Outsourcing Coordination of Supplier Involvement in Collaborative Product Development Projects

A Risk Analysis

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Outsourcing Coordination of Supplier Involvement in Collaborative Product Development Projects - A Risk Analysis

by

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Outsourcing koordinering av leverantörsinblandning i kollaborativa produktutvecklingsprojekt

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The automotive industry is in the midst of historic change: changing consumer preferences, new technologies and tougher sustainability requirements. Car manufacturers are forced to transform their businesses fundamentally while striking a balance between current needs and future opportunities. In recent years, collaborative product development has become an important business strategy as a means to respond to the changing market conditions. Despite many benefits, however, collaborations with suppliers place substantial pressure on the focal firm as joint efforts must be managed and coordinated carefully.

The purpose of this thesis was to explore the feasibility of outsourcing coordination of supplier involvement in collaborative product development projects. The purpose was operationalized by a research question seeking to identify characteristic risk factors in the aforementioned outsourcing context. Thus, the thesis was built upon a theoretical foundation of the interface between collaborative product development, outsourcing and risk management theories. In the methodology, a multi-step research design was taken that included reviewing documents, observing participants as well as conducting interviews and workshops.

The analysis yielded a comprehensive overview of relevant risk factors in outsourcing coordination of supplier involvement in collaborative product development projects. The outsourcing practice has proven to be inherently risky as a total of 10 different risk factors were identified and their characteristics assessed. The research has shown that both effective risk management strategies and adjustment to corporate regulations and policies are required if the outsourcing practice is to be implemented within the contextual setting studied in the thesis. The research findings have further contributed to the existing body of literature on relevant outsourcing risk factors.

**Key-Words**
Risk Analysis, Outsourcing, Collaborative Product Development, Automotive Industry
Sammanfattning


Syftet med avhandlingen var att utforska möjligheten att outsourca koordinering av leverantörsinblandning i kollaborativa produktutvecklingsprojekt. Syftet blev operationaliserat av en forskningsfråga som sökte att identifiera karaktäristiska riskfaktorer i den tidigare nämnda outsourcing kontexten. Således var avhandlingen byggd på en teoretisk grund av gränssnittet mellan kollaborativ produktutveckling, outsourcing och riskhanteringsteorier. I metoden togs en flerstegad forskningsdesign som inkluderade att granska dokument, observera deltagare samt utföra intervjuer och workshops.

Analysen gav en omfattande översikt av relevanta riskfaktorer i outsourcing av koordinering av leverantörsinblandning i kollaborativa produktutvecklingsprojekt. Bruket av outsourcing har bevisats att innebära risker, totalt 10 olika riskfaktorer blev identifierade och deras karakteristik bedömdes. Forskningen har visat att både effektiva riskhanteringsstrategier och justering av företagsbestämmelser behövs om bruket av outsourcing ska kunna implementeras inom den kontext som studerades inom avhandlingen. Fynden i forskningen har bidragit till den existerande litteraturen om riskfaktorer i outsourcing.

Nyckelord
Riskanalys, outsourcing, kollaborativ produktutveckling, bilindustri
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Stockholm, June 2018
Christopher Hofmann
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<td>3D</td>
<td>Three-dimensional</td>
</tr>
<tr>
<td>BMG</td>
<td>Baumustergenehmigung (Build Sample Approval)</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer-aided Design</td>
</tr>
<tr>
<td>CO2</td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>CPD</td>
<td>Collaborative Product Development</td>
</tr>
<tr>
<td>Ed.</td>
<td>Editor</td>
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<tr>
<td>EMC</td>
<td>Electromagnetic compatibility</td>
</tr>
<tr>
<td>ID</td>
<td>Identity Document</td>
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<tr>
<td>Min</td>
<td>Minutes</td>
</tr>
<tr>
<td>NPD</td>
<td>New Product Development</td>
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<tr>
<td>OEM</td>
<td>Original Equipment Manufacturer</td>
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<tr>
<td>PDP</td>
<td>Product Development Process</td>
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<td>R&amp;D</td>
<td>Research and Development</td>
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1 Introduction

This chapter introduces the reader to this master thesis. First, a background of the research is presented. The background ends in a problem area, which aims to justify the importance of the research. Further, the problem is narrowed down to a purpose, which is conceptualized into the main research question. Following the research question, the delimitations set the parameters of research and analysis for this thesis. The chapter ends with the contributions and the disposition of the paper.

1.1 Background

The automotive industry is in the midst of historic change: changing consumer preferences, new technologies and tougher sustainability requirements (Gao et al., 2016). This transformation is driven by the mega trends of digitalization, urbanization and sustainability. Environmental regulations will particularly exert immense pressure on the industry, enabling a more sustainable world for future generations (Kastensson, 2014). The impact of cars on the environment during all phases of the product lifecycle is well known, leading to aggressive regulations on fuel economy and emissions in core markets such as Europe, the US and Japan (Valentine-Urbschat & Bernhart, 2009). Hence, the reduction of this impact has become a priority for many original equipment manufacturers (OEM) (Aggeri et al., 2009).

The focus on reducing carbon dioxide (CO2) emissions is one of the main drivers in the development of less environmentally destructive cars (Aggeri et al., 2009). The new European 2020 targets for emission of the entire average new car fleet of 95g/km (European Commission, 2009) demand major efforts and will force carmakers to find new solutions. Battery electric vehicles (BEV) are perceived as strategically important in the industry to contribute to sustainable development with lower CO2 emissions and less air pollution. However, the shift to electrified cars requires new technologies and capabilities, and old ones will lose their previous importance (Altenburg, 2014). For OEMs, a key challenge is to replace fuel-based vehicles gradually by introducing alternative drive concepts across their fleets (Autenrieb et al., 2014). Put differently, carmakers are forced to manage a larger, more complex technology portfolio while striking a balance between optimizing for current needs and positioning themselves for future opportunities (Valentine-Urbschat & Bernhart, 2009).

Collaboration in Product Development

To respond to the changing conditions in markets and technologies, OEMs must innovate to provide a constant stream of new, eco-friendly vehicles (Ranky, 1994). As stated by Clark and Fujimoto (1991), an organization’s ability to introduce new products and services is a key success factor for sustaining competitive advantage. New product development (NPD) emerges consequently as a crucial process for OEMs to manage the disruptive shift towards alternative drive concepts (Büyüköüzkan et al., 2007). NPD is geared to organizations core competencies, used to realize corporate objectives. It includes all sub-processes that are
required for a product from the idea to its start of production (Dombrowski & Karl, 2016). However, as the importance of NPD grows, so do the demands for corporate capabilities and performance levels (Van Echtelt, 2004).

In recent years, car manufacturers have increasingly extended their NPD activities across organizational boundaries by involving suppliers in product development; thereby using their external knowledge and expertise to complement internal capabilities (Wagner & Hoegl, 2006). In collaborative product development (CPD), suppliers typically receive extensive tasks such as developing, prototyping and testing (Dombrowski & Karl, 2016). The benefits of collaboration include higher return on R&D investments (Handfield & Lawson, 2007), faster and more flexible product development and access to external development capabilities (Petersen et al., 2005). As a result, CPD often forms an answer for firms seeking to improve their product development performance (McIvor, 2000). However, the practice leads to increased coordination amongst internal and external interfaces. Further challenges such as the loss of proprietary knowledge and reduced control over the development process must also be carefully managed (Luo et al., 2010).

1.2 Problem Definition

The transformation of the automotive industry results in new challenges. Mastering these requires OEMs to transform their businesses fundamentally while maintaining a balance between current needs and future opportunities (Klug, 2013). CPD with suppliers has become an important business strategy as a means to stay competitive in a global, rapidly changing market environment (Lakemond et al., 2006). The benefits are manifold; however, collaboration with external partners takes time, effort and money in terms of coordination and communication (Wynstra & Pemierick, 1999). This is because to realize the benefits of collaboration, OEMs must not only integrate, manage and coordinate all internal functions in their product development process but also their external partners (Luo et al., 2010). In fact, CPD requires frequent communication among all involved parties, making it a resource-demanding strategy (Gadde & Snehota, 2000). In times of change, however, organizational resources tend to be limited for performing such duties properly (Pons, 2008). The reason for this is simple: businesses focus primarily on redefining their core capabilities by developing new expertise across the organization (Zook, 2007).

As a result, there is a need for new practices that facilitate successful coordination of supplier involvement in order to meet the upcoming challenges. Existing research on CPD focuses on a variety of different streams. Some scholars have concentrated on studying intra-firm collaboration related to the integration of the different functions within the organization (e.g. Swink, 1999; Ittner & Larcker, 1997). Other studies in literature have explored the inter-firm relationship between the collaborating parties (e.g. Fagerström, 2004; Langerak & Hultink, 2005; Tuli & Shankar, 2015). Further references have also examined the effects of external stakeholder involvement effort on the performance of NPD (e.g. Kamath & Liker, 1994; Tavani et al., 2013). However, research that investigates outsourcing as a strategic practice
in this particular context appears to be limited. A possible explanation for this is that the original motive for outsourcing was cost reduction (e.g. Arnold, 2000; Gilbert et al., 2006). With new purposes of outsourcing arising (e.g. buying time to focus on core competencies), the practice becomes increasingly relevant (Chou & Chou, 2011). There is, however, a large body of literature that shows that risk is an inherent part of outsourcing (e.g. Kliem, 1999; Leavy, 2001; Van Weele, 2005). As outlined by Normman and Lindroth (2004), potential risk factors can be of different nature and are often organized in risk categories (e.g. performance risk, people risk). Within these categories, a variety of different risk factors exist that may result from the supplier, the business environment or the buyer organization itself (Shi, 2007). If managers are to employ the outsourcing arrangement, potential implications and risks must be better understood.

1.3 Research Purpose

The purpose of this study is to explore the feasibility of outsourcing coordination of supplier involvement in collaborative product development projects.

The exploratory purpose is motivated by the novelty of the studied phenomenon in the automotive industry. The build sample (BMG) approval process acts as the specific case study context for this thesis. The approval process is an integral part of car manufacturers new product development process and can be considered as complex, time-consuming and critical to success in collaborative development projects. It further involves the coordination of numerous stakeholders across functional, divisional and organizational boundaries and was therefore deemed appropriate for this thesis.

1.4 Research Question

To operationalize the purpose of this work, the following main research question (RQ) will be posed and addressed:

- RQ: What are characteristic risk factors in outsourcing coordination activities in collaborative product development projects?

1.5 Delimitations

Given the purpose of this thesis, the area of investigation can be analysed on the following hierarchical and contextual levels: the industry, firm, and activity level. On the first contextual level, the thesis was delimited to the automotive industry. As outlined, there is a need for new practices that facilitate successful collaboration in product development in order to meet the upcoming challenges in the automotive industry. On the firm level, the thesis was delimited to original equipment manufacturers; thus taking the focal firm’s perspective in CPD projects. Car manufacturers are particular interesting for the underlying phenomenon of interest since collaboration in the field of product development has been an integral part of their development strategy in the recent years. Since the research is performed at the
German car manufacturer Audi, the focus of the thesis was geographically delimited to Germany.

On the activity or process level, the study was delimited to the BMG approval process, which is an integral part of the case company’s new vehicle development process. The thesis was further delimited to individuals who interact or are immediately concerned with the BMG approval process. Hence, the supplier side in the given context was not taken into consideration. Put differently, the identification and assessment of outsourcing risk factors was delimited to risk factors with relevance to car manufacturers.

### 1.6 Contributions

The contributions of this study are twofold: academic and practical. From an academic point of view, the thesis adds to existing research on risk factors in outsourcing projects. In a first step, the author provides a systematic approach for the identification of characteristic risk factors associated with outsourcing coordination activities in CPD projects. The findings are then synthesised into a framework that allows the assessment of identified risk factors in the given case study context. The assessment results serve the purpose of exploring the relative importance of risk factors in the given outsourcing context.

From a practical point of view, the thesis provides an overview of the unit of analysis by mapping the BMG approval process in a comprehensive manner. The thesis further identifies characteristic outsourcing risk factors and much needed empirical assessment data on identified risk factors. The collected information serves as a basis for giving an estimation of the feasibility of outsourcing coordination of supplier involvement in collaborative product development projects.

### 1.7 Disposition

The outline of the thesis is presented in nine chapters, including this introduction chapter. The following chapters of the paper are structured as follows:

- Chapters two and three present the pertinent literature concerning the area of research of this thesis.
- Chapter four describes the research methodology implemented to gather the required data for the thesis. It includes the type and approach of research, sample selection technique, data collection methods and a detailed outline of the research design steps.
- Chapter five provides detailed information about the case company as well as the particular case study context of this thesis.
- In chapter six, the contextual setting studied in the thesis is established by modelling the BMG approval process. A particular focus is laid on relevant process dimensions such as stakeholders, process activities and communication systems.
- Chapter seven outlines both the procedure and the results of identifying and assessing characteristic risk factors in the given case study context.
• Chapter eight discusses the implications of the research findings for theory and practice. The chapter further includes general reflections on the issue of sustainability.
• Finally, chapter nine answers the research question raised and conclusions are drawn. The chapter further discusses the limitations of the thesis and provides suggestions for future research.
2 New Product Development: A Collaborative Setting

New product development (NPD) – defined as the ability to identify the needs of customers and to quickly create products that meet these needs – is widely known to be critical for economic success of manufacturing firms and an important core competence (e.g., Brown & Eisenhardt, 1995; Clark & Fujimoto, 1991). In recent years, however, product development has become an ongoing race against time, technology constraints, changing trends and competitors (Ulrich & Eppinger, 2008). To make matters worse, increasing complexity and shortening product lifecycles have made NPD far more expensive and even more important than it used to be. Maintaining and creating competitive edge therefore increasingly calls more and more for effective product development (Korhonen, 2009). However, simply spending more money on the same NPD processes as before is not a lasting solution (Van Echtelt, 2004). Instead, allying with others may form an answer to win in the constantly changing marketplace (Harbison & Pekar, 1995). Firms sharing mutual interest must learn to collaborate with each other as a means to save time and reduce costs (Hart, 1993).

2.1 The Process of Developing New Products

Literature review shows that the process of developing new products has been a subject of much study. Numerous definitions and generalized models of the process have been developed, but most of them differ only in details. Monczka et al. (2000), for example, define the NPD process as “a series of interdependent and often overlapping stages during which a new product (or process or service) is brought from the idea stage to readiness for full-scale product or operation”. Ulrich and Eppinger (2008), in turn, define the process as “the sequence of steps or activities which an enterprise employs to conceive, design, and commercialize a product”.

The definitions emphasise a series of predefined stages as an integral part of the NPD process. In fact, all reviewed models in the literature divide the NPD process into distinct stages or steps, with common elements such as problem-definition stages and concept embodiment (Seidel, 2007). The actual number of stages differs between four and six but includes essentially the same activities (Korhonen, 2009). Clark and Fujimoto (1991), for example, describe a process comprising of four generic steps: (1) concept development, (2) basic design, (3) detailed engineering, and (4) pilot production and ramp-up (cf. Figure 2.1).

