points out that today, compared to 20 years ago, it is much easier to find alternative parts. Furthermore, respondent **P3.4** also mentioned that their business environment is very competitive. This means that the lead time gap, the difference between the time a customer is willing to wait and the actual time required to deliver a part (Christopher, 2000), is directly utilized by local competitors. Since the bad-will parameter of the total cost model was set around 15 years ago, it is obvious that the parameter is not based on the current market environment where the competition is much higher. In terms of the bad-will parameter, this means that there are reasons that argue for an increased bad-will cost due to increased competition alongside easiness to change supplier and therefore lower switching costs. However, this is not necessarily the same for all markets, since the theory suggests that the switching cost is dependent on easiness to change supplier (Chopra and Meindl, 2007), which in practice means that markets that have less competition will have higher switching costs, resulting in lower bad-will costs compared to highly competitive markets.

The switching cost is also highly dependent on whether a customer has signed a gold contract with the dealer. If a customer has signed a maintenance or gold contract with the dealer, this works as a "locked-in" effect on the customer, as respondent **P3.4** witnessed, resulting in the lower bad-will cost since the customer cannot change supplier.

6.6 Regional Conditions

The different regional conditions create different business environments which underline the fact that bad-will cannot be seen as an universal constant, but rather as a result from regional conditions. Theory about institutional distance argues that there are difficulties for large companies to balance central efficiency and local legitimacy (Kostova and Zaheer, 1999). The empirical findings highlight the same argument, mainly where respondent **P3.3** and respondent **P3.5** highlight the regulatory barriers that emerge by being located outside EU, pointing out customs formalities and regulatory border controls that add two extra delivery days as lead time. At the same time, the same respondents say that this has led to them being used to having longer lead times. Meanwhile they are used to longer lead times, they put price in the first room which is in contrast to Northern Europe respondent that states that providing customers with an ETA during a back order is bringing more value to the customer than having a low price to some extent. This differentiated view of the economic aspect is also reflected in the compensation structure for gold contracts with customers, where the eastern Europe respondent says that compensations can actually increase satisfaction, known as service recovery paradox (Smith et al., 1999), while northern Europe respondents witness the compensation more as a symbolic atonement. This argues for a divergent view of what is actually important in case of a stockout. Respondent **P3.5** further mentioned that a truck that does not meet EU roadworthiness standards upon entering EU faces the risk of

substantial fines and prolonged downtime. This puts extra pressure on the non-EU countries that EU countries does not face to the same extent.

6.7 Other themes

Other themes is an open ended category, capturing inductive factors that emerged outside the theoretical framework's categories, but still in the context of generating bad-will. As Volvo operates as a transnational organisation, the organisation must address the difficulties between global integration and local responsiveness to meet specific market needs (Doz and Prahalad, 1991). Empirical findings highlights the fact that there is a structural distance between planning functions and the local dealer's experience, as well as a lack of understanding through the chain. Respondent **P3.2** noted that central functions is very far from the customers, leading to this lack of understanding of different situational urgency. In global supply chains as Volvo's, Dolgui et al. (2018) argues that this distance increases the risk of a "ripple effect", where failing to provide responsiveness locally is seen as direct failure of the brand's service promise rather than a logistical oscillation.

Another finding is within this category is the phenomenon of "internal leniency", where respondent **P3.1** noted that Volvo-owned dealer can often be less demand regarding the service levels because of being part of the same organisation. This can lead to false evaluation of bad-will.

7

Discussion

The aim of the study is to identify how bad-will is currently defined within Volvo's total cost model and what factors that the customers perceives as the primary drivers of bad-will, and how this relates to existing literature. The following sections begins with discussing the current definition of bad-will within Volvo followed by evaluation of the the current factors within the bad-will parameter. Furthermore, implementable factors and other high impact factors are discussed.

7.1 Current Definition of Bad-will within Volvo Group's Total Cost Model

The analysis of Volvo's current cost model shows that the customer bad-will is defined through a transactional and products centred perspective, when it was set around 15 to 20 years ago. Since then, the bad-will parameters have remained the same and has not been adjusted with regards to inflation, globalisation or servitization. Instead of measuring actual customer experiences or financial losses for the customers, the parameter works as a weighting tool based on the spare part's inherent characteristics. It is based on four static elements; *base bad-will*, *criticality*, *life cycle phase*, and *brand*. These four elements forms the bad-will cost in its entirety. Base bad-will cost is a standardized cost that has been decided when the bad-will parameter was evaluated. The criticality element decides whether this base bad-will costs is set to either a higher or lower value [per line], dependent on the spare part is segmented as critical (higher) or default (lower). The spare part is segmented as critical when it is necessary for the truck to drive, and if a critical spare part is missing, the truck is considered "off-road". The life cycle element is dependent on the spare parts stage in the life cycle phase. It consists of four phases; *initial*, *prime*, *decline*, and *phase-out*, where the model weight spare parts in the initial phase the highest (100%) and then the rest in descending order; Prime (60%), Decline (20%) and Phase-out (5%). The last element assessed in the bad-will parameter is the brand, either Trucks or Penta, which is a theoretical variable that in the current model is neutralised and do not differ between the brands.

These parameters then decides the bad-will cost that is part of the total cost model that balance the inventory costs and costs shortages. If these parameters are set incorrectly, this will eventually lead to inaccurate calculations of optimal inventory levels.