![Figure 2.1: A generic new product development process (Clark & Fujimoto, 1991)](image)

As organizations specialize, each of these phases includes different responsibilities for a given firm’s key functions (Carlile & Rebentisch, 2003). In fact, many papers within the literature have recognized the interdisciplinary nature of the NPD process and highlighted the importance of inter-functional coordination (e.g., Clark & Fujimoto, 1991). A popular
approach for achieving functional integration is the use of cross-functional product development teams (Parker 1994). However, coordination in cross-functional teams in NPD projects is especially challenging for large organizations with highly specialized functional departments (Melander, 2014).

2.2 External Collaboration in New Product Development

The development of new products has traditionally been kept in secrecy. The reason for this is simple: NPD is closely tied with the key technologies and strategy of the firm, and few firms want to share their secrets (Korhonen, 2009). However, with increasing global competition, firms are exploring the various means of collaboration to fully exploit opportunities to reduce costs and time-to-market, share risks and benefit from complementary knowledge and resources (Tuli & Shankar, 2014). The literature recognizes this concept as collaborative product development, which may exist between suppliers, customers and sometimes even competitors.¹

Numerous authors have attempted to develop a definition for CPD. Lawton-Smith et al. (1991), for example, simply refer to CPD as a “cooperative relationship between firms contributing to innovation and the development of new products”. Dodgson (1993) defines CPD as “any activity where two (or more) partners contribute differential resources and know how to agree complementary aims in order to design and develop a new or improved product.” In fact, CPD is a technology-centred process including two or more partners with diverse competence, experience, culture, skill and location joining complementary resources to gain competitive advantage (Arsenyan, & Büyüközkan, 2014).

The definitions demonstrate that collaboration in product development in characterized by several dimensions. Firstly, suppliers may contribute to NPD by bringing in their capabilities to improve performance of the process (Hart, 1993). Dowlatshahi (1998) mentions prototyping expertise as an example, which one of the firms may not possess. In addition to capabilities, a partner may contribute by allocating resources (e.g. financial, human or capital resources). Such resources are often cited as being a critical condition for making collaboration successful (e.g. Lakemond, 2001). Contributions by suppliers may also comprise specific information, ideas and knowledge that help to improve product performance; for instance, by suggesting alternative product materials (Van Echtelt, 2004).

Moreover, the aforementioned contributions can be linked to a variety of tasks a partner can perform in NPD projects (Büyüközkan & Arsenyan, 2012). These tasks are a selection of the total amount of activities that need to be executed in such projects and may refer to concept development, basic design or production ramp-up (Van Echtelt, 2004). The possible stages where collaboration may occur are depicted in Figure 2.2.

¹ Recall that this thesis focuses on collaborations with suppliers.
In fact, collaboration may range from inclusion in only one stage of the NPD process to inclusion in the entire process (Büyüközkan & Arsenyan, 2012). In other words, CPD can occur in varied levels of responsibility (Petersen et al., 2005). Handfield et al. (1999) theorize the amount of supplier’s responsibility within NPD projects into a spectrum of three categories ranging from ‘white box’, ‘grey box’ to ‘black box’. At the high responsibility end of the spectrum (‘black box’), the OEM may develop the performance specifications for a particular component while the supplier performs the tasks of designing the part based on those specifications (Van Echtelt, 2004). At the other end of the spectrum (‘white box’), the focal firm may be fully responsible for component design while the supplier plays merely a consultative role (e.g. partners opinion concerning design).

2.3 The Rationale for Collaboration: Benefits and Risks

The attention for the concept of collaboration in NPD in academic literature emerges from various research and discipline streams, each with different focuses and perspectives. The subject can be studied in terms of its potential benefits and risk in collaborative relationships. Some of these findings, commonly presented in the literature, are introduced in the following.

Potential Benefits

There are several benefits why firms choose to collaborate. One of the most frequently mentioned benefits is that of speed. Considerable attention has been focused on the importance of reducing time-to-market in today’s competitive market environment (Littler et al., 1995). Collaboration is seen as one way for introducing new ideas and innovations faster to the market. Sharing the risks and costs of NPD thorough collaboration has been acknowledged by numerous authors as another significant benefit (Farrukh et al., 2003; Hou et al., 2007). A third benefit of CPD is that of obtaining access to new technologies and complementary skills in order to improve competitive edge (Littler et al., 1995). Moreover, Hoffmann and Schlosser (2001) list access to resources as another advantage of CPD. In fact, close collaboration with partners may help in overcoming lacking resources relative to future needs.

As outlined above, various reasons for engaging in CPD have been identified. Although the concept CPD is promoted as an effective means for lowering – or at least sharing –
organizational risk, collaborations in complex processes such as NPD present their own challenges (Bruce et al., 1995).

**Potential Risks**

Although sharing capabilities, resources and costs with partners presents an attractive option in NPD, collaborative arrangements with suppliers are inherently risky and difficult to manage (Büyüközkan & Arsenyan, 2012). For example, there can be a leakage to collaborating partners of a company's unique skills and expertise that may form a vital part of the basis of its competitiveness (Littler et al., 1995). Bardhan (2007) further mentions the reduction of direct control held by the manufacturing organization over the NPD project as a second risk. Additional coordination and time costs are another concern in a collaborative setting. Particular attention is paid to the difficulties of coordinating the divergent management styles, organizational cultures and social behavior of the collaborating firms (Büyüközkan & Arsenyan, 2012). A further risk of CPD is that there can be severe opportunity costs since excessive effort and resources may be directed toward the collaborative arrangement; such that the coordination and maintenance of the collaboration becomes the major objective, at the expense of the actual NPD project (Littler et al., 1995).

2.4 Towards Successful Collaboration

Collaboration in NPD places substantial pressure on the focal company: the firm must not only integrate all the internal functions in their NPD process (cf. also Section 2.1) but also their external partners (Luo et al., 2010). CPD also requires frequent communication among all involved parties, making it a resource-demanding strategy (Gadde & Snehota, 2000). Nevertheless, proactive management of collaborative relationships can contribute to the competitive position of the organization. This contribution, however, must be coordinated and managed properly (Brown & Eisenhardt, 1995). Within an organization, task dependencies are implicit under the assumption that people in cross-functional teams work together in NPD projects. These task dependencies drive the need for coordinative efforts by the organization. Similarly, when part of NPD activities is performed by suppliers, dependencies between the collaborating firms are altered (Lakemond et al., 2006). Activities that are carried out across the borders of an organization therefore call for effective inter-organizational integration and management. However, as pointed out by Camerer and Kney (1996), integration between collaborating parties often lacks alignment of action and interest. Lack of such alignments may result in inefficiencies in the interdependent tasks and impedes NPD project progress by sub-optimal utilization of shared resources (Tuli & Shankar, 2015).

As a reaction to these findings, numerous authors have attempted to develop generalized models that allow for differentiated approaches towards successful collaborative relationships. Some scholars have focused on intra-firm collaboration related to the integration of the different functions within the organization (e.g. Parker, 1994; Souder & Sherman, 1993). A primary recommendation has been the concept of integrated product
development characterized by the concurrent product development process and/or the use of cross-functional teams (Luo et al., 2010).

Other studies in the literature have explored the inter-firm relationship between the collaborating parties. Fagerström (2004), for example, has investigated the different interfaces that may exist between the focal firm and the external partner. The author proposes a model for managing the interfaces relevant for collaboration in NPD. The focus lies on interfaces between general processes and interfaces related to the NPD process (for more details see Fagerström, 2004, p. 77). Tuli and Shankar (2015) suggest to combine the concept of CPD with three fundamentals of lean thinking (purpose, process and people). The proposed ‘collaborative and lean’ approach aims to restructure the inter-firm interactions during NPD; thereby reducing non-value-added activities and facilitating superior utilization of mutual capabilities and expertise (Tuli & Shankar, 2015). None of these frameworks, however, provide sufficient insights into practical issues such as the management and coordination of the collaboration. Lakemond et al. (2006) suggest three distinct coordination approaches for collaborative NPD projects; ‘project integration coordination’, ‘disconnected sub-project coordination’, and ‘direct ad-hoc contacts’ (for more details see Lakemond et al., 2006, p. 60).

Several studies have also examined the effects of external stakeholder involvement effort on the performance of NPD. Tavani et al. (2013) have studied the relationship of absorptive capacity and stakeholder involvement with NPD performance. The authors suggest that collaborative relationships coupled with focal firm’s capacity and capability to absorb external and internal knowledge may be correlated to the NPD performance. Moreover, integrated problem-solving approaches have emerged from the fact that CPD environments are typically characterized by high levels of uncertainty (e.g. Wheelwright & Clark, 1992).

Collaborative product development has been studied from different perspectives. Suppliers are seen as important contributors to stay competitive in a global, rapidly changing market environment (Lakemond et al., 2006). However, managing and coordinating this contribution takes extensive time and effort (Wynstra & Tem Pierick, 1999). Although much research has been conducted in the field, there are a number of issues that remain to be resolved. It is not clear, for instance, how firms with limited internal capacity can still engage in collaborative relationships. This may be of interest for organizations facing transformational change; therefore, focusing primarily on redefining their core competencies (Zook, 2007). One suggestion is to outsource the coordination of supplier involvement in CPD. However, research that investigates outsourcing as a practice in this particular context is very limited. If managers are to employ outsourcing in collaborative product development, potential implications and relevant risk factors must be better understood.
3 The Phenomenon of Outsourcing

The concept of outsourcing has become an important element of business strategy and a popular research area (Mullin, 1996). The pertinent academic literature has been growing rapidly in size, covering the whole range from traditional theoretical discussions (e.g. transaction cost economies; cf. Williamson, 1975) to practitioners’ handbooks on how and when to outsource. However, the research area is by no means clear or well-defined and ambiguity often exists (Dolgui & Proth, 2012). To facilitate a common understanding of the concept, the section reviews literature and theories most relevant for this thesis.

3.1 Defining the Concept

Definitions of the term outsourcing are abundant. Ellram and Maltz (1995), for example, argue that outsourcing is simply “moving functions or activities out of an organization.” Lei and Hitt (1995) support this view by referring to outsourcing as “reliance on external sources for manufacturing components and other value-adding activities”. Perry (1997) focuses on employment, defining outsourcing as “another firm’s employees carrying out tasks previously performed by one’s own employees”. A more comprehensive definition is provided by Axelsson and Wynstra (2002), defining outsourcing as “the decision and subsequent transfer process by which activities that constitute a function, that earlier have been carried out within the company, are instead contracted from an external supplier.” Based on these affirmations, it can be concluded that the key characteristics of outsourcing are that (Van Weele, 2010):

- Activities that initially performed in-house are transferred to an external party
- Assets, knowledge and, in some cases, people go over to that external actor
- There will be an extended relationship between the parties involved
- The buyer is exposed to both a cost and risk profile by transferring the activity

Outsourcing may come in different forms: it can be domestic or carried out in another country (Mella & Pellicelli, 2012). However, as noticed by Dolgui and Proth (2012), confusion between terminologies used in the field of outsourcing often exists. To avoid any ambiguities, a clarification of the terms is provided below.

In simple terms, outsourcing is the transfer of activities to a third-party entity (cf. above). The institution that plans to outsource is known as the buyer organization. Outsourcing objects are processes\(^2\) or process results that might be outsourced (Arnold, 2000). Outsourcing suppliers are possible external actors that perform the objects considered for outsourcing. Offshore outsourcing relates to the commissioning of work to a supplier located in a country different from that of the buyer (Van Weele, 2010). Off-shoring, in turn, refers

\(^2\) A process is a set of activities that interact to achieve a result (Prasher, 1987).
Motives for Outsourcing

The literature in the field discusses many motives for firms to engage in outsourcing. A large body of literature identifies cost reduction as one of the main drivers for outsourcing (e.g. Lacity & Hirschheim, 1993; McFarlan & Nolan, 1995; Gilbert et al., 2006). As documented by Kremic et al. (2006), outsourcing for cost reasons may occur when suppliers’ costs are low enough that even with added overhead, profit, and transaction costs external parties can still deliver a service for a lower price. However, there is increasing evidence that expected savings have been overestimated, and costs appear to be even higher after outsourcing (e.g. Pepper, 1996). Main drivers for outsourcing appear therefore to be shifting from cost to more strategic issues (Wright, 2001). One of the most cited reasons for outsourcing is to allow an organization to better focus on its core competencies (e.g. Quinn, 1999). However, many other strategic motives have been identified, including among others (Bragg, 2006; Chou & Chou, 2011; Lonsdale & Cox, 2000; Quelin & Duhamel, 2003):

- Acquiring new skills and talent by handing over to specialized supplier
- Buying time to focus on corporate reorganization
- Freeing up internal resources for other purposes
- Expanding to new markets by taking activities closer to end users
- Mitigating risk by transferring responsibility with the activity

Given the increased focus on core activities and the simultaneous leveraging of external pools of resources, capabilities and competencies, Parkhe (2007) concluded that no company alone possess the full complement of resources needed to compete in today’s hyper-competitive environment. Hence, the key challenges for organizations lie in defining their key competence areas, finding complementary suppliers, and managing the resulting network of external actors (Nummela, 2004).

3.2 The Process of Outsourcing

The outsourcing literature is populated with studies on describing the process in which outsourcing occurs (e.g. Probert, 1996; Greaver, 1999; Momme & Hvolby, 2002). Most of the existing frameworks illustrate three phases of the process (e.g. Van Weele, 2005). In the first stage, they typically suggest that companies should determine potential candidates for outsourcing. The second stage is related to the management of the transition of activities to the supplier whereas the final stage is connected to managing the outsourcing process (Hätönen, 2008).

While there is clear consensus in the literature of the importance of the process and some general guidance on factors that should be considered, authors hold diverse views of the focus of the outsourcing process. Some models (e.g. Probert, 1996) indicate a clear emphasis on
the first phase (i.e. what should be outsourced) whereas others (e.g. De Boer et al., 2006) focus on the entire process (i.e. from the initial evaluation of outsourcing candidates to the final evaluation of the outsourcing performance and its implications). In this thesis, the process of outsourcing refers to the initial phase; thereby focusing on identifying and deciding on the most suitable activities for outsourcing. In the following, two exemplary frameworks are introduced.

**Review of Existing Frameworks**

Momme and Hvolby (2002; see also Van Weele, 2005) describe a process comprising of six generic steps: (1) competence analysis, (2) assessment and approval, (3) contract negotiation, (4) project execution, (5) relationship management and (6) contract termination. The authors further divide these steps into three distinct phases: the strategic phase, the transition phase and the operational phase (see Figure 3.1). Keeping in mind the focus of this study, only the strategic phase is described in detail.

During the strategic phase, three main considerations have to be taken into account by the buyer organization. The first aspect relates to the motivation of the firm to outsource a certain object. As mentioned previously, many motives for outsourcing exist (e.g. focus on core competencies). Against this background, it is important to account for a company’s overall strategy to ensure alignment with the decision to outsource. In other words, the outsourced activities should support the strategic direction of the firm (Van Weele, 2005). Momme and Hvolby (2002) suggest a number of key activities that may support this first step such as a strategic or SWOT analysis.

![Outsourcing framework adapted from Momme & Hvolby (2002, p. 71)](image)

**Figure 3.1: Outsourcing framework adapted from Momme & Hvolby (2002, p. 71)**

The second consideration centres around determining which activities are candidates for outsourcing. The authors suggest two approaches on which the outsourcing decision can be based on: the transaction cost approach and the core competence approach. The transaction
cost approach is based on the idea of finding a governance structure aimed at arriving at the lowest cost possible of each transaction that is made (e.g. Williamson, 1975). The core competence approach has evolved from the work of Prahalad and Hamel (1990) and is based on the assumption that, in order to create a sustainable competitive edge, a company should concentrate its resources on a set of core competencies (Van Weele, 2005). Following the logic of the core competence approach, Momme and Hvolby (2002) recommend mapping a firm’s core competencies to not only facilitate the outsourcing decision but also to define critical assessment criteria, which can be both qualitative and quantitative in nature.

The last aspect that has to be considered concerns the qualifications a supplier must possess in order to qualify as a potential partner in the outsourcing context. Momme and Hvolby (2002) mention technical and managerial capabilities as relevant parameters for assessing the required level of performance in the buyer-supplier relationship. The authors further mention supplier audits and benchmarking as practical techniques in this context.

Summary: The framework by Momme and Hvolby (2002) provides a comprehensive view on the outsourcing process. Although the stages of the model can be identified as generic, they consist of several suggested management tasks and activities. It can be argued, however, that the model tends to underestimate assessment- and planning-related tasks in the outsourcing process (e.g. no methodological support or guideline for defining assessment criteria). In fact, reported failures in outsourcing projects are often due to outsourcing wrong activities and/or poor framework selection in the outsourcing context (Van Weele, 2005).

Platts et al. (2000) propose an encompassing framework that addresses the decision to outsource in a manufacturing context. Starting point of the process are external factors such as competition, political events, and economical events that threaten the competitiveness of the organization. These factors usually activate triggers (e.g. cost reduction, lack of capacity, and skills shortage) for reviewing outsourcing as a viable option to respond to the changing market conditions. Put differently, the triggers relate to the motivation of the firm to undertake the outsourcing review.

The authors divide the outsourcing process into three distinct phases: (1) preparation phase, (2) data collection phase, and (3) data analysis phase (see Figure 3.2). The preparation phase starts with selecting a multi-disciplinary project team. In a second step, the unit of analysis (i.e. the outsourcing objects) is identified. Platts et al. (2000) suggest clustering relevant objects according to the following dimensions: technology, manufacturing processes, costs and support systems. The preparation phase ends with having selected candidates for outsourcing.
The second phase aims to collect relevant data for the outsourcing decision. In a first step, decision variables (e.g. cost saving, quality, flexibility) are defined. Then, Platts et al. (2000) suggest using a three-step workshop format for data collection, with each workshop addressing the different principles of decision-making according to Yoon and Hwang (1995). As part of the workshops, the project team assigns weightings and ratings to the identified decision variables. In the data analysis stage, assigned weightings and ratings are combined to generate a final score, which forms the basis for the outsourcing decision (Bloem & Bean, 2015).

**Summary:** The framework by Platts et al. (2000) can be summarized as a multi-attribute decision-making tool. It allows capturing relevant factors to be taken into account in an outsourcing decision that go beyond the considerations of costs. The method further establishes a structured process for data collection and subsequent analysis. By using a multi-step workshop format, the framework also reduces the risk of biased decision-making, as it includes a large project team in the process of doing so.

### 3.3 Risk and Outsourcing

While numerous motives for outsourcing exist, it is imperative to outline potential risks confronting outsourcing arrangements as well. However, before reviewing risk factors in the literature, a rudimentary knowledge of the term risk is necessary.

In general, unexpected events may occur in outsourcing arrangements, resulting in either positive or negative outcomes. Positive outcomes provide opportunities while negative outcomes generate a loss (e.g. Ahmed et al., 2007). Williams (1995) therefore concluded that risk focuses on the avoidance of loss from unexpected events. Several definitions of risk are
available (e.g. Webb, 1994). In this thesis, the definition by the Risk Management Standard AS/NZS 4360 (1999) is adopted, which refers to risk as “a probability of losses in a project”. This definition implies that risk is quantifiable, allowing to assess and analyse it through conceptual methods.

Potential risk factors in an outsourcing context can be of different nature and are often organized in risk categories (Norrman & Lindroth, 2004). Kliem (1999), for example, simply uses the three risk categories of legal, operational and financial risk. Van Weele (2005) organizes risks into a typology that includes technical risk, commercial risk, contractual risk and performance risk. Still another, more granular classification is provided by Viswanathan (2011), who distinguishes between budgetary risk, scheduling risk, relational risk, technological risk, performance risk, personnel risk, and dependency risk. While there are some differences between the typologies (e.g. the level of detail), many similarities exist. To facilitate a systematic review of outsourcing risk factors, a comprehensive categorization is provided in the following.

- **Contract Risk:** involves litigious issues prior to and after negotiating an outsourcing agreement (Kliem, 1999). Risk factors may include unclear clauses in the agreement (Quélin & Duhamel, 2003), failure to specify appropriate measures and locking into an unrealistic long-term contract (Abdullah & Verner, 2012). Graham (1996) stresses the issue of inadequate protection of intellectual property in outsourcing arrangements. That is, the risk of breach of confidentiality must be considered to prevent sensitive information from leaving the organization.

- **Financial Risk:** relates to the uncertainty with regard to the price the buyer organization will pay and the costs that will incur when having outsourced certain activities (Van Weele, 2005). Risk factors to consider may include unrealized savings (Prahalad & Hamel, 1990) and non-competitive fees for services (Kliem, 1999). Kumar and Eickhoff (2005) add the risk of unexpected costs to this category. Abdullah and Verner (2012) further mention currency exchange fluctuations as another factor to consider.

- **Operational Risk:** involves uncertainty with regard to the ongoing management of the outsourcing arrangement (Kliem, 1999). Leavy (2001) mentions the risk of becoming too dependent on a supplier for mission-critical activities. Mulin (1996) lists the risk of poor selection of the supplier (e.g. supplier with short life expectancy and different geographical locations). Poor cultural fit between buyer and supplier may also lead to considerable loss potential (Abullah & Verner, 2012).

- **People Risk:** refers to the uncertainty that individuals at both buyer and supplier organization will act in a way that compromises the position of the firm that outsources (Viswanathan, 2011). Belcourt (2006) identifies bad employee morale as an important risk factor within this category. That is, outsourcing is a sensitive subject
that may evoke negative employee reactions in an organization if inadequately implemented and managed. Leavy (2001) adds loss of internal coherence as another risk factor. The author states that outsourcing may be detrimental to cross-functional skills and that there can be a loss of profitable contact between that function and others which relate to it. Momme (2001) further documents that supplier employees are rarely as prepared as in-house colleagues to go beyond their immediate commitments and take the time to work out ideas that may be of benefit.

- **Performance Risk:** relates to the chance that the supplier is not capable to deliver according to expectations (Abdullah & Verner, 2012). Many potential risk factors exist within this category. Quélin and Duhamel (2003), for example, mention the risk of interruptions to supply and poor quality of supply. Londsdale (1999) adds poor performance, lack of required skills and experience as potential risk factors to consider in this category.

- **Planning Risk:** refers to the uncertainty associated with the ability of the buyer or supplier organization to meet deadlines assumed by the formal or informal terms of the outsourcing arrangement (Viswanathan, 2011). Risk factors may include loss of control of the outsourced activity and thus difficulty in reacquiring it (Quinn, 1999), losing customers (Blumberg, 1998) or reputation (Quinn & Hilmer, 1994).

The list of risk categories demonstrates that risk is an inherent part of outsourcing. In fact, an outsourcing arrangement is likely to have several of these elements, which may result from the supplier, the business environment or the buyer organization itself (Shi, 2007). Effective management of these risks generally requires a structured approach, known as risk management process, which is introduced in the following section.

### 3.4 The Process of Managing Risk

The risk management process has been discussed by a number of authors. An often cited definition is provided by Risk Management Standard AS/NZS 4360 (1999), referring to the process as “uncovering weakness in methods used in a structured approach so that timely mitigation actions are initiated to avoid risk, transfer risk, reduce risk likelihood or reduce risk impact.” Although many different models of the process exist, their elements are somewhat similar: one or more risks must be identified, the probability and consequences of the risks should be assessed in some manner, attempts at mitigating the risk should be considered and implemented, and some measures should be taken proactively to ensure that risks can be dealt with once they are identified (e.g. Leitch, 2010). A more granular view of the process is provided by the Australian Standard for Risk Management (1999), which is shown in Figure 3.3.

The process comprises of the six iterative steps of (1) establishing the context of risk, (2) identifying risks, (3) analysing risks, (4) evaluating risks, and (5) treating and (6) monitoring.
risk events. Given the focus of this thesis on risk management in an outsourcing arrangement, tools and techniques relevant to the aforementioned steps are introduced below.

![Risk management process adapted from AS/NZS 4360 (1999)](image)

**Figure 3.3: Risk management process adapted from AS/NZS 4360 (1999)**

**Context Establishment**

The first step involves the representation of project units (e.g. functional, process, data) and their interrelationships; thereby providing an overview of the project status in dimensions such as resource usage, stakeholder involvement, deliverables and schedule (Ahmed et al., 2007). Tools for context establishment in risk management are similar to those used in project modelling including, for example, network diagrams, design structure matrices and process modelling.

**Process Modelling**

In broad terms, process modelling is a graphical method used for illustrating a sequence of tasks. Process modelling tools often form the starting point for gaining a deep understanding of the present situation by highlighting information flow and interrelationships between tasks (Ahmed et al., 2007).

A commonly used tool by practitioners is the SIPOC process modelling technique, which is best viewed as an interviewing, write-up and modelling technique all in one (Starinsky, 2016). The tool allows for a structured identification of the suppliers (the ‘S’ in SIPOC) of a process, the inputs (the ‘I’) to the process, the process itself (the ‘P’), the outputs (the ‘O’) of the process, and the customers (the ‘C’) that receive the process outputs (Montevechei et al., 2008). The result of SIPOC is an AS-IS or current state process model that becomes the important deliverable at this stage of the risk management process.

**Risk Identification**

In order to identify risks in an outsourcing arrangement, the given situation must be studied to realize what could potentially go wrong in the lifecycle of implementing such project
(Chou & Chou, 2011). Therefore, sources of risk and potential consequences need to be identified by following a systemic approach. Possible ways to do so are to create a risk checklist or to perform a failure mode and effect analysis (FMEA), amongst others (Ahmed et al., 2007).

**Checklists**
Checklists are a simple method to identify specific risk areas (e.g. technology, business environment, process, people), where pre-determined points are examined for potential sources and symptoms of risk (Webb, 1994). As stated by Chapman and Ward (1997), checklists are simple to use and usually evolve over time through contributions from subject matter experts and collective experiences.

**Failure Mode and Effect Analysis**
FMEA is one of the most used techniques for determining causes, effects and relationships in a technical system (Segismundo & Miguel, 2008). The tool provides a clear structure to identify and assess possible modes of failure and malfunctions in terms of their effects and relevance, typically recorded in a specific FMEA worksheet (Rausand & Arnljot, 2004).

Several variations of the FMEA format exist. Ahmed et al. (2007), for example, mention that failures modes and their effects can be studied with a product (design FMEA or DFMEA) or process focus (process FMEA or PFMEA). Lee et al. (2011) modify the FMEA technique to fit outsourcing risks in a supply chain context (SCR-FMEA). Nowicke (2008) developed a tool for analysing the risks associated with outsourcing decisions for corporations (outsourcing risk FMEA). Small changes to the typical FMEA format were made to provide a relevant tool to identify and analyse outsourcing risks.

**Risk Analysis**
After potential risks are identified, their characteristics need to be assessed. For this purpose, risk information need to be acquired in order to estimate the potential and magnitude of any loss (Modarres, 2006). Chapman and Ward (1997) discuss the issue of risk measurement by suggesting two parameters: risk probability and risk consequence. Risk probability refers to a chance of a risk even occurring while risk consequence (or impact) indicates an outcome generated from the risk event. These metrics can then be used for computation of risk magnitude (Ahmed et al., 2007).

Risk quantities are either quantitative or qualitative in nature. The qualitative approach to determination of risk parameters is the most commonly used one because it is simple and quick to perform (Modarres, 2006). It utilizes linguistic scales such as low, medium and high; thereby relying on human judgements, feelings and opinions. The quantitative approach, in turn, requires analysis of historical data through statistical analysis, which is often hard to achieve (Ahmed et al., 2007). Hence, organizations tend to employ qualitative risk analysis techniques, out of which one is presented below.
### Probability and Impact Grids
An often used technique is to represent risk events on a grid with probability on one axis and impacts on another axis (Chapman & Ward, 1997). The grid consists of defined threshold regions, which represent low, medium and high risk events based on past experience or organizational practices. Probability and impact grids provide a trivial method for displaying relative importance of risk events (Ahmed et al., 2007).

### Risk Evaluation
Risk evaluation refers to a process that is used to prioritize risk analysis results in order to determine risk mitigation plans based on past experience, lessons learnt, best practices as well as benchmark practices (Ahmed et al., 2007). In this step of the risk management process, the various aspects of the outsourcing practice may be considered with regard to identified risk events to determine risk mitigation options (Modarres, 2006). Several risk evaluation tools exist such as the decision tree analysis, portfolio management technique and the multiple criteria decision-making method (for more details see e.g. Risk Management Standard AS/NZS 4360, 1999).

### Risk Mitigation
Risk events may diminish project objectives and project success when harmful effects occur due to unforeseen circumstances. Risk mitigation is therefore an important element of risk management to avoid risk, reduce the likelihood of risk, reduce the impact of risk or to retain risk (Ahmed et al., 2007).

**Summary:** The risk management process is a powerful method for studying potential risks that may occur in any type of project in detail so that timely actions for risk reduction and mitigation can be initiated. The approach further provides a structured guideline to follow and a comprehensive set of tools for the different process steps respectively. However, as mentioned by Shenhar (2001), risk management techniques cannot be standardized for all kinds of projects and may therefore need adjustment to the nature of the project.
4 Methodology

This chapter presents and discusses the methodology used in this thesis. The chapter starts with a brief outline of the research design, followed by a description of the research approach as well as the research strategy. Before specifying the data collection methods used in this thesis, the case selection and sampling strategy are motivated. Then, the evolution of the research design is described in detail. Finally, a critical discussion about the quality of the research and research ethics is provided.

4.1 Research Design

The primary objective of the research design is to provide a plan for answering the research questions (Brink & Wood, 1998). To put it into the words of Blomkvist and Hallin (2015), it is the overall plan for how the problematization is made researchable. For this study, a qualitative research design was chosen in order to investigate characteristic risk factors in outsourcing coordination tasks in CPD projects. The research design of the thesis includes the following steps: process modelling, risk identification and risk assessment (see also Figure 4.1). A detailed description of the individual research design steps is outlined in Section 4.6.

![Research design steps](image)

**Figure 4.1: Research design steps**

4.2 Research Approach

The choice of a research approach requires a researcher to decide on the logic that will build the understanding of the phenomena of interest. In research, two distinct approaches exist; *inductive* and *deductive* research. In broad terms, deductive research involves testing hypothesis from existing theory while inductive research is concerned with the generation of theory from collected data (Creswell & Plano Clark, 2007; Robson, 2002). However, these two approaches are not mutually exclusive. In fact, Dubois and Gadde (2002) add a mixture of deductive and inductive approaches; described as the *abductive* research approach. The authors argue that it is rarely the case that learning and knowledge generation in research is exclusively deductive or inductive.