7.1.1 Comparison with Theoretical Framework

The comparison between Volvo's internal bad-will parameter and the layered analytical framework reveals a significant discrepancy between the operational modelling and the theoretical customer evaluation process, as illustrated in figure 7.1. When comparing the theoretical foundation that is represented through figure 3.2, and the model currently model used by Volvo, it emerges that Volvo's focuses exclusively on Spare Part Attributes layer. More exactly Volvo only asses factors as brand, criticality, and life cycle phase to determine the bad-will cost.

The model used entirely omits the intermediate layers of the framework. The model assumes the impact of a stockout is identical regardless of how the interaction between the service provider and receiver is handled. It lacks a mechanism to account for what the operational impacts is resulting in for the customers, the interaction of the service, the business relation between Volvo, dealers, and the customers, the local and regional competitiveness that the business is navigating within, and possible cultural discrepancies between different countries or regions.

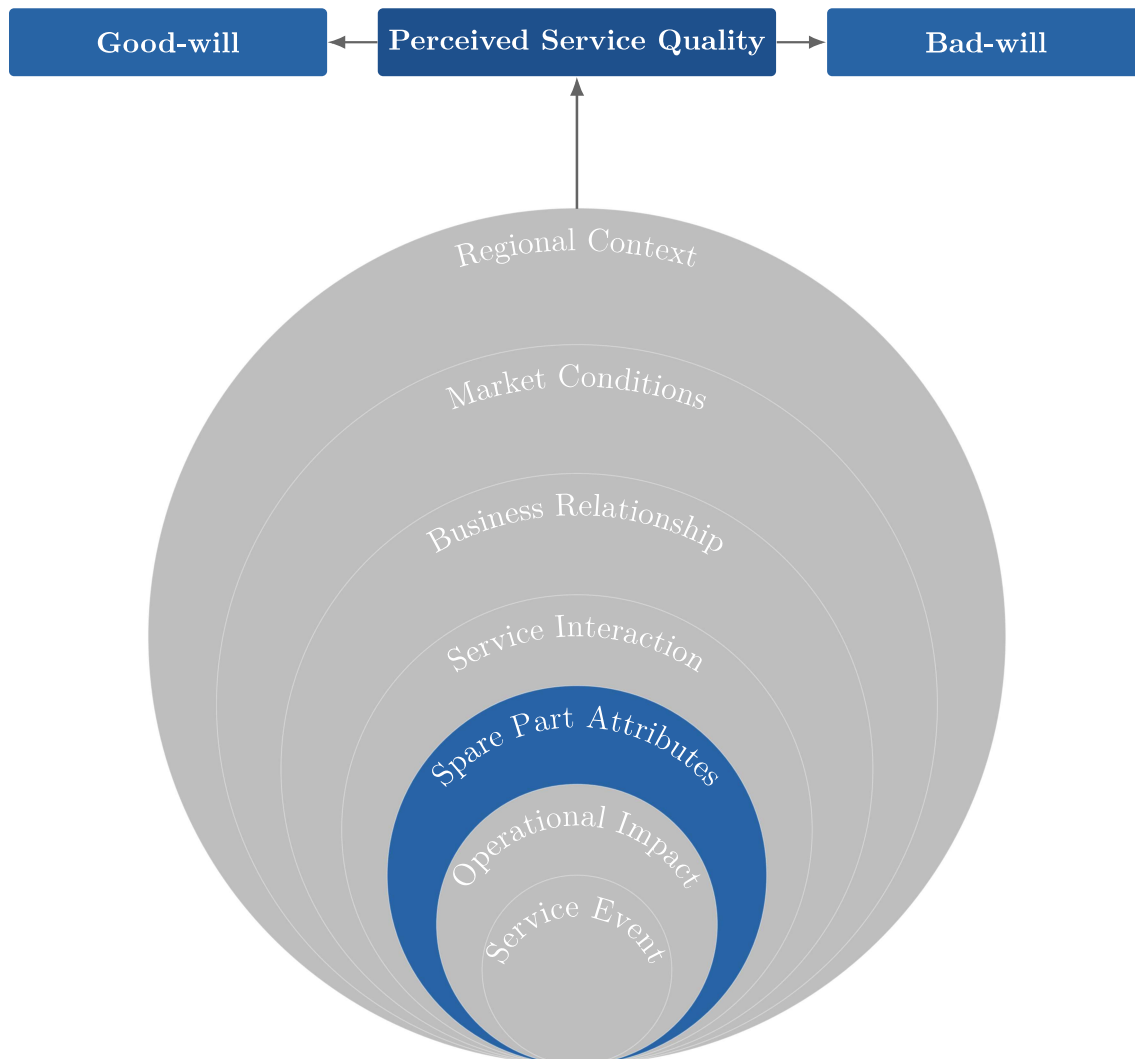


Figure 7.1: Layers current bad-will parameter covers in total cost model.