This thesis has adopted an abductive research approach because it can be argued that it is neither exclusively theory nor data driven. Characteristic risk factors have been identified in a structured and iterative way by combining elements of existing research in the field and empirical insights; i.e. by what was discovered during data collection, analysis and interpretation. Given the scarcity of theory around the phenomenon, the abductive research approach was considered appropriate to follow in this thesis.
4.3 Research Strategy

A research strategy represents a way of collecting and analysing empirical material (Yin, 1994). The choice of a research strategy is guided by the research questions, the extent of existing knowledge and the amount of time and resources available (Saunders et al., 2009). Yin (1994) describes four research strategies and their applicability to different research situations. These strategies are: archival analysis, case study, experiment and survey. When studying a particular phenomenon within its real-life context by stating how and why questions, case study is the preferred strategy (Robson, 2002). Moreover, two types of case study designs exist: single case and multiple case (e.g. Yin, 1994). Single case design is utilized by researchers to study an extreme or unique case. Multi case design, in turn, is used to focus on the need to establish whether the findings of a particular case occur in other cases and, as a consequence, the need to generalize from these findings (Saunders et al., 2009).

The present study was designed to investigate and provide an understanding of the phenomenon of outsourcing the coordination of supplier involvement in collaborative product development projects. To explore this phenomenon, the single case study approach was used as a strategy as it allows to investigate the phenomenon within its real-life environment. This strategy was deemed appropriate to explore potential implications and outsourcing risk factors in the given situation. Further elaboration on the strategy used for the selection of the particular case of this thesis is presented in the following section.

4.4 Case Selection and Sampling

The research is based on a single case study conducted at the German car manufacturer Audi thus taking the focal firm’s perspective in CPD projects. The Audi AG is part of the Volkswagen Group and employs more than 87,000 people worldwide. In the 2016 fiscal year, deliveries reached a record level of almost 1.9 million cars with a total revenue of EUR 59 billion (Audi AG, 2016).

The reasons for the applicability of Audi as a case company are twofold. First, the carmaker is relevant for the underlying phenomenon of interest since collaboration in the field of product development has been an integral part of the firm’s development strategy in the recent years. Second, Audi is in the midst of corporate transformation in response to the historic change in the industry. Hence, organizational resources tend to be limited for coordinating collaborative relationships in new product development properly.

Case Selection

The case (or unit of analysis) relates to a specific group, event or process that is being studied in a bounded context (Miles & Huberman, 1994). The unit of analysis in this study relates to the build sample (BMG) approval process as in integral part of the case company’s product development process. The case was selected for many reasons. Firstly, the approval process can be considered as complex and time-consuming as it involves the coordination of

---

3 More information about the case company and the specific case study context can be found in Chapter 5.
numerous stakeholders across functional, divisional and organizational boundaries. Secondly, the process is associated with considerable administrative overhead for the development department that is responsible for issuing the approval. Lastly, the BMG approval process is inherently risky and critical to success; it acts as the final confirmation that the system component meets the requirements described in the performance specifications.

**Sampling**
In qualitative research, sampling refers to the process of identifying and selecting individuals to be studied (Marshall, 1996). In fact, the sample is a representative part of a population from which data will be collected. The choice of the study sample is therefore an important step as it is impractical to study the entire population. This study used purposeful sampling as a method for selecting individuals (Creswell, 2013). Purposeful sampling was chosen as it provides focused access to respondents who are especially knowledgeable about the phenomenon of interest. Hence, target respondents were mainly individuals who interact with or are intimately involved with the BMG approval process. In fact, most of the consulted informants were staff from the responsible development department or project managers from other technical departments. In some cases, employees from corporate functions (e.g. purchasing, legal) but also in-house consultants who are knowledgeable about the studied phenomenon were interviewed as well.

### 4.5 Data Collection Methods

Case study research usually combines several data collection methods, including interviews, questionnaires, observations and data gathering from documents (Eisenhardt, 1989). In this study; qualitative interviews, document analysis and participant observation were used as data collection techniques. In fact, the use of multiple methods – also referred to as *triangulation* – allowed for the capture of different dimensions of the investigated phenomenon (Bryman, 2015).

**Interviews**

Interviews were used as the main method to collect data pertaining to the phenomenon of interest. Interviews can have different degrees of structure; often labelled *structured, semi-structured, and unstructured* (Blomkvist & Hallin, 2015). The structured interview has predefined questions, while the unstructured interview is a discussion between the interviewer and the interviewee. The semi-structured interview is prepared by stating a few questions that ensure the achievement of the overall goal of the interview. However, no detailed formulation or order of questions is prepared (Collis & Hussey, 2014).

In this thesis, both structured and semi-structured interviews were chosen as a method to gain in-depth knowledge about the phenomenon of interest. The thesis has encompassed interviewing subject-matter experts and employees from various functional areas. The full list of interviewees is presented in Table 4.1. The list has the interviewees being referred to as respondents in order to guarantee the anonymity of the individuals (see also Section 4.8).
Table 4.1 further outlines information regarding the interviewees, the setting in which interviews were conducted and respective research design steps.

**Table 4.1: List of consulted informants**

<table>
<thead>
<tr>
<th>Informant</th>
<th>Role</th>
<th>Date</th>
<th>Length</th>
<th>Research Design Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondent 1</td>
<td>In-house Consultant</td>
<td>2018-03-12</td>
<td>30 min</td>
<td>Process Modelling</td>
</tr>
<tr>
<td>(R1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respondent 2</td>
<td>Technical Project Manager</td>
<td>2018-03-15</td>
<td>60 min</td>
<td>Process Modelling</td>
</tr>
<tr>
<td>(R2)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Respondent 3</td>
<td>Technical Project Manager</td>
<td>2018-03-16,</td>
<td>90 min,</td>
<td>Process Modelling, Risk Identification,</td>
</tr>
<tr>
<td>(R3)</td>
<td></td>
<td>2018-04-18,</td>
<td>60 min</td>
<td></td>
</tr>
<tr>
<td>Respondent 4</td>
<td>Project Manager</td>
<td>2018-03-22</td>
<td>30 min</td>
<td>Process Modelling</td>
</tr>
<tr>
<td>(R4)</td>
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<td></td>
</tr>
<tr>
<td>Respondent 5</td>
<td>In-house Consultant</td>
<td>2018-03-29,</td>
<td>60 min,</td>
<td>Process Modelling, Risk Identification</td>
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<td>(R5)</td>
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<td>2018-04-20,</td>
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</tr>
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<td>Respondent 6</td>
<td>Technical Project Manager</td>
<td>2018-04-09</td>
<td>60 min</td>
<td>Process Modelling</td>
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<td>(R6)</td>
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</tr>
<tr>
<td>Respondent 7</td>
<td>Project Engineer</td>
<td>2018-04-18,</td>
<td>45 min,</td>
<td>Risk Identification, Risk Assessment</td>
</tr>
<tr>
<td>(R7)</td>
<td></td>
<td>2018-05-17</td>
<td>60 min</td>
<td></td>
</tr>
<tr>
<td>Respondent 8</td>
<td>Project Engineer</td>
<td>2018-04-19,</td>
<td>60 min,</td>
<td>Risk Identification, Risk Assessment</td>
</tr>
<tr>
<td>(R8)</td>
<td></td>
<td>2018-05-09</td>
<td>45 min</td>
<td></td>
</tr>
<tr>
<td>Respondent 9</td>
<td>Technical Project Manager</td>
<td>2018-04-20,</td>
<td>60 min</td>
<td>Risk Identification, Risk Assessment</td>
</tr>
<tr>
<td>(R9)</td>
<td></td>
<td>2018-05-16</td>
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<td></td>
</tr>
<tr>
<td>Respondent 10</td>
<td>Technical Project Manager</td>
<td>2018-05-02</td>
<td>60 min,</td>
<td>Risk Identification, Risk Assessment</td>
</tr>
<tr>
<td>(R10)</td>
<td></td>
<td>2018-05-09</td>
<td>60 min</td>
<td></td>
</tr>
<tr>
<td>Respondent 11</td>
<td>Project Engineer</td>
<td>2018-05-16</td>
<td>60 min</td>
<td>Risk Assessment</td>
</tr>
<tr>
<td>(R11)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respondent 12</td>
<td>Technical Project Manager</td>
<td>2018-05-16</td>
<td>60 min</td>
<td>Risk Assessment</td>
</tr>
<tr>
<td>(R12)</td>
<td></td>
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<td></td>
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</tbody>
</table>

Interviews were conducted by using a list of themes and questions to be covered as guide. In fact, a comprehensive literature review was conducted throughout the research process to facilitate the identification of themes and questions. Furthermore, the interview guide was tailored for consulted informants (e.g. for subject matter experts), and new questions were formulated based on data being analysed during the interview.
Document Review

In addition to qualitative interviews, documents were used as a method of data collection. The method involves reviewing of content from written material such as corporate handbooks, presentations and brochures (Eisenhardt, 1989). In case study research, document analysis is applied to support evidence from other sources based on the study parameters (Yin, 2002). Documents that were collected include process guidelines, corporate handbooks and information on the issue of compliance among others. A list of reviewed documents in this thesis is provided in Table 4.2.

Table 4.2: List of reviewed documentation retrieved from Audi

<table>
<thead>
<tr>
<th>Name</th>
<th>Subject Area</th>
<th>ID</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements for Development Performance</td>
<td>Approval Processes in NPD</td>
<td>Corporate Document B</td>
<td>2015</td>
</tr>
<tr>
<td>Outsourcing the Right Way</td>
<td>Guidelines on Outsourcing</td>
<td>Corporate Document E</td>
<td>2017</td>
</tr>
<tr>
<td>Product Development Process</td>
<td>New Product Development</td>
<td>Corporate Document F</td>
<td>2017</td>
</tr>
</tbody>
</table>

Participant Observation

The thesis also employed participant observation as a method to develop a holistic understanding of the phenomena under study. Participant observation refers to the process of learning through exposure to or involvement in the day-to-day or routine activities of participants in the researcher setting (Schensul et al., 1999). In this thesis, the method was used to better understand the different actors involved in the BMG approval process. For this purpose, the author joined status update meetings where current task progress, challenges, and next steps in the BMG approval process were discussed among the different stakeholders involved. The meetings gave meaningful insights on the issue of managing and coordinating internal and external stakeholders in the process (e.g. organizational structures, corporate regulations and working practices). Moreover, status updates meetings facilitated a comprehensive understanding of the different roles that individuals play and how responsibility and accountability is distributed across the organization. Participant
observation further provided the context for the development of interview guides used in this thesis (cf. Appendix B).

**Data Analysis**

Yin (2003) argues for the need of using strategies when analysing empirical material. Given the abductive and qualitative nature of the thesis’ research methodology, *categorization* was adopted as a means to transform collected information into meaningful conclusions. In fact, this strategy rearranges data into categories in order to facilitate comparison and development of theoretical concepts (Maxwell, 2012). In this thesis, the new product development process of the case company acted as the overall frame for the analysis of collected information. The PDP includes all phases of development projects and describes the core processes involved in launching a product on schedule, budget, and with the desired quality. It was therefore used to examine the simultaneous engineering efforts across functional, divisional and organizational boundaries. The analysis of collected data was further aided by the risk management process (Risk Management Standard AS/NZS, 1999). By adopting relevant steps of the process, a frame for analysing the empirical material was provided.

**4.6 Research Design Steps**

As mentioned previously, this study adopted a three-step research design to make the problematization researchable. Each of these steps will be further outlined below.

**Process Modelling**

Before attempting to identify relevant outsourcing risk factors, it was imperative to gain a deep understanding of the unit of analysis. Process modelling was therefore used as a tool for establishing the context of the investigation. This step involved the representation of the BMG approval process; thereby providing an overview of the different process dimensions including stakeholder involvement, sequence of tasks, flow of information as well as communication tools and systems. This understanding needed was gained through the SIPOC process modelling technique (cf. Section 3.4).

The SIPOC method relies on structured interview sessions built around the SIPOC process modelling diagram (cf. Appendix A). Interviews were conducted with individuals who are intimately involved with the build sample approval process. Interview sessions followed a guide (cf. Appendix B) and were facilitated by the use of post-it notes. In fact, the interview sessions upheld the following structure: first, the person was asked to identify the outputs (and customers) from the process; then the inputs (and suppliers) needed by the process. After that, the discussion shifted to the conversion process, focusing on how the inputs are transformed through activities or tasks into outputs. The SIPOC process modelling diagram and post-it notes were thereby used to map the individual elements of the BMG approval process. In a last step, a responsibility and assignment matrix, also known as RASI matrix, was used as a tool for assigning the responsibilities and accountabilities to each role in the BMG approval process. The result of the RASI matrix was a comprehensive overview of the
different process activities and roles that are involved in some way that facilitated a consistent understanding of the process.

**Risk Identification**

After the context was established, the next step aimed at identifying sources of risk and potential consequences in the lifecycle of implementing the outsourcing arrangement. For this purpose, a modified FMEA format was used as a framework to study the BMG approval process in a systematic way. The FMEA format was considered appropriate as it is commonly used to identify possible failures in a design, a process or a product before the unit of analysis is designed, redesigned or applied in a new way (Rausand & Arnljot, 2004).

The process first involved identifying and sorting risk factors from literature research under risk categories. This was followed by an iterative cycle that included reviewing corporate documents, conducting interviews as well as workshops. Semi-structured interviews with individuals from different functions acted as the main source of data collection. Input from interview candidates was gathered and incorporated into an initial list of risk factors. Risk factors were then grouped and sorted among the risk categories according to the perceived appropriateness. Relevant information was further refined and developed through workshops where different stakeholders contributed to the identification of risk factors. Conducted workshops further aimed at eliminating redundancies among the risk factors through an effort to make the categories and risk factors mutually exclusive and collectively exhaustive.

**Risk Assessment**

After characteristic risk factors were identified, their characteristics had to be assessed. For this purpose, risk information was acquired in order to estimate the probability and severity of any loss in the outsourcing endeavour. To allow a systematic process for data collection, the adapted FMEA format was used as a framework to assess identified risk factors. In fact, the risk parameters (i.e. probability and severity) were determined by conducting interviews as well as workshops with different internal stakeholders. The assessment of risk parameters took place by rating each risk factor as ‘low’, ‘medium’, or ‘high’. The workshop format helped to reduce the risk of biased assessment by including individuals from different functional and expertise areas. In a last step, the risk assessment results were visualized by using a grid with probability being represented on one axis of the chart and severity on the other in order to display the relative importance of identified risk factors.

4.7 Quality of the Research

Critical thinking is regarded as a key pillar of social science research. Determining the quality of the conducted research is therefore expected and seen as ethically correct (Blomkvist & Hallin, 2015). The quality of this research was evaluated in terms of its *validity* and *reliability* (Collis & Hussey, 2014).
Validity
The validity of research refers to how well the research does what it is meant to do (Creswell, 2013). In case study research, two types of validity should be considered: internal and external. Internal validity concerns the accuracy of empirical results with regard to the studied reality. External validity, in turn, refers to the generalizability of the findings to the phenomenon in general (Corbin & Strauss, 2008).