7.2 Evaluation of Factors in the Current Bad-will Parameter

The current bad-will parameter in the model used in the total cost model is a static approach to approximate and internalize the impact a stockout has on customer dissatisfaction. The empirical findings in combination with literature suggests that this phenomena is not a static but rather dynamic, in this case the time from stock-out until the issue is solved is not taken into consideration even though it is of great importance to customers. The bad-will is defined and set through the factors of criticality, life cycle phase, and brand. Labelling the bad-will parameter as static means that the factors contributing to bad-will are largely part- or segment-specific attributes that do not vary depending on different situations. Implementing dynamic factors in bad-will parameter is however a very complex issue when addressing the bad-will cost in a planning system, as the total cost model, which require numbers in order to calculate inventory levels. An important issue to address is therefore what factors can we convert from dynamic factors to static proxies and how can we do the conversion in order to provide the static data required for a better calculation of the bad-will parameter. By looking into possible implementable factors that could increase the accuracy and precision of the bad-will parameter to reflect the actual dynamic bad-will cost, it is important to validate or invalidate the current factors of the bad-will parameter.

Through the interviews, the literature review, and the the Volvo pre-study it is clear that the criticality factor is very necessary factor that affects the bad-will parameter. Criticality is defined as a binary technical classification decided upon whether the truck can be driven without the part (uptime critical). When an (uptime) critical part is missing, it results in operational impacts for the customers where the cost of down-time can often exceed the commercial value of the part itself, which make criticality to the dominant driver for customer dissatisfaction. However, the current bad-will parameter do only classify a part as critical or non-critical, i.e. two levels. Criticality for the customer is in reality not a binary event, either critical or not, but this factor is converted into a static representation of a dynamic phenomena where different parts are all of different importance to customers. Since the study suggests that criticality is of major importance when calculating bad-will it is important that the bad-will parameter is representing reality as accurately as possible. A way of doing so is to make the criticality factor more granular. There is a great amount of parts that are classified as critical, but is it really likely that all these parts are just as important to customers? It is near impossible to represent this dynamic phenomena into a perfect model, but by increasing granularity it would at least provide a model that represents the reality more accurately. A feasible option would be to implement more levels to criticality. The study shows that some parts are *uptime critical*, meaning that the trucks can not move without them, meanwhile some parts are critical parts because without them they are not allowed to cross the EU-borders, referred to as *regulatory criticality*. Another criticality addressed in the study is the *business critical parts*, more specifically parts that is critical in terms of securing revenue for Volvo. Competitive critical parts are another critical-

ity categorisation, which is parts that are necessary to provide to customers in order to secure market shares, often parts that are under heavy competition and can lead to additional sales. By enabling a more granular criticality factor with regards to these different types of criticality, the static parameter would better represent the dynamic phenomena of criticality.

The life cycle phase factor is also highly relevant, and has been witnessed as an important factor that is highly affecting the bad-will parameter throughout the entire study. In the current model Volvo uses a multiplier where parts in the initial phase is weighted high while prime phase decline phase, and phase out is decreasing in descending order. This structure is validated through both theory and the empirical evidence as an accurate method of reflect how customers dissatisfaction decrease along the life cycle of a part. For young trucks that is covered by warranty, the customer is often obliged to use original parts which furthermore decrease the options and easiness for the customer to change supplier. In case of such a stockout, a customer that has to wait for a longer time can lead to increased frustration and dissatisfaction. Dealers also witness that customers have a low acceptance of stockout on parts for newer models, where a stockout is not seen as a logistic accident but rather an organisational failure of Volvo, damaging the brands reputation. By using the life cycle phase as a static parameter Volvo can steer the bad-will costs to where it makes the most impact, and the study verify that this factor is of high importance to the evaluation of the bad-will parameter. No theory or empirical evidence suggest anything else than that the life cycle phase factor is accurate and therefore there is no reason to suggest any changes to the factor.

The brand is the last factor that decide the bad-will cost. However, since the study only investigated customers regarding the brand Volvo Trucks, there is no found differences between Volvo Trucks and Volvo Penta, and there is nothing in the study that indicates a difference. Meanwhile the current model indicates that there is two brands, the multiplier remains the same for the two brands, indicating either that there is no shown differences between the two, or as some interviews have indicated; that there could potentially be a difference but the distinction is not yet decided and suggested to be part of future research and investigation.

7.3 Implementable Factors

This chapter discusses the factors that is suggested to be implemented in the bad-will parameter, and those factors that is to be considered from a strategic aspect, affecting the bad-will parameter.

7.3.1 Bad-will Factors

One insight gained throughout the study is the need for a factor within the bad-will cost that represent the time. The findings in the study shows that the bad-will cost is not static but rather increases over time. Since time is another dynamic factor, it is difficult to evaluate the cost of time in the planning phase. It is feasible to repre-

sent the time of a stockout in the bad-will parameter by assuming it is correlated to lead time. But in order to convert a dynamic time factor into a static factor there is some assumptions needed to be made. For a dealer closely located to a RDC or SDC there is a smaller chance of ending up in a situation where a part is missing for a longer time. In the same way, a dealer located far away from a RDC or SDC tend to face a longer stockout time and subsequently longer downtime for customers. Therefore, the lead time indicates what time it could potentially take for a missing part to be delivered to the dealer. Lead time to each country and/or dealer can therefore work as a proxy for the shortage time, and represent an otherwise dynamic factor. Furthermore, the empirical finding highlights that there is two extra days in lead time for non-EU countries due to border controls and customs. However, these factor might not represent dissatisfaction themselves but, once again, they act as an proxy for the dynamic factor time by assuming the stockout time is related to lead time.

Furthermore the thesis indicates that the market conditions has a greater impact than before suggested. The bad-will is representing the customers dissatisfaction and also the risk for changing supplier of product and services, which both theory and the empirical findings of this study indicate is dependent on the local competitiveness. A very competitive market lower the barrier for change of supplier as well as decrease the switching costs. From these perspectives there is reasons to believe that a factor representing the market competitiveness could be motivated.

Another relevant factor is contractual customers and service agreements, such as Gold Contracts. These clearly affect the consequences of service failures as the results showed. However, not always because the customer experiences stronger bad-will in an emotional or relational sense. Rather, contracts often create stronger formal obligations, financial penalties, compensation mechanisms, and switching barriers. The study indicates that such customers may be less likely to leave immediately after a failure, since the relationship is contractually structured, but may at the same time expect a higher degree of accountability and recovery performance. Therefore the contractual arrangements influence the cost of service failure in a way that is somewhat different from bad-will. Higher service priority for contracted customers may therefore be justified, but the rationale may rest more on contractual exposure and business commitment than on higher customer bad-will alone.

7.3.2 Strategic Factors

The findings of this study suggest that some factors may justify higher service levels without necessarily representing customer bad-will strictly. This distinction is important, because the stated purpose of the bad-will parameter is to internalize customer-related consequences of stockouts in the total cost model. However, some of the factors raised during the study are better understood as reflecting Volvo's own strategic exposure rather than the customer's perceived service outcome. In such cases, the cost of failure may still be high, but for reasons that are strategic rather than customer-related.

One such factor is strategic market prioritization. From an Volvo point of view, it may be appropriate to assign higher shortage costs to certain markets, for example where Volvo seeks future growth, where market penetration is strategically important, or where brand visibility and long-term positioning are extra valuable. This can be applied both to markets that is under development but also to mature markets that Volvo wants to defend. However, such prioritization does not necessarily mean that customers in those markets experience more bad-will from a stockout. Rather, Volvo may face higher potential loss if service failures damage customer retention, growth ambitions, or brand perception in those markets. By assigning a higher bad-will value to strategically important markets, Volvo would partly represent the strategic business risk rather than customer dissatisfaction alone.

A similar issue arises in relation to business-critical parts. The study shows that some parts are seen as highly important because they represent a large share of Volvo's parts revenue or support strategically important product areas. This is not necessarily the same as saying that the customer experiences stronger direct dissatisfaction when these parts are missing. A shortage of a business-critical part may create a major commercial consequence for Volvo because the customer sources the part elsewhere or because the company loses aftermarket sales. These are fair reasons for assigning higher service priority, but they do not always imply that the service failure is perceived as more severe by the customer. This raises an important conceptual question: whether the purpose of the parameter is to represent the customer's experience of the failure, or Volvo's total business exposure when the failure occurs.

A third strategically relevant consideration concerns the factor brand. As previously discussed, brand is already included as a factor in the current bad-will parameter, but is currently neutralised and does not affect the final bad-will cost value. From a strategic perspective, however, there may still be reasons to question whether all brands should be treated identically. Different brands may have different market positions, different customer expectations, and different strategic roles within Volvo Group's portfolio. A service failure may therefore have different long-term implications depending on how central the brand promise of uptime, reliability, or premium service is to the customer relationship. At the same time, such a distinction should be treated with caution. In the context of this study, no empirical indications has been found for differentiating between brands in the current model. Brand can therefore be discussed as a strategically relevant factor, but not as one that can be justified in the same way as criticality or lifecycle phase. This means that brand may be relevant for future evaluations of the model, but only if clearer evidence emerges regarding whether service failures are perceived differently across brands or whether the strategic cost of failure differs between them.

Another strategic factor needed to address is the area related to driveline type. This factor's implementation consists of the same arguments as previously mentioned for brand. There is reasons to questions to whether the different drivelines should be of

equal weight. However, this is also highly dependent on what the strategic direction Volvo wants to make, e.g. putting a higher bad-will cost for battery electric vehicles.

The distinction of strategic factors becomes important when discussing whether the model should absorb broader strategic priorities. If the parameter is intended to represent customer bad-will, then strategic market prioritization, business-criticality, brand positioning, and driveline types should ideally be treated separately. If, on the other hand, the parameter is also expected to steer service levels in line with Volvo's strategic priorities, then it becomes more relevant. A high bad-will value would then no longer mean only that the customer suffers more from the stockout, but also that Volvo has more to lose if the part is unavailable. From a practical standpoint, this suggests that Volvo may benefit from distinguishing more clearly between customer-related bad-will and strategic service prioritization. Some markets, parts, brands, or customer groups may warrant higher availability because they are strategically important for growth, market share, contract fulfilment, brand positioning, or aftermarket revenue.

7.3.3 Implications on Total Cost of Implementation

Implementing additional factors in the bad-will parameter would likely not affect all segments equally, but the sensitivity analysis in Section 4.3 indicates the overall direction of the effect. If the new factors lead to a higher estimated bad-will cost, the total cost model would justify a higher theoretical service level, since shortages become more expensive relative to holding inventory. If the factors instead lead to a lower bad-will cost, the opposite would apply. In such cases, the model would suggest a lower service level where shortages are expected to result in less severe customer consequences. The sensitivity analysis also suggests that this relationship is not linear across the two segment types used today, critical and non-critical. For the critical segment, the TSL moved within a relatively narrow range, while total cost remained almost unchanged. This indicates that the critical segment is already positioned in a high-service setting, where an increase in bad-will mainly reinforces an already high priority rather than fundamentally changing the cost picture.