In this thesis, internal validity was achieved by the fact that the research clarification (i.e. the problem statement, purpose and research questions) was grounded in and based on multiple sources of evidence (Blomkvist & Hallin, 2015). Methodological choices were motivated in relation to the purpose and research questions of this study. Moreover, different sources of data were triangulated during the analysis to account for internal validity of the thesis.

External validity in case study research is typically hard to prove (Corbin & Strauss, 2008). In fact, there is no proof that the findings can be generalized and applied to another context. However, a detailed description of the case study is provided in order to illustrate the setting in which the findings are valid.

Reliability
Reliability traditionally refers to the extent to which an experiment can be repeated with the same outcome (Collis & Hussey, 2014). Social science research is typically concerned with the dynamics of human behaviour (Bryman, 2012). The accurate repetition of an experiment generating the same results becomes therefore far too complex to be possible. Reliability then becomes a matter of ensuring that researchers gain access to the same documentation and well-documented research procedures (Yin, 2002).

This thesis was conducted by using methods such as qualitative interviews within an industrial context. Due to possible changes in the context and access to the same documentation, reliability was hard to achieve. However, the author attempted to specify analysed documents and interviewees and to provide detailed descriptions of interview guides as well as the research design steps.

4.8 Research Ethics
In social science research, it is important to account for the various facets of ethics (Israel & Hay, 2015). Hence, the author followed the recognized ethical principles of the Swedish Research Council during the lifecycle of this thesis (Sveriges Ingenjörer, 2018). The first ethical principle, information, was adhered to by providing respondents a clear explanation of the purpose of the interview, including their expected contribution to the study. The second principle, consent, was addressed by emphasising that interview participation is voluntary and the possibility to stop an interview at any time. Confidentiality of entrusted information is the third principle of the Swedish Research Council (Sveriges Ingenjörer, 2018). It was followed by, for example, anonymizing interview participants and storing collected
information in a secure manner. The last ethical principle, *good use*, was addressed by gathering and processing data with relevance to the purpose of this study.


5 The Case Study Background

This chapter is divided into four sections and introduces the case study context of this thesis. The chapter starts with an overview of the case company, including the strategic direction and the vision of the company. Then, the research and development division is introduced. The next section presents the organizational structure of vehicle projects at the case company. The chapter ends with detailed information about the product development process since it acts as the specific case study context of this thesis.

5.1 Company Profile

Audi AG is a German premium car manufacturer with operations on a global scale. The business activities of Audi mainly comprise of the development, production and sale of cars. Audi represents the brand essence ‘Vor sprung durch Technik’, which loosely translates to ‘Advancement through technology’. Visionary design, superior quality and innovative technology have made Audi a leading manufacturer of premium vehicles in the automotive industry (Audi AG, 2018a).

The Audi brand was founded in 1909 by August Horch. The four rings symbolize the brands Audi, DKW, Horch and Wanderer, which were consolidated into Audi in 1932. Audi, with its headquarters in Ingolstadt, is a member of the Volkswagen Group since 1966. Today, Audi employs more than 87,000 people worldwide (Audi AG, 2016). The car manufacturer has production units and subsidiaries in Europe, Asia, South America, North America, Australia, and Africa. In the 2016 fiscal year, deliveries reached a record level of almost 1.9 million cars (+ 3.6 percent) with a total revenue of EUR 59 billion (+ 1.5 percent), making Audi to one of the most successful luxury car brands in the world (Audi AG, 2016).

Strategic Direction

At the annual Management Conference in 2016, Audi announced its new corporate strategy for 2025. In response to the historic change in the industry, the strategy aims to transform Audi from a traditional vehicle manufacturer to a premium digital car company (Audi AG, 2016). This goal is anchored in the following vision statement (Audi AG, 2016, p. 94):

“Vorsprung is our promise. We inspire through individual, sustainable premium mobility. Our premium vehicles are the foundation”.

To transform this vision into reality, Audi has identified three main pillars of activities: digitalization, urbanization and sustainability (Audi AG, 2016). In the following, the mission behind each of these pillars is briefly presented:

- **Digitalization**: Audi is not only consistently digitalizing its production and customer-oriented processes but also creating a platform for integrated, connected premium mobility, and digital services. This is achieved through development of a central
platform for digital ecosystem, which is equally attractive to both suppliers and customers.

- **Urbanization:** Audi aims to work together with cities throughout the world and ensure access to city-friendly premium mobility. This is achieved through automation solutions and pilot projects such as piloted driving, which will increase road safety, aid traffic space, and ensure effective utilization of space within cities.

- **Sustainability:** Audi stands for sustainability in its vehicles which include not only environmental-friendly aspects but also civic and social values such as making improvements in the air quality. This is achieved through development of innovative driving technologies and new material cycles which do not produce any waste.

Within these fields, Audi has set ambitious targets to drive the transformation (Audi AG, 2018a). As part of the sustainability pillar, for example, Audi focuses heavily on the development of alternative drive technologies. Especially e-mobility is a key topic for Audi since it is considered as a major issue towards sustainable development with emission-free mobility. Hence, the declared goal for 2025 is for one-third of all vehicles produced by Audi to be battery electric vehicles (Audi AG, 2016).

### 5.2 Research and Development

Research and Development (R&D) has always played a key role at Audi in order to create new insights, technologies and platforms as the foundation for corporate success. The development of innovative technologies is closely linked to the company through its declared brand essence of ‘Vorsprung durch Technik’ (Audi AG, 2018a). However, the R&D field is subject to continuous change. In the last years, for example, the product portfolio of Audi has grown considerably and international markets as well as individual customer requirements have led to a significant rise in product complexity. In response, global development units and activities have been increased. In the 2016 reporting year, Audi employed an average of 10,000 people in R&D with activities reaching a total of about EUR 4.5 billion (Audi AG, 2016).

**Capability Transformation**

The new strategic direction of Audi brings the development of electric drive concepts more sharply into the focus of its R&D activities (Audi AG, 2016). Electric vehicles, however, require a range of new components such as high-voltage batteries, different power electronics and electrified engines; implying a fundamental change in powertrain\(^4\) and vehicle technologies (Altenburg, 2014). OEMs such as Audi traditionally regard powertrain technologies as an integral part of their R&D and production activities (Klug, 2013). The shift to more environmentally friendly vehicles requires therefore a fundamental change of

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\(^4\) The powertrain encompasses every component that converts the engine’s power into movement (Mukherjee & Chandra, 2017)
capabilities. This change is especially important since electrical drive concepts have not been a major focus area of Audi in the past (Audi AG, 2016). Experts believe, for example, that demand for competencies in mechanical engineering and mechatronics will decrease, whereas competencies in electronics, electrical engineering and new materials will be high in demand (Altenburg, 2014).

Audi has placed strong focus on identifying and building respective capabilities to manage the disruptive shift towards alternative drive concepts. However, capability building is a continuous and time-consuming process, requiring an organization to develop new competencies, operational procedures and tools among others (Hemerling et al., 2016). The situation is exacerbated by the EU targets to bring fleet average emissions down to 95g CO2/km by 2020. Audi therefore seeks solutions that allow the transformation of respective capabilities while maintaining competitive advantage. These solutions are of particular importance for the R&D division to direct its resources effectively, thereby addressing the outlined vision and targets of the organization.

5.3 Organizational Structure of Vehicle Projects

New vehicle development projects are organized based on the matrix principle. The multi-divisonal project management is handled by the product lines (PL) small, compact, mid-full and e-mobility, which report to their respective Board of Management (G). In fact, the product lines are responsible for all aspects of the vehicle projects. At the same time, the product lines steer the activities within the respective vehicle project with the help of the senior managements and product teams of the model series. In addition to the employees in the model series, representatives from the Research and Development (R&D), Production (P), Procurement (B), Marketing & Sales (V), Finance (F), and Quality Assurance (GQ) divisions are involved in each product development project. An overview of the organizational structure in new vehicle development projects is depicted in Figure 5.1.

![Organizational structure in vehicle development projects](Corporate Document A, 2015)
5.4 The New Product Development Process

At Audi, new vehicle developments are grounded in a standardized process referred to as the product development process (PDP). This process is divided into the following phases: (1) pre-development, (2) product definition, (3) design development, (4) series development, (5) series preparation, (6) production start-up, and (7) series production (Corporate Document F). In PDP, many interfaces between development-related departments exist. The PDP forms, therefore, a detailed procedural tool for mapping the simultaneous engineering efforts within an organization (Rudert & Trumpfheller, 2015). Figure 5.2 shows a simplified representation of the PDP at Audi. The different stages including the most important elements are briefly introduced in the following.

Pre-Development
The first phase serves to flesh out the product idea and integrate pre-development topics into the project. The outlines are defined in a product profile, supplemented by a rough assessment of feasibility and the specification of requirements. Moreover, the positioning of the product in the market landscape (e.g. competition, target markets) is determined. Project management starts to establish the project organization, rough scheduling as well as initial resource and budget planning (Rudert & Trumpfheller, 2015).

Product Definition
In this stage, the departments involved (i.e. development, quality, procurement, marketing and sales) define the product requirements based on its profile. Besides developing styling designs, the product definition step also contains analysis of the competition and elaborations on the concept (Rudert & Trumpfheller, 2015). As a result, the design of the vehicle, including a rough concept, the package, safety considerations, production technology and aerodynamic values have been set out at the end of this phase. Put differently, both the technical targets and an economic outline of the development project have been defined (Corporate Document F, 2017).

Design Development
This PDP phase centres around the design and production of digital prototypes as well as detailed planning and finalization of the specifications. The phase demands high coordination efforts between the different departments involved for successful implementation of the project. Development processes range from design to calculation and product trials. In addition to simulation, initial testing with unit carriers takes place. Based on the final styling model, refinements start and continue into series production of the car (Corporate Document F, 2017).
Figure 5.2: Schematic representation of the PDP at Audi adapted from Rudert and Trumpfeller (2015) and Corporate Document F (2017)
Series Development
In this PDP phase, the creation of prototypes, design of series vehicles and the start of testing occurs. The different development units assume responsibility for components and modules from the concept and sample phases through pre-series and on into series production (Corporate Document F, 2017). This task includes responsibility for all interfaces between the different development areas as well as development-related departments (e.g. procurement, production, quality and sales).

Moreover, all suppliers have been selected at the end of this stage to take up its development work (Rudert & Trumpfheller, 2015). The involvement of external stakeholders in new vehicle development projects is subject to standardized processes in order to ensure alignment and accountability throughout the development project. For instance, different approval procedures, also known as quality gates, exist in the PDP (cf. Figure 5.2). As synchronization points, these approvals are used to ensure that specified requirements are being met by suppliers (Attias, 2016). In fact, the approvals require suppliers to prove that all features correspond with Audi’s component performance specifications by providing initial volume production samples or test reports among others (Corporate Document F, 2017).

Series Preparation & Full-Scale Production
The final stage of PDP involves moving closer to series production-readiness through a sequence of staggered pre-series. The main purpose of producing first vehicles in series and series-like facilitates is to stabilize both internal production and logistics processes as well as the entire process throughout the supply chain (Rudert & Trumpfheller, 2015). When the run-up to series production is completed; the actual development activity is at an end, and the work of the project organization as well as the development teams is finished. Emerging issues are handled by the series product team, which has started its work with the systematic hand-over and finalization of approvals during the pre-series stage (Corporate Document F, 2017).

The foundation for the success of any new vehicle development project is laid in the product development process. The PDP includes all phases of development and describes the core processes involved in launching a product on schedule, budget, and with the desired quality. It further acts as a procedural tool for mapping the simultaneous engineering efforts across functional, divisional and organizational boundaries. The PDP was therefore used as frame for categorizing the different processes involved in new vehicle development projects as a foundation for the subsequent analysis of this thesis.
6 Process Modelling: Establishing the Context

This chapter focuses on modelling the BMG approval process for the sake of establishing the context of this thesis. The chapter starts with an introduction to the approval process. The next section outlines the results of the structured interview sessions that were built around the SIPOC process modelling template. This is followed by a detailed description of relevant process dimensions such as roles as well as communication channels and systems that were identified during the interviews. The chapter ends with assigning responsibilities of identified roles to process activities with the use of a responsibility assignment matrix.

6.1 Introduction

The build sample (BMG) approval process acts as the specific case study context for this thesis. The aim of the BMG approval is to prevent serial occurrences of failures and their severe consequences for Audi. These failures may be caused by deficiencies in the component arising from process, production or material faults. As indicated in the previous section, the BMG approval is an integral part of the product development process and pertains to the approval procedure of system components and production parts (Corporate Document B, 2015). The approval ensures that components manufactured by suppliers fulfil the performance requirements specified by the case company. Broadly speaking, the BMG approval process can be categorized into the following four main steps: planning, execution, preparation of issuance, and final issuance (cf. Figure 6.1).

![Figure 6.1: Overview of the BMG approval process steps](image)

The issuance of the BMG approval is handled by the responsible development department, which is, in this case, the powertrain development department at the case company. The department is mandated with the development of components for electrified powertrains such as power electronics and electric engines. An important part of the department’s responsibilities is to ensure coordination and collaboration among the many stakeholders involved in component as well as vehicle development projects. With the purpose of this thesis being to explore the feasibility of outsourcing coordination of supplier involvement in CPD projects, a particular focus was laid on risk factors that need to be taken into account when considering outsourcing as a viable practice. The identification of characteristic risk factors required, however, a more granular understanding of the BMG approval process. Against this background, the next sections focus on the modelling of the BMG approval process to outline relevant process dimensions such as roles, activities and communication systems.
6.2 SIPOC Process Map

It is imperative to gain a deep and consistent understanding of the current BMG approval workflow before attempting to identify characteristic risk factors in the given case study context. This means, in other words, outlining the sequence of tasks that each individual role is performing, the motivation behind the activities and commonly used systems for information exchange (Starinsky, 2016). This understanding was gained primarily through the interviewing and write-up technique SIPOC. The result of SIPOC is an AS-IS or current state process model that becomes the important deliverable for the identification of outsourcing risk factors. For this purpose, interviews were conducted with individuals who are intimately involved with the BMG approval process. The SIPOC process modelling template was used as it provides a visual view of the process during the interview. Figure 6.2 shows a graphically formatted example of a completed SIPOC diagram. All other SIPOC diagrams can be found in Appendix C.