For the non-critical segment, the analysis indicates greater sensitivity to changes in bad-will cost. Here, changes in bad-will produced a larger shift in TSL, which suggests that this segment is more exposed to how shortage consequences are interpreted in the model. If new factors, such as the implementable factors discussed earlier, would increase the estimated bad-will cost, the model would move toward a higher TSL for that segment. If the opposite occurs, and the estimated bad-will cost is decreased, the model would instead allow for a lower TSL.

This suggests that identifying which parts and shortage situations actually matter to the customer is particularly important in the non-critical segment, where relatively small changes in bad-will cost can have a comparatively large effect on the TSL. In that sense, a more granular criticality structure or segmentation appears especially relevant here, since it could help the model better distinguish where higher

service levels are justified and where they are not.

7.4 Other high Impact Factors

The findings of this study indicate that several important drivers of bad-will are better understood as organizational and process-related capabilities than as fixed model parameters. An example is ETA transparency. Throughout the dealer interviews, the ability to provide a reliable estimated time of arrival (ETA) was repeatedly described as critical in stockouts. Customers can understand that a part is temporarily unavailable, but they are less tolerant of uncertainty regarding when the vehicle can be on-road again. In this sense, ETA should not be understood only as information, but as part of the service itself. Although ETA quality clearly influences bad-will, it is difficult to represent it as a stable parameter in the total cost model. Its quality depends on many internal factors that is hard to navigate and investigate.

These factors are better understood as process capabilities than as characteristics of the spare part. A similar argument applies to communication during the shortage episode. The interviews show that customers evaluate not only whether the part eventually arrives, but also whether the dealer can provide updates, explain the situation, and show that the situation is taken care of. Progress updates reduce frustration because they signal ownership and activity, whereas the situation without updates can be understood as not taking ownership. This increases pressure on the dealer as well as customer dissatisfaction. Communication quality therefore appears to be highly relevant for bad-will, but it is not well suited to translation into a fixed cost parameter. Its effect depends on the interaction between the dealer, support functions, and the customer, and it varies across cases. This suggests that communication should primarily be addressed through routines, support processes, and internal service standards rather than through parameter design.

The study also highlights the importance of organizational distance from the customer. Interviewees described a gap between customer-facing roles and central support functions, where actors further from the market do not always recognize the urgency of the dealer's situation. This is closely related to planning being performed far from the market, where central planning and warehousing structures may optimize at a system level while lacking sufficient understanding of local operational consequences. Such distance can contribute to bad-will by reducing responsiveness, slowing escalation, and limiting the relevance of the information reaching the dealer. However, this is not primarily a parameter issue. Rather, it reflects organizational structure and the extent to which local market knowledge is incorporated into decision-making. A further factor is internal escalation capability. The findings indicate that the ability to mobilize support quickly and coordinate urgent cases can strongly influence how a shortage is experienced. Dealers described both informal workarounds, such as dealer-to-dealer sourcing, and more formal escalation paths through support functions. When these mechanisms work well, they can reduce the severity of the failure while if it functions poorly, it may develop into a more severe bad-will event. This suggests that escalation capability is strategically important,

but better understood as an operational capability than as a factor to implement in the model.

Taken together, these findings suggest that the gap between the current bad-will parameter and customer reality cannot be closed through parameter design alone. Some of the most important influences on bad-will arise from how the service system performs during a failure, rather than from how the spare part is classified in advance. Volvo may therefore need to address these issues outside the total cost model, for example through improved ETA processes, clearer escalation routines, stronger coordination between central and customer-facing roles, and greater sensitivity to local market conditions. This does not reduce their importance. On the contrary, it suggests that some of the strongest opportunities to reduce bad-will may lie in process improvement rather than in redesign of the cost model.

7.5 Summary

The purpose of this summary is to identify what factors are of biggest importance for Volvo to take action upon and furthermore be implemented in the model. Figure 7.2 illustrates the different factors by mapping the degree of implementation difficulty against impact on bad-will representation in order to identify these factors. In the mentioned figure, granular criticality stands out as the strongest candidate. Criticality is already a central part of the current parameter, but the results of the study suggest that just a single distinction between critical and non-critical is too simplified. A more granular structure would likely improve the model's representation of reality.

A second strong candidate is the lead time proxy. Throughout the study, time sensitivity emerged as a major driver of bad-will. The downtime is hard to measure in advance, since the bad-will cost is calculated in the planning phase, and therefore the lead time can work as a proxy for this as already discussed. It does not capture the full picture of a shortage situation, but it points in the direction of a more realistic representation than the current model.

The distinction between EU/non-EU is closely related to this, since it increases downtime by being located in a non-EU country due to border procedures and customs.

Market competitiveness is identified as having relatively high potential impact, although with somewhat greater implementation difficulty. This reflects that local competition clearly affects the consequences of a stockout, but is harder to translate into a stable and objective model parameter. Service contract ratio appears lower in impact and somewhat mixed in interpretation, since it influences service consequences.

The factors marked as strategic, such as business-critical segmentation, driveline,

market prioritisation, and brand, are placed in the figure as relevant but conceptually less suitable for direct inclusion in the bad-will parameter. These factors may justify higher service levels, but they often reflect Volvo's own strategic choices rather than the customer's experienced bad-will. Overall, the figure therefore suggests that the most suitable path forward is to refine the bad-will parameter primarily through granular criticality and lead-time-related proxies, while more strategic factors are better handled separately but still a potential action to take.