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Input</th>
<th>Process</th>
<th>Output</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Auditors:</strong> - Vehicle Safety - Laboratory - Testing - EMC - Integration - Miscellaneous</td>
<td>- Admitted sub-approvals and documentation</td>
<td><strong>Activities:</strong> - Conceptual preparation of BMG approval template - Obtaining relevant signatures and respective documentation - Transferring final document into approval system - Performing plausibility check and, if necessary, final adjustments</td>
<td>- Final BMG approval document</td>
<td>- Approver (business unit manager)</td>
</tr>
</tbody>
</table>

**Figure 6.2: Example of a SIPOC process modelling diagram**

The example of the process modelling diagram shows the most important elements of the process step ‘Preparation of issuance procedure’. Recall that ‘supplier’ applies to (external) people, processes, departments and companies which provide whatever is work on in the process. ‘Inputs’ signify the material or information provided by the supplier. ‘Process’, in turn, determines all activities performed in the process. The ‘output’ is emerging from the process and is ultimately delivered to the ‘customer’, who has similar characteristics as the supplier (George & George, 2003). As input factors, admitted sub-approvals and relevant documentation has been identified. The respective suppliers are auditors from different functional departments such as vehicle safety and integration among others. Moreover, a list of activities being performed by the process responsible has been determined. The activities
include the conceptual preparation of the BMG approval template and transferring final
document into approval system, to mention a few (cf. Figure 6.2). As an output factor, the
final BMG approval document has been listed, which is delivered to the approver, the
customer of the process. The diagram further outlines relevant process dimensions such as
the process responsible and communication systems. Some of these dimensions are discussed
in more detail in the next section.

6.3 Process Dimensions

A comprehensive process understanding requires, amongst other things, the identification of
relevant roles that are involved in the process (Savory & Olson, 2001). The given case study
context of outsourcing coordination tasks in CPD projects further calls for outlining the
underlying channels and systems that are used for communication. Consequently, the
different roles and communication systems are discussed in the following.

Process Roles

A total of five different roles has been identified in the BMG approval process. A more
granular description of these roles is set out below:

- **Manager:** This role is usually assigned to technical project managers that are
  responsible for a specific system component as part of a new vehicle development
  project. The manager takes responsibility for the BMG approval workflow and
  accompanies the process from the beginning to the end. The manager’s tasks range
  from establishing the project plan to clarifying requirements as well as monitoring
  progress. The role further acts as the moderator between the different actors involved
  and has a holistic view of the process.

- **Auditor:** The auditor role is typically taken on by project engineers who are experts
  in different disciplines such as vehicle safety, electromagnetic compatibility and
  integration to name a few. Auditors are responsible for verifying that the system
  component is suitable for the use in the vehicle by issuing sub-approvals in their
  respective field of expertise. For this purpose, auditors perform tests on samples in
  order to check compliance with specified clearance criteria (e.g. for vehicle safety)
  and, if necessary, confer with the supplier of the system component.

- **Approver:** The approver holds the ultimate decision-making authority in the BMG
  approval process. The role oversees the process and is accountable and responsible
  for the final review of the BMG approval package. With the approval of the build
  sample of the system component, the approver verifies that the component is suitable
  for the use in the vehicle. The role is usually assigned to the head of the respective
development department.

- **Steering Committee:** The role of the steering committee is to ensure successful
delivery of the development project. For this reason, the steering committee monitors
all important project issues and provides support and advice on those that may present a risk; for example, by devoting additional resources to the approval workflow. The steering committee also reports on the project and its progress to the respective product line, which handles the entire vehicle development project.

- **Supplier**: In the BMG approval workflow, the supplier is responsible for providing samples as well as testing data and reports in order to demonstrate that the quality of the component is both known and controlled. In case it is not possible to comply with any of the specified performance requirements, the supplier is required to take appropriate action to ensure success of the development project.

**Communication Systems**

A smooth flow of the exchange of information, data and documents among the different stakeholders involved is an important prerequisite in the BMG approval process. Hence, different systems (or channels) are commonly used to communicate and collaborate across functional, divisional and organizational boundaries (Lee, 2009). At the case company, e-mail is used as the most basic channel for sharing information such as status updates and projected timelines, amongst others. Further communication systems used in the process are briefly introduced below:

- **System A**: is a corporate system to manage change requests in vehicle development projects. With System A, modifications to parts and system components which may have an impact on technology, schedules, quality and costs are assessed technically and financially, and subsequently documented in the system.

- **System B**: is a data management system that serves as a document hub and archive for the worldwide exchange of engineering data and associated descriptive documents. This includes CAD documents as well as documents that were created by hand and made available to the system at a later point in time (e.g. scanned drawings). System B facilitates the administration of design data, version handling and the data exchange with external parties.

- **System C**: is a corporate system for the provision of control unit information across different functional areas of the new product development process chain. The system allows for tracking progress of vehicle projects, maintaining time schedules as well as administrating testing locations and stations.

### 6.4 Responsibility Assignment Matrix

In this section, a responsibility and assignment matrix, also known as RASI matrix, was used as a tool for assigning the responsibilities and accountabilities to each role in the BMG approval process. The result of the RASI matrix is a comprehensive overview of all activities and roles that are involved in some way; thereby establishing a consistent understanding of the process. The different types of responsibilities are usually indicated by using the RASI
initials (Smith & Erwin, 2005). The responsible of a process (the ‘R’) refers to the person who is in charge of performing the activity until the work is finished and approved by an accountable. The accountable (the ‘A’) is the person or group of people who approve the work performed by the person responsible for an activity, and who become responsible for it after approval. Support (the ‘S’) refers to people who may assist in completing an activity, i.e., the person in charge can delegate work to them. Informed (the ‘I’) stands for a person who is kept up-to-date about the progress of an activity and/or the results of the task.

Figure 6.3 shows an excerpt of the RASI matrix for the BMG approval process. The rows represent the identified activities undertaken in the process, the columns of the matrix are the respective process roles, and each cell contains an indication of the type or responsibility, if applicable, of a role on an activity as corresponding to the RASI initials assigned. The complete responsibility assignment matrix can be found in Appendix D.

<table>
<thead>
<tr>
<th>ID</th>
<th>Activity</th>
<th>Manager</th>
<th>Auditor</th>
<th>Approver</th>
<th>Steering Committee</th>
<th>Component Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Establishing schedule including target dates</td>
<td>R</td>
<td>S</td>
<td>I</td>
<td>A</td>
<td>--</td>
</tr>
<tr>
<td>2</td>
<td>Planning of tasks, test environments and assignment details</td>
<td>R</td>
<td>S</td>
<td>I</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>3</td>
<td>Clarifying requirements and documentation for BMG approval</td>
<td>R</td>
<td>I</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>4</td>
<td>Communicating relevant information to parties involved</td>
<td>R</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>--</td>
</tr>
<tr>
<td>5</td>
<td>Preparing and executing tests</td>
<td>I</td>
<td>R</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>6</td>
<td>Checking compliance with clearance criteria and, if necessary, conferring with component supplier</td>
<td>A</td>
<td>R</td>
<td>--</td>
<td>--</td>
<td>S</td>
</tr>
<tr>
<td>7</td>
<td>Transferring final document into approval system</td>
<td>I</td>
<td>R</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>8</td>
<td>Issuing BMG sub-approval</td>
<td>A</td>
<td>R</td>
<td>--</td>
<td>--</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Reporting to involved parties and committees</td>
<td>I</td>
<td>--</td>
<td>R</td>
<td>S</td>
<td>--</td>
</tr>
<tr>
<td>20</td>
<td>Closing of BMG approval workflow</td>
<td>I</td>
<td>--</td>
<td>R</td>
<td>A</td>
<td>--</td>
</tr>
</tbody>
</table>

R: Responsible  
S: Support  
A: Accountable  
I: Informed

**Figure 6.3:** Responsibility assignment matrix of the BMG approval process
To illustrate the use of the RASI matrix, an example will be provided using the activity ‘checking compliance with clearance criteria and, if necessary, conferring with component supplier’ where the auditor is responsible for the activity. After testing, the auditor compares the test report against the defined criteria (e.g. for vehicle safety). In the event of any discrepancy, the supplier may support the auditor in troubleshooting and problem solving. The manager, the accountable person of the activity, oversees the activity and approves the work once all clearance criteria are met.

After assigning the responsibilities and accountabilities to each role in the BMG approval process, a deep and consistent understanding of the process was gained. On this basis, the next chapter focuses on identifying and assessing characteristic risk factors in the given case study context of outsourcing coordination tasks in CPD projects.
7 Risk Identification and Assessment

In this chapter, the identification and assessment of characteristic risk factors in the given case study context is presented. The chapter starts with a motivation of the conceptual frame choice. The following section outlines the developed framework that was used for identifying and assessing risk factors in the BMG approval process. It describes and motivates the deviations from the existing format as well as the procedure of applying the adapted FMEA. Section 7.3 then presents the identified risk factors and respective risk categories in a comprehensive manner. The chapter concludes with a further outline of the risk assessment results.

7.1 Introduction

Upon completion of the BMG approval process modelling, a framework was developed with which relevant outsourcing risk factors can be identified and assessed. Following the risk management process by Risk Management Standard AS/NZS (1999), a modified Failure Mode and Effect Analysis (FMEA) was used as a frame for identifying and assessing characteristic risk factors in a systematic way. In fact, there were many reasons to utilize the existing FMEA format as a frame. First, the FMEA - initially developed as a formal design methodology in the 1960s - has proven to be a powerful tool in identifying and assessing potential failures in a design, a process or a product before it is designed, redesigned or applied in a new way (Liu et al., 2013). A further aspect was familiarity as the FMEA is often used in the engineering world, for example in new product development (Pillay & Wang, 2003). Another consideration was the variety of possible FMEA applications that have been developed over the years, ranging from process- to service-oriented FMEAs (cf. Chapter 3.4). Adding an application of FMEA for the given study context of outsourcing coordination tasks in CPD projects was therefore deemed appropriate. It was, however, necessary to adjust the existing FMEA format to the specific context of this thesis. To give an example, potential failure modes of products vary widely from risk factors in outsourcing. Failure modes of products are characterized by measurable and physical units (e.g. time to obsolete) whereas outsourcing risk factors such as the breach of confidentiality are fairly hard to measure (Nowicke, 2007). Against this background, the existing FMEA format had to be adjusted to fit the context of this study. Further details are outlined below.

7.2 The Outsourcing Risk FMEA

A modified version of the FMEA was developed to provide a tool for identifying and assessing characteristic risk factors in the given context of this study. The adjusted FMEA format, from now on referred to as ‘Outsourcing Risk FMEA’, is illustrated in Figure 7.1 The Outsourcing Risk FMEA was structured in accordance to the research design steps ‘Risk Identification’ and ‘Risk Assessment’. Then, different FMEA elements were incorporated for each of the two steps: ‘Process Activity’, ‘Risk Category’ and ‘Risk Factor’ for the ‘Risk Identification’ design step and ‘Severity’ and ‘Probability’ for the ‘Risk Assessment’ step.
The elements incorporated were derived and combined from previous studies which were related to the context of this thesis (cf. Section 3.4). The nature of these elements as well as a detailed description of the Outsourcing Risk FMEA procedure will be outlined below in correspondence to the respective research design steps.

<table>
<thead>
<tr>
<th>Process Activity</th>
<th>Risk Category</th>
<th>Risk Factor</th>
<th>Severity</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td>Category A</td>
<td>Risk Factor</td>
<td>Rating</td>
<td>Rating</td>
</tr>
<tr>
<td>Activity</td>
<td>Category B</td>
<td>Risk Factor</td>
<td>Rating</td>
<td>Rating</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

**Figure 7.1: The Outsourcing Risk FMEA**

**Risk Identification**

The first step in the Outsourcing Risk FMEA procedure aimed at identifying characteristic risk factors that are associated with outsourcing coordination tasks in CPD projects. The starting point for this step were the activities performed in the BMG approval process. Each of these activities underwent analysis which followed an iterative cycle that included reviewing corporate documents and conducting interviews. Interview sessions were mainly conducted with employees who interact with or are intimately involved with the BMG approval process. Interviews first involved the identification of comprehensive risk categories with relevance to the given case study context. Then, a detailed list of risk factors was generated to outline what could potentially go wrong in the lifecycle of implementing the outsourcing arrangement. In fact, each activity might have a different number of risk factors; however, only controllable risks\(^5\) were considered. Another important aspect was that the risks associated with the activities performed in the BMG approval process must be relevant to the case company. Put differently, risks for the supplier side were not included in this thesis. Lastly, identified risk factors were linked to the established risk categories in order to eliminate redundancies among the risk factors.

**Risk Assessment**

The second step in the Outsourcing Risk FMEA procedure aimed at assessing the risk factors that were identified in the previous step. Similar to the existing FMEA format for product and process defects, outsourcing risk factors were assessed in terms of their severity and probability (cf. Figure 7.1). It is important to note, however, that the Outsourcing Risk FMEA was performed before the outsourcing arrangement was implemented. In other words, identified risk factors were not realized and therefore difficult to mitigate. As a result, the mitigation element was not incorporated in the modified version of the FMEA. For the assessment of risk factors, two basic approaches exist: quantitative and qualitative (Li &

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\(^5\) Controllable risks are those that an organization can detect with some degree of certainty before they happen (Pillay & Wang, 2003).
Quantitative assessment is a mathematical approach with rating scales of, for example 1-10, and typically provides more precision in estimates and separation in score between the risk factors (Welborn, 2007). Qualitative assessment, in turn, involves rating risk factors as ‘low’, ‘medium’, or ‘high’ and is often used for an initial appraisal of objects under investigation (Nowicke, 2007). Given the exploratory purpose of this thesis and the current early stage of outsourcing the BMG approval process at the case company, the qualitative risk assessment method was adopted. Even though the rating system might not present the utmost analytical accuracy, it served the purpose of exploring the relative importance of risk factors in the outsourcing arrangement.

The evaluation of risk factors followed a multi-step workshop format where different stakeholders contributed. As previously mentioned, each risk factor was assessed in terms of its severity and probability using the ‘low’, ‘medium’, or ‘high’ rating scale. The rating was determined by consensus following a group discussion in order to reduce the risk of biased assessment results. Figure 7.2 provides a detailed description of the severity and probability rating system.

<table>
<thead>
<tr>
<th>Severity Rating</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td>Impact on department is negligible, insignificant effect</td>
</tr>
<tr>
<td>medium</td>
<td>Impact on department is moderate but manageable</td>
</tr>
<tr>
<td>high</td>
<td>Impact on department is significant</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Probability Rating</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td>Probability is very unlikely</td>
</tr>
<tr>
<td>medium</td>
<td>Probability is likely</td>
</tr>
<tr>
<td>high</td>
<td>Probability is very likely</td>
</tr>
</tbody>
</table>

**Figure 7.2: Description of Severity and Probability Rating**

The severity score indicates the level of impact on the development department of the case company if identified risk factors materialize. A risk factor with a ‘low’ severity rating causes minimal impact on the outsourcing arrangement while a risk with a ‘high’ severity rating creates a significant impact. The probability score for a risk factor indicates the expected likelihood that the risk factor will actually materialize. A ‘low’ rating indicates an unlikely probability of occurrence whereas a ‘high’ rating refers to a very likely probability (cf. Figure 7.2). The assessment results were subsequently visualized on a graph with severity on one axis and probability on another axis in order to display the relative importance of risk factors.
7.3 Identification of Risk Factors

This section outlines the results of the risk identification step. Figure 7.3 presents an excerpt of the Outsourcing Risk FMEA after completion of the iterative data collection procedure. A total of 10 outsourcing risk factors were identified in the given case study context. Those were assigned to three comprehensive risk categories, namely ‘Relational Governance’, ‘Operational Performance’, and ‘Organizational Environment’. A full representation of the Outsourcing Risk FMEA can be found in Appendix E. In the following, the risk categories and their assigned risk factors will be outlined in detail.