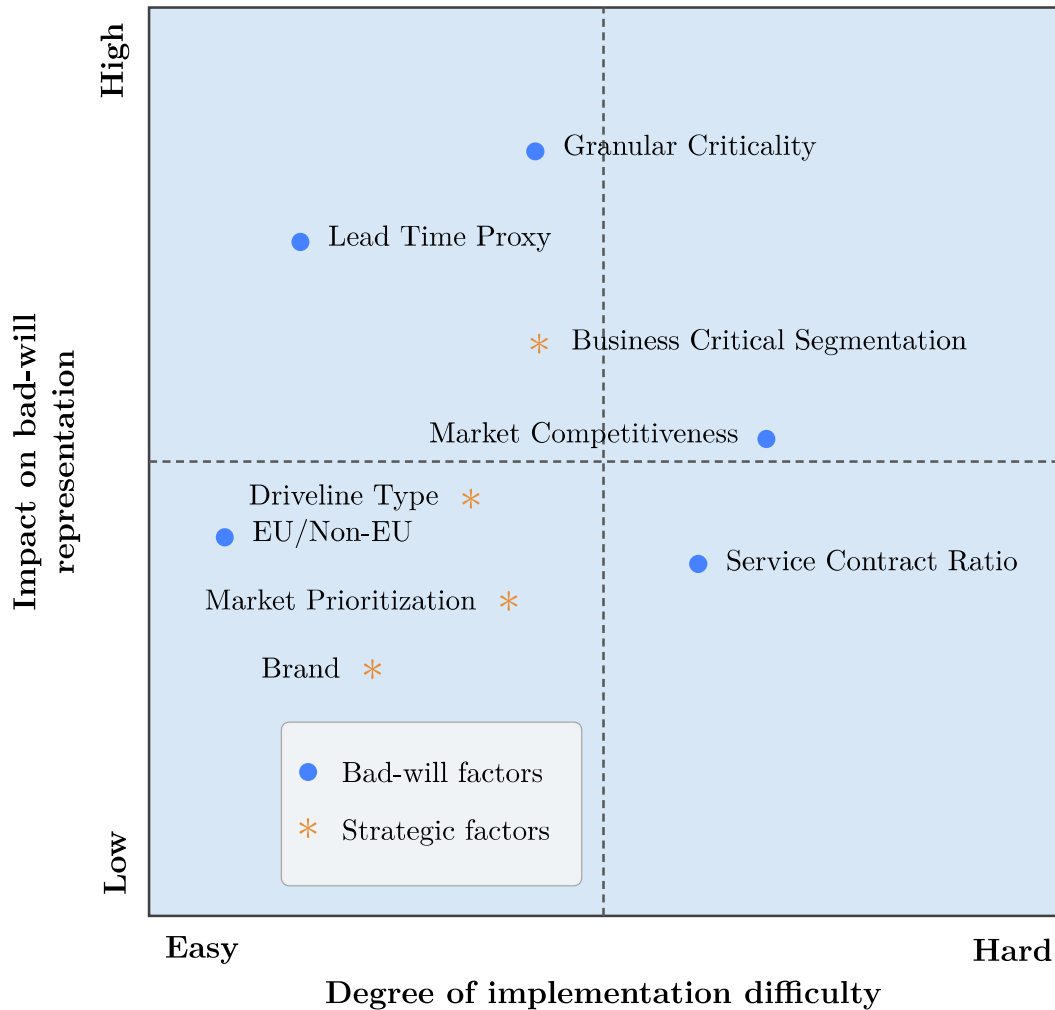


Figure 7.2: Impact vs difficulty of implementation.

8

Conclusions and Recommendations

This section concludes the study by answering the research question and by specifying the recommendations for Volvo in order to address the problem definition of the study.

8.1 Conclusions

The aim of the study is to analyse how service-related consequences of spare-parts distribution are represented in the bad-will parameter in the total cost model for spare-parts and to map and visualize the bad-will parameter internally. This was investigated within Volvo Group and carried out by a Volvo pre-study, a literature review, and qualitative data collection. This was operationalised into the following two research questions:

RQ1: How is customer bad-will currently defined within Volvo Group's total cost model?

Volvo's current customer bad-will cost is defined based on an outdated framework established between 15 to 20 years ago that has not taken into account global trends and shifts such as inflation, globalisation, and servitization. Instead of measuring customer dissatisfaction, the bad-will parameter currently functions as weighting tool based on four static spare parts attributes; a standardized base bad-will cost, criticality (whether a missing part puts a truck off-road), life cycle phase (weighted heavily toward newer parts), and brand (which is currently neutralized). These factors decide the bad-will cost that furthermore affect the inventory levels, where inaccuracies lead to flawed calculations of optimal inventory levels.

RQ2: Which factors are perceived by customers as the primary drivers of bad-will, and how do these relate to existing literature?

The study shows that the primary drivers of customer bad-will extend beyond the

static spare parts attributes currently used in the model. As illustrated in Figure 8.1, these factors can be conceptualized as layers that influence the evaluation of the service event. Some of these factors have a more direct and immediate effect on customer bad-will, while others operate more indirectly through the wider service and business context. The findings suggest that the most direct driver are operational impact, spare parts attributes, and service interaction. Customers primarily react negatively when a shortage leads to concrete consequences, such as downtime or missing deliveries. This is further increased by the length of the shortage, as a longer resolution time increases the level of bad-will. In addition, these effects can be further increased or decreased depending on the attributes of the missing spare part. If the spare part is seen as critical by the customer, or is a part that they expect to have stocked they can further intensify the bad-will. In addition to these layers, the way the dealer manages the service interaction strongly influences how the customer evaluates the situation. Particularly transparency, communication, and showing ownership over the stockout are important for the bad-will evaluation.

Beyond these immediate drivers, the study also shows that business relationships, market conditions, and regional context shape customer expectations. Although these factors are less directly tied to the stockout event itself, they influence how tolerant or critical customers become. For example, strong relationships and trust may mitigate bad-will, whereas competitive markets with low switching costs or weak local service conditions may intensify dissatisfaction. In this sense, the outer layers reflect more strategic and structural conditions that frame how the shortage is interpreted by the customer.

In relation to existing literature, these findings are consistent with research showing that service quality is not determined solely by the service failure itself, but also by the surrounding interaction, recovery process, and contextual conditions. The results therefore extend a product-centered perspective by indicating that bad-will emerges through a combination of operational consequences, interaction quality, and broader business conditions. Overall, the study suggests that customer bad-will should be understood as a multidimensional phenomenon rather than as a direct outcome of the shortage alone.

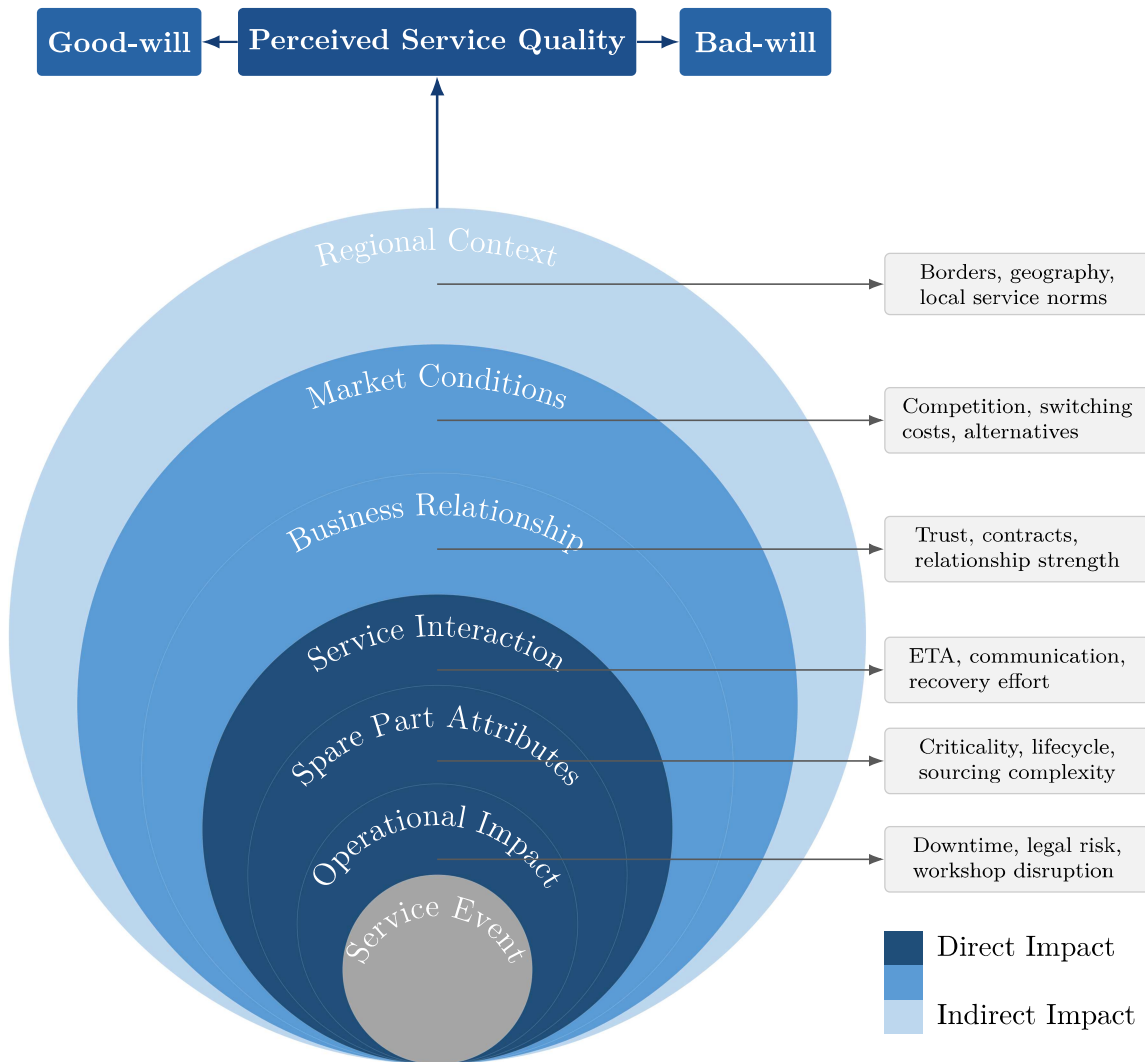


Figure 8.1: Developed framework in Volvo context.