<table>
<thead>
<tr>
<th>ID</th>
<th>Process Activity</th>
<th>Risk Category</th>
<th>Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Establishing schedule including target dates</td>
<td>Organizational Environment</td>
<td>Inefficient workflows</td>
</tr>
<tr>
<td>2</td>
<td>Planning of tasks, test environments and assignment details</td>
<td>Relational Governance, Organizational Environment</td>
<td>Intellectual property theft, Inefficient workflows</td>
</tr>
<tr>
<td>3</td>
<td>Clarifying requirements and documentation for BMG approval</td>
<td>Relational Governance</td>
<td>Constrained access to face-to-face meetings</td>
</tr>
<tr>
<td>4</td>
<td>Communicating relevant information to parties involved</td>
<td>Relational Governance</td>
<td>Information management deficiencies</td>
</tr>
<tr>
<td>5</td>
<td>Preparing and executing tests</td>
<td>Operational Performance</td>
<td>Inadequate capabilities and capacities for task-completion</td>
</tr>
<tr>
<td>6</td>
<td>Checking compliance with clearance criteria and, if necessary, conforming with component supplier</td>
<td>Relational Governance, Operational Performance</td>
<td>Limited directive authority, Inadequate capabilities and capacities for task-completion</td>
</tr>
<tr>
<td>7</td>
<td>Obtaining relevant signatures and respective documentation</td>
<td>Operational Performance</td>
<td>IT-System incompatibility and access limitations</td>
</tr>
<tr>
<td>8</td>
<td>Issuing BMG sub-approval</td>
<td>Operational Performance</td>
<td>Delayed decision-making</td>
</tr>
<tr>
<td>19</td>
<td>Reporting to involved parties and committees</td>
<td>Relational Governance</td>
<td>Constrained access to face-to-face meetings, Unfamiliarity with and deviation from internal workings</td>
</tr>
<tr>
<td>20</td>
<td>Closing of BMG approval workflow</td>
<td>Operational Performance</td>
<td>Delayed decision-making, IT-System incompatibility and access limitations</td>
</tr>
</tbody>
</table>

**Figure 7.3: Outsourcing Risk FMEA: Risk Identification**

**Relational Governance**

This risk category covered risk factors pertaining to the management of the outsourcing arrangement. It related to elementary requirements such as cooperation, communication and coordination for effective work procedures between the different actors involved. Risk factors associated with this category are outlined below.

**Risk Factor 1: Information Management Deficiencies**

An important mechanism for coordination of supplier involvement in CPD projects is the information flow and communication among the different stakeholders involved. The mechanism has an immediate impact on the effectiveness of the cooperation and execution of tasks in the outsourcing initiative (Suh, 1999). The activities ‘Communicating relevant information to parties involved’ and ‘Monitoring and reporting process’ in the BMG approval process, for example, rely on a seamless and timely exchange of information as they involve communicating and directing information and decisions across functional, divisional and
organizational boundaries. In an outsourcing context, however, contact (or communication) should in principle only be made through a defined person from all sites of the project (i.e., the case company, the service provider, and the component supplier). The single point of contact then acts as the focal point of information concerning the CPD project (Corporate Document E, 2017). This bears the risk that important information will be missed or get lost considering the fact that all information must be first bundled, transferred, and then distributed again by the service provider.

**Risk Factor 2: Limited Directive Authority**

For the successful execution of the outsourcing arrangement, it is imperative for both Audi employees and employees of the service provider to have full authority to direct and coordinate work in an effective and efficient manner. The foundation for this is to be laid in the written agreement of the outsourcing project. The agreement is to contain the hard factors that bind the actors to the performance specifications, schedules and escalation mechanisms. This requires, amongst others, the specification of all work packages in the performance specification sheet before the actual start of the project (Corporate Document C, 2016). It is, however, practically impossible to specify all work packages in the outsourcing initiative due to the complex nature of the process activities (e.g., ‘Coordinating BMG approval workflow’, ‘Providing support and, if necessary, undertaking problem management’). This is particularly risky in light of the fact that it is not permissible for Audi employees to give any work-related instructions to the employees of the service provider with regard to scope and content and vice versa (Corporate Document E, 2017). In fact, the work must be carried out independently on the basis of the specifications and without any organizational integration.

**Risk Factor 3: Constrained Access to Face-to-Face Meetings**

As previously mentioned, the exchange of information is vital to ensure coordination and control of activities between the outsourcing partners. In the given case study context, various communication channels are used to facilitate collaboration, coordination, and integration. Among these, face-to-face meetings (or personal communication) are commonly used in CPD projects as is it one of the richest channels of communication (Bruce et al., 1995). The process activities ‘Clarifying requirements and documentation for BMG approval’, and ‘Reporting to involved parties and committees’, for example, are often performed by the means of regular meetings where the different process roles (e.g., manager, steering committee, and component supplier) participate. Outsourcing these activities, however, bears the risk that the service provider has limited access to discussion and status update meetings. The risk arises from the fact that it is not permissible for employees of external service providers to deputise for employees of Audi, including the attendance by employees of service providers at discussion meetings as representatives of the responsible development department (Corporate Document D, 2016). The desired reduction of the workload for employees of the development department is therefore expected to be marginally lower.
**Risk Factor 4: Intellectual Property Theft**

Outsourcing the coordination of supplier involvement in collaborative product development projects includes disclosing valuable intellectual property (IP) such as trade secrets to the service provider. The activities ‘Planning of tasks, task environments and assignment details’ and ‘Checking compliance with clearance criteria’ in the BMG approval process involve important in-house knowledge (e.g. clearance criteria, testing procedures) that may constitute a substantial source of competitive advantage for the case company. Under certain circumstances, however, there is a risk that the service provider can misappropriate the IP towards its own benefit. It is possible, for example, that proprietary knowledge finds its way to other car manufacturers when the service provider runs similar projects with competing rivals or employees of the service provider migrate to the competitors. This loss of IP can lead to adverse effects on profitability, brand image, and competitive edge of the case company.

**Operational Performance**

The risk category ‘Operational Performance’ covers risk factors associated with the ability to deliver the service to the desired outcome and can refer to all parties in the outsourcing arrangement. The risk factors within this category are described in the following.

**Risk Factor 5: Inadequate Capabilities and Capacities for Task-Completion**

Successful execution of certain activities in the BMG approval process requires a unique set of capabilities as well as special infrastructure and equipment. The activities ‘Performing preliminary plausibility checks’ and ‘Checking compliance with clearance criteria’, for instance, involve expert knowledge within the field of powertrain and vehicle technologies. When outsourcing these activities, there is a risk that the service provider may overestimate its capability levels or simply lack the necessary expertise to perform these activities to an acceptable standard. Additionally, the decision about which of the external service provider’s employees are to fulfil the order is taken exclusively by the service provider itself. It is not allowed, for example, to request employees from previous projects to reduce the risk of unsatisfactory work performance. Other activities in the BMG approval process require special infrastructure and equipment to perform them properly. The activity ‘Preparing and executing tests’, for example, implies the need for special testing infrastructure and instrumentation. It is important to note that the service provider must deliver the work commissioned under its own responsibility and, in principle, with its own resources (Corporate Document D, 2016). Hence, there is a risk that the service provider overestimates its capacity levels with regard to test rigs and personnel, amongst others.

**Risk Factor 6: Delayed Decision-Making**

New product development projects need to be managed in a timely and efficient manner in the present competitive business environment (Eriksson et al., 2007). Against this background, timely decision-making becomes an important factor in order to support effective execution of the project. The process activities ‘Issuing BMG sub-approval’,
‘Signing off the BMG approval package’, and ‘Closing of the BMG approval workflow’ are just a few examples in the BMG approval process that require a well-functioning decision-making process in the outsourcing initiative. Corporate regulations and policies, however, impede efficient decision-making as the external service provider may not exercise any approval and decision rights. In fact, the service provider may only issue approval and decision recommendations to the representatives of the development department (Corporate Document E, 2017). This bears the risk of delayed decision-making due to waiting and buffering effects in the project (i.e. the decision recommendation has to be issued first by the service provider, transferred to the case company’s point of contact, distributed across the organization, and finally approved). Delayed decisions can have significant consequences for the development partners in terms of increased uncertainty as well as budget and time overruns.

**Risk Factor 7: Increased Complexity and Workload**

The work commissioned and expected results of the outsourcing arrangement must be clearly defined in the contract and the performance specification sheet prior to the start of the collaboration (Corporate Document C, 2016). This requires the development department to clearly and concisely specify all relevant work packages in the performance specifications. Current processes, procedures, and work instructions are, however, not well documented or even missing due to the rapid growth of the department. The intransparent process and work environment makes it therefore a time-consuming task for the development department to outline the work packages in the contract and specification sheet. Discrepancies and flaws in the contract further bear the risk of costly change requests since the work of the service provider must be carried out independently on the basis of the specifications and without any further instructions with regard to scope and content. Outsourcing the coordination of supplier involvement further implicates the broader issue of compliance\(^6\). When outsourcing key activities, it becomes increasingly difficult for the development department to manage and monitor compliance risk exposure.

**Risk Factor 8: IT-System Incompatibility and Access Limitations**

In CPD projects, information technology (IT) systems are among the primary tools used to facilitate communication, cooperation, and organizational integration (Bennett & Klug, 2012). In the BMG approval process, the case company utilizes a variety of different IT-systems to share information such as engineering data, product modifications and descriptive documents (cf. Section 6.3) in real-time across functional, divisional and organizational boundaries. System compatibility therefore emerges as a natural risk in the given outsourcing context as collaboration is not merely a matter of making the systems available to the service

\(^6\) Compliance can be defined as a state of accordance between an actor’s behaviour or products on the one side, and predefined explicit rules, procedures, conventions, standards, guidelines, principles, legislation or other norms on the other (Foorthuis & Bos, 2011).
provider. In fact, the systems must be compatible and the nomenclature synchronized to guarantee smooth processing of information. Furthermore, the process activities ‘Manage change requests’ and ‘Transferring final document into approval system’ require unrestricted access to the IT-systems of the case company. Access rights to the case company’s IT systems, however, are limited due to corporate regulations (Corporate Document E, 2017). Hence, IT-system incompatibility and access limitations are among the factors that significantly impede effective and successful collaboration between the different actors involved.

Organizational Environment
This risk category refers to alignment requirements arising from culture, politics and standards of practice that the service provider needs to comply and work with. The identified risk factors associated with this risk category are outlined in the following.

Risk Factor 9: Unfamiliarity with and Deviation from Internal Workings
Another important consideration in outsourcing coordination of supplier involvement in CPD projects centres around the organizational and cultural fit between the partner firms. The successful execution of the outsourcing arrangement requires alignment of the formal organizational structures, working practices, and the different roles that individuals play. It further requires a deep understanding of how decisions are made and how responsibility and accountability is distributed across the organizations. The process activity ‘Coordinating the BMG approval workflow’, for example, touches upon all of these firm-specific nuances (cf. Sections 6.3 and 6.4). The activity demonstrates that several aspects have to be considered such as the number of layers in the hierarchy, organizational integration, degree of autonomy, and corporate working practices, amongst others. Misalignment or simply the lack of understanding concerning these organizational and cultural aspects represent a major risk in the outsourcing arrangement as it may introduce periods of conflict, lowered productivity and ultimately undermine the collaboration.

Risk Factor 10: Inefficient Workflows
A large amount of information has to be coordinated in the product development process and the right information must be available to all stakeholders involved at the right time (Reijers et al., 2003). To avoid long throughput times, information redundancies and iterations, however, it is imperative to have efficient process workflows defined and implemented in the outsourcing arrangement. This requires a deep and consistent understanding of the logic behind corporate workflows as well as their integration into the overall organizational environment (i.e. the course of which information, documents, or tasks move from one individual to another). The activity ‘Planning of tasks, test environments and assignment details’, for example, requires and produces a lot of information that has to be managed in accordance with a set of procedural rules. Misalignment of these rules, however, bears the risk of inefficient management and administration of workflows in the given outsourcing arrangement. This may result in delayed and miscommunicated information, confusing tasks and long iteration cycles in the project.
Summarizing the above, a total of 10 risk factors were identified in the given case study context. As depicted in Figure 7.4, the risks were assigned to the established risk categories in order to eliminate redundancies among the risk factors and respective activities in the BMG approval process. In the next section, the results of the risk assessment step in the Outsourcing Risk FMEA are presented.

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Definition</th>
<th>Risk Factors</th>
</tr>
</thead>
</table>
| Relational Governance         | Risk category covers risk factors pertaining to the management of the outsourcing arrangement. It relates to elementary requirements such as cooperation, communication and coordination for effective work procedures between the different actors involved. | • Information management deficiencies  
• Limited directive authority  
• Constrained access to face-to-face meetings  
• Intellectual property theft |
| Operational Performance       | Risk category covers risk factors associated with the ability to deliver the service to the desired outcome and can refer to all parties in the outsourcing arrangement. | • Inadequate capabilities and capacities for task-completion  
• Delayed decision-making  
• Increased complexity and workload  
• IT-System incompatibility and access limitations |
| Organizational Environment    | Risk category refers to alignment requirements arising from culture, politics and standards of practice that the service provider needs to comply and work with. | • Misaligned working practices  
• Inefficient workflows |

*Figure 7.4: Comprehensive summary of risk categories and factors*

### 7.4 Risk Assessment Results

After characteristic risk factors were identified, their characteristics had to be assessed. For this purpose, risk information was acquired in order to estimate the probability and severity of any loss in the outsourcing arrangement. Figure 7.5 presents the Outsourcing Risk FMEA after completion of the iterative assessment procedure. Each risk factor was assessed qualitatively in terms of its severity and probability using the ‘low’, ‘medium’, or ‘high’ rating scale with probability addressing how likely the risk factor is to occur, and impact dealing with the extent of what would happen to the responsible department if the risk materializes.

To illustrate the logic behind the risk assessment results, some examples are outlined in the following. The severity of the risk factor ‘Inadequate capabilities and capacities for task-completion’ was assessed as high since appropriate capability and capacity levels of the service provider are an important prerequisite for successful execution of the outsourcing initiative. There is also a high probability that the risk factor will materialize as the availability of required capability and capacity levels is considered as limited. The shift to more environmentally friendly vehicles requires a completely new set of capabilities as well as special infrastructure and equipment as part of the development procedure. With the fast
emergence of electric cars, the demand for skilled personnel is difficult to satisfy for a large OEM such as Audi which suggests an increased difficulty for service providers to acquire the skilled personnel needed.