8.2 Recommendations

Based on the developed analytic framework, figure 8.1, and the evaluation of the degree of impact against the ease of implementation, figure 7.2, the recommendation is to focus on the implementation of the factors in the top right quadrant in figure 7.2. These factors are identified as the factors with most potential to most effectively align the bad-will parameter with reality.

The first implementation should be to implement a more granular structure for criticality. While the study shows that the current binary segmentation of uptime-critical and standard parts is too simplified, a more granular model would increase precision and accuracy of the part's actual bad-will cost. This means that by defining what parts that are regulatory critical and by expand the criticality factor into a more granular structure and by comprising multiple levels, the evaluation of the bad-will cost will be more accurate.

The second recommendation is to implement a factor that represent the time during a stockout and one proposal is that lead time can work as a proxy for this factor. An implementation of such a factor would represent the fact that a stockout in a market where you have longer lead time would imply a higher bad-will cost than a market that has a shorter lead time, which this study suggest.

The final recommendation is to implement a business critical segmentation. This factor is categorized as a strategic factor since the evaluation of what parts can be part the segment is dependent on what parts that has unique importance for Volvo and a specific market. As previously discussed, it might be more complex to include such a factor in the bad-will, but the impact to bad-will justify the recommendation from this study. Integrating such a factor as a level of criticality, or as a separate factor, would help Volvo in representing business critical parts in the bad-will parameter since these are parts where customers dissatisfaction can be more important to address, since these part generates much revenue for Volvo.

Another relevant suggestions that has emerged throughout the study is to investigate whether the base bad-will should be adjusted for inflation, since the base bad-will cost was most recently evaluated 15-20 years ago. The time since the most recent evaluation can justify that such an investigation should take place.

8.3 Future Research and Limitations

This study is limited by its geographical scope, solely focusing on Volvo Trucks operations in Europe, where interviews and data collection have taken place. The finding are relevant for similar contexts, but might not be fully applicable to other industries or regions. The output of the study is dependent on interviews and available data which might not consider all variables and may also change over time as trends and global shifts is also under constant change.

Another limitation of the study that is needed to address in the future research is to evaluate the actual cost of each level of current and suggested factors. This is because the study only suggest factors to be implemented in the bad-will parameter, and not suggesting what the actual cost for each level should be. The evaluation of the actual cost for each factor and level is identified as out of the scope and also dependent both internal data, calculations, and strategic decisions. Future research should also investigate the applicability outside Europe where cultural differences might lead to different results in some areas.

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A

First Round Interviews Volvo Pre-study

These questions form the base of our semi-structured interviews within the first phase of the Volvo pre-study.

- What is the purpose of using the total cost model?
- How is the total cost model configured today? What parameters are included?
- Does bad-will parameter have an official definition?
- How is the bad-will cost estimation calculated?
- When was bad-will introduced to the total cost model? Has it changed over time?

B

Second Round Interviews

These questions form the base of our semi-structured interviews within the second phase of the Volvo pre-study.

B.1 Roles and network structure

- Can you describe your role and how the interaction with dealers looks like?
- Who are the most important internal and external actors regarding securing availability for the end customer?
- How does the flow of information look like between SO&T, market companies, and the dealers?
- How is the bad-will cost estimation calculated?

B.2 Order and distribution logic

- How is the ordering process looking like from the dealer to RDC/SDC?
- What is the procedure of LPAs and what parts are usually ordered manually?

B.3 Stockout handling and procedures

- What happens with the system when a stockout takes place?
- How do you work with providing ETA and how does it affect the quality of service?

C

Third Round Interviews

These questions form the base of our semi-structured interviews within main data collection with dealers and other actors to understand the bad-will parameter.

C.1 Expectations vs. Delivered Service

1. Can you describe a recent case where the delivered service was clearly below what you expected?
2. What part of the stockout created the most frustration?
3. When service fails, what do you feel Volvo does not understand about your reality as a dealer?

C.2 Factors Influencing the Evaluation of Service

1. Do you know the reason why a part is not in stock? If so, what would you say are acceptable and unacceptable reasons for a delay?
2. When a part is delayed, what makes it feel manageable versus unacceptable?
3. Which part of categories or order situations tend to produce the biggest pain for you?
4. In a failure situation, how do you typically get information that something is wrong (proactive versus reactive approach)?
5. In a typical shortage case, how do you decide how long you are willing to wait?
6. How does your experience of the situation change the longer time it takes?
7. Do you get any insights into the process when a part is not in stock (ETA, how it is handled, why the part is not in stock)?
8. When there is a shortage, do you feel a mismatch between what you think is important versus what Volvo thinks is important? (e.g. what products are prioritized)

C.3 Consequences

1. Are there some parts or segments of parts that you do not buy from Volvo
 - (a) Are there parts or segments that you used to buy from Volvo but no longer do so?
 - (b) What initiated that change?

- (c) Is it harder, more expensive, or do you have fewer opportunities when changing supplier from Volvo?
- 2. What is the main reason that you order from Volvo?
 - (a) What are reasons that you continue to order from Volvo?
- 3. If you have a bad experience with ordering from Volvo (service not fulfilled), how do you act and react?
 - (a) Does your image of Volvo get affected in that case?
 - (b) Have you been affected by any word of mouth about Volvo?