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Risk Factor</th>
<th>Severity</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relational Governance</td>
<td>• Information management deficiencies</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Relational Governance</td>
<td>• Limited directive authority</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Relational Governance</td>
<td>• Constrained access to face-to-face meetings</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Relational Governance</td>
<td>• Intellectual property theft</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Operational Performance</td>
<td>• Inadequate capabilities and capacities for task-completion</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Operational Performance</td>
<td>• Delayed decision-making</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Operational Performance</td>
<td>• Increased complexity and workload</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Operational Performance</td>
<td>• IT-system incompatibility and access limitations</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Organizational Environment</td>
<td>• Unfamiliarity with and deviation from internal workings</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Organizational Environment</td>
<td>• Inefficient workflows</td>
<td>High</td>
<td>Medium</td>
</tr>
</tbody>
</table>

**Figure 7.5: Outsourcing Risk FMEA: Risk Assessment**

Moreover, the severity of the risk factor ‘Intellectual property theft’ was rated as high since losing important in-house knowledge may have severe consequences for the case company (e.g. adverse effects on profitability, brand image, and competitive advantage). The likelihood that the risk factor will materialize was evaluated as medium due to the fact that the external service provider does not have much incentive to threaten the business relationship with Audi. The confidentiality agreement between the outsourcing partners further prevents the disclosure of important information. There is, however, a chance that proprietary knowledge finds its way to competitors when employees of the service provider migrate to the competition. To give another example, the severity of the risk factor ‘Information management deficiencies’ was rated as high. The single point of contact rule is expected to slow down the mechanism for information exchange and communication among the different actors involved. The probability that the risk factor will materialize in the outsourcing initiative was also rated as high. The assessment is based on the department’s past experience from previous CPD projects where two focal points of communication exist. Outsourcing the coordination of supplier involvement makes a seamless and timely exchange of information even more difficult as a third stakeholder (i.e. the service provider) is added to the project environment.
In a last step, the risk assessment results were visualized by using a probability-severity grid (see Figure 7.6). The reason for the usage of the grid was twofold. First, the probability-severity grid allowed for the placement of the risk factors in correspondence to their rating which facilitated a comprehensive overview of the assessment results. Second, the grid allowed for the display of the relative importance of identified risk factors as it becomes clear which risk must be handled at what priority in the outsourcing initiative. In fact, each of the risk factors placed in the grid fell under one of the following risk classes: minor risk, moderate risk and major risk. Risk factors towards the bottom left corner of the probability and severity grid were classified as minor risks and considered as broadly acceptable in the outsourcing arrangement. Risk factors that were positioned within the area from the top left to the bottom right corner of the grid were categorized as moderate risks and call for immediate risk management strategies if the outsourcing arrangement is to be implemented. Lastly, risk factors towards the upper right corner of the grid were classified as major risks. Risks within this area are most critical for the outsourcing arrangement and must be considered on a high priority basis.

![Probability-Severity Grid](image)

**Figure 7.6: Risk Assessment: Probability-Severity Grid**

It can be noted that all identified risk factors were placed within the moderate and major risk class area and none of them in the minor risk class (cf. Figure 7.6). Particular attention must be paid to the risk factors ‘Information management deficiencies’, ‘Limited directive authority’, ‘Inadequate capabilities and capacities for task-completion’, ‘IT-System incompatibility and access limitations’ and ‘Misaligned working practices’ as these factors were placed in the major risk area. However, careful consideration must also be given to the remaining risk factors as they are positioned close to the threshold of the major risk class. It can further be noted that the severity and probability rating for risk factors within the ‘Relational Governance’ risk category is highest on average compared to the other risk
categories and associated risk factors. The reason for this can be attributed to the governing regulations and policies that are nearly impossible to evade. In summary, it is fair to conclude that the outsourcing arrangement is an inherently risky undertaking. It will require both effective risk management strategies and adjustment to corporate regulations and policies if the project is to be implemented in the future.
8 Discussion

Based on the empirical results of the previous chapter, this chapter discusses the implications of the findings for theory and practice. The first section outlines the results in relation to previous research findings. In the next section, the discussion focuses on the practical implications of the research findings. The chapter ends with reflections on the issue of sustainability.

8.1 Implications for Theory

The concept of outsourcing is well researched and documented. The pertinent academic literature has been growing rapidly in size, covering the whole range from traditional theoretical discussions to practitioners’ handbooks on how and when to outsource (Dolgui & Proth, 2012). Although ambiguity may sometimes exist within this area of research, there is general agreement that risk is an inherent part of outsourcing (e.g. Leavy, 2001). This thesis has attempted to contribute to the existing body of work on relevant outsourcing risk factors. Special attention was paid to characteristic risk factors in outsourcing coordination of supplier involvement in CPD projects. In fact, a total of 10 risk factors were identified in the contextual setting studied in the thesis. Identified risk factors were grouped into three comprehensive risk categories of ‘Relational Governance’, ‘Operational Performance’, and ‘Organizational Environment’. In the following, the results are discussed in relation to previous work and research findings.

The risk category ‘Relational Governance’ covers risk factors pertaining to the management of the outsourcing arrangement and relates to elementary requirements such as cooperation, communication and coordination for effective work procedures between the different actors involved. The risk category does not only combine elements of the typology provided by Kliem (1999), but also provides a more granular view on risks regarding the actual management of the outsourcing arrangement. It further stresses the importance of elements such as communication, coordination and coordination among the different stakeholders involved in outsourcing arrangements. The identified risk factor ‘Information management deficiencies’, for example, refers to the mechanism required for a seamless and timely exchange of information across functional, divisional and organizational boundaries. In contrast to existing factors, it indicates that important information can be missed or lost in the project due to corporate regulations and policies that may exist such as the single point of contact rule. The risk factor ‘Limited directive authority’ discusses the level of authority granted to employees of the outsourcing partner to direct and coordinate work in an effective and efficient manner. In fact, the work commissioned must be carried out independently on the basis of performance specifications and without any work-related instructions with regards to scope and content. As the literature review has shown, none of the existing risk

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7 In this thesis, risk is referred to a quantifiable probability of losses in an outsourcing project, thereby allowing to assess and analyse it through conceptual methods.
factors account for this fact properly (cf. Section 3.3). The third risk factor identified, ‘Constrained access to face-to-face meetings’, discusses restrictions on personal communication that may exist in outsourcing initiatives, with severe consequences for the coordination and control of activities between the outsourcing partners. The risk factor ‘Intellectual property theft’ centres around the infringement of important proprietary rights and shows clear similarities to the risk factor ‘Inadequate protection of intellectual property’ provided by Graham (1996). The risk factor outlined by Graham (1996), however, does not specify how important intellectual property rights might be stolen in outsourcing initiatives. The research conducted in this thesis has discovered that important in-house knowledge might find its way to competitors when the outsourcing partner (i.e. the service provider) runs similar projects with competing rivals or staff of the service provider migrate to the competition.

The second risk category ‘Operational Performance’ covers risk factors associated with the ability to deliver the service of coordinating supplier involvement to the desired outcome and can refer to all parties in the outsourcing initiative. It combines elements of the existing categories ‘Planning Risk’ and ‘Performance Risk’ provided by Viswanathan (2011) as well as Abdullah and Verner (2012) respectively. Although existing risk factors within the aforementioned categories share some characteristics with the category of ‘Operational Performance’, distinct differences were identified. To give an example, the existing risk factors ‘Poor quality of supply’ and ‘Lack of required skills and experience’ provided by Quélin and Duhamel (2003) and Londsdale (1999) are to some extent similar to the identified factors ‘Inadequate capabilities and capacities for task-completion’ and ‘IT-System incompatibility and access limitations’. The authors, however, do not mention or specify possible reasons behind the risk factors. This thesis has added possible causes; for example, that the outsourcing partner may not possess the expert knowledge and unique infrastructure needed within the area of interest. Moreover, the risk factor ‘IT-System incompatibility and access limitations’ refers to restrictions on systems and tools used to facilitate communication, cooperation, and organizational integration. It was found that compatibility requirements are often not met and access rights to IT-systems are limited due to corporate regulations. Further risk factors that may impact the ability to deliver the outsourcing service were identified in this thesis. ‘Delayed decision-making’, for example, refers to the hindrance of timely and efficient decision-making in the outsourcing arrangement that may result in unforeseen delays in the execution of the development project. In fact, the investigation has shown that the outsourcing partner (i.e. external service provider) may not exercise any approval and decision rights due to corporate regulations and policies. The importance of efficient decision-making in outsourcing arrangements, however, has not yet been addressed properly by previous research. Moreover, the risk factor ‘Increased complexity and workload’ addresses the difficulties in defining the work packages and expected results in the written agreement of the outsourcing initiative. The research has shown that a fragmented process landscape can make it a time-consuming and costly task to outline the performance
specifications in a comprehensive manner; findings that confirm and add to the existing risk factor of ‘Unexpected costs’ provided by Kumar and Eickhoff (2005).

The risk category ‘Organizational Environment’ refers to alignment requirements arising from culture, politics and standards of practice that the service provider needs to comply and work with; a category that has not been targeted adequately by previous research. Literature review has shown that merely the existing categories of ‘Operational Risk’ and ‘People Risk’ introduced by Kliem (1999) and Viswanathan (2011) are touching upon the importance of cultural and organizational fit between the outsourcing organizations. While Abdullah and Verner (2012) mention the risk of ‘Poor cultural fit between buyer and supplier’, the authors do not outline details that may have to be considered in an outsourcing context. The research conducted in this thesis has intended to close this gap by discussing possible drawbacks that may arise from misalignments between organizational structures, working practices and corporate cultures. The risk factor ‘Unfamiliarity with and deviation from internal workings’ outlines possible consequences of poor cultural and organizational alignment between outsourcing partners, including periods of conflict or lowered productivity. Moreover, the identified risk factor ‘Inefficient workflows’ focuses on the impact of ill-defined workflows and procedural rules. It was found that delayed and miscommunicated information, confusing tasks and long iteration cycles in the outsourcing arrangement are potential aspects to consider. Leavy (2011) adds that outsourcing may be detrimental to cross-functional skills of the focal organization, an important aspect that has to be considered within this risk category as well.

8.2 Implications for Practice

The purpose of this study was to explore the feasibility of outsourcing coordination of supplier involvement in CPD projects. The outsourcing practice was considered as a business strategy for organizations that face limited internal capacities (e.g. due to corporate transformation) but still want to engage in collaborative relationships with their suppliers. To explore the feasibility of the outsourcing practice, it was imperative to better understand potential implications and risks associated with it. A risk analysis was therefore conducted for the sake of identifying characteristic risk factors in the given context. As outlined in the previous chapter, the outsourcing practice has proven to be inherently risky and will require both effective risk management strategies and adjustment to corporate regulations and policies if the project is to be implemented. The results of this study, however, have further implications for organizations that are to employ the outsourcing practice.

A first implication addresses the issue of organizational learning, which can be defined as a dynamic process of creation, acquisition and integration of knowledge aimed at developing the resources and capabilities that allow the organization to achieve better performance (López et al., 2006). In fact, outsourcing the coordination of supplier involvement in CPD projects may hamper the process of building and transforming organizational capabilities; imperative for staying competitive in a global, rapidly changing market environment. In the
contextual setting studied in the thesis, OEMs have to manage the disruptive technology shift to more environmentally friendly cars. Electric vehicles, however, require a range of new components, implying a fundamental change of organizational capabilities (Altenburg, 2014). An important question to be raised therefore concerns the long-term orientation of the outsourcing practice as car manufacturers do not want short-term outsourcing benefits (e.g. freeing up staff) to become long-term strategic problems. Thus, a consideration of the balance between the short-term benefits of outsourcing and the long-term benefits of developing organizational knowledge becomes an important aspect to address.

Another implication for practice pertains the fact that a large number of identified risk factors was caused by established regulations and corporate policies. In the automotive industry, special attention has been devoted to the compliance with governing rules and policies. The main catalyst for this development was the ‘Dieselgate’ emissions scandal by Volkswagen AG in 2015, which resulted in unprecedented penalties and reputational damage for the car manufacturer (Bovens, 2016). Research has shown that legal or illegal avoidance of regulations and policies often arises when compliance enforcement is difficult (Zachariadis, 2016). When outsourcing coordination activities in new vehicle developments projects, it can be argued that it becomes increasingly difficult for the focal firm to manage and monitor compliance risk exposure. Thus, the outsourcing of coordination activities is influenced by regulatory and legal pressures that are particularly increased for the case company given its proximal association to a recent scandal.

8.3 Reflections on Sustainability

The commonly cited Brundtland report by the United Nations World Commission on Environment and Development (1987) defines sustainability as “meeting the needs of the present generation without compromising the ability of future generations to meet their need”. Sustainability and sustainable development are frequently interpreted as a synthesis of the following dimensions: economic, social and environmental (Gauthier, 2005). This view is connected to the ‘Triple Bottom Line’, a concept created by Elkington (1994). The concept emphasises the need for organizations to operate in ways that ensure long-term economic performance by avoiding short-term behaviour that is socially detrimental or environmentally wasteful (Porter & Kramer, 2006). When reflecting on the sustainability implications of this research, all three dimensions were addressed.

The economic dimension of sustainability requires a business to utilize its resources in a responsible and efficient manner (Slaper & Hall, 2011). In financial terms, the practice of outsourcing coordination of supplier involvement in CPD projects may pose a threat to the economic viability of car manufacturers as the costs associated with it represent a high economic burden for them. If not managed properly, the outsourcing practice may further put the entire business at risk with severe consequences for the organizations and their profitability (e.g. reputational damage). Given the historic change in the industry, however, a more holistic view on the economic dimension of sustainability should be taken. The
A disruptive shift towards alternative drive concepts requires OEMs to develop a new set of organizational capabilities – a continuous and time-consuming process (Hemerling et al., 2016). Time that is limited, given the changing consumer preferences and aggressive regulations on fuel economy and emissions (Gao et al., 2016). The outsourcing practice may therefore present a suitable solution for car manufacturers that allows the transformation of respective capabilities while striking a balance between current needs and future opportunities; an important prerequisite for sustainable growth of revenues and operational profit in the future.

The social dimension of sustainability measures social capital, well-being and quality of life for individuals (Slaper & Hall, 2011). A large body of literature has shown that outsourcing as a business practice does not only promote social sustainability (e.g. Li et al., 2014). Traditional outsourcing strategies, for instance, had a strong focus on cost-cutting measures such as staff layoffs and are often considered contradictory to the social responsibility and moral obligation of corporate organizations (Lonsdale & Cox, 2000). In fact, the ethics of a firm comes into question when profits go over the people that have helped in the success of the organization for years (Porter & Kramer, 2006). Outsourcing the coordination of supplier involvement in CPD projects, however, aims at buying time for car manufacturers to manage the disruptive change in the industry while maintaining competitive advantage. Hence, the outsourcing practice can be considered as sustainable and ethical given that the primary objective is to develop and maintain employees rather than to replace them.

The environmental dimension of sustainability centres around the indulgent consumption of natural resources, environmental protection and waste reduction (Slaper & Hall, 2011). The impact of outsourcing on environmental sustainability is a well-researched field. Most studies, however, have focused on outsourcing manufacturing to third-party entities in low-cost countries (e.g. Kara et al., 2013). In the contextual setting studied in the thesis, a more holistic contemplation is necessary when examining the environmental dimension of sustainability. It can be argued, for example, that outsourcing the coordination of supplier involvement in CPD projects may help car manufacturers to reduce the environmental impact of their products. The outsourcing practice can be considered as an important strategic component in realizing large-scale development and production of electric vehicles, thereby contributing to sustainable development with lower CO2 emissions and less air pollution (Altenburg, 2014).
9 Conclusions and Future Work

In this chapter, a summary of the main findings from this thesis is presented. In the first section, the research question posed is answered and conclusions drawn. In the following section, the limitations of the thesis are stated and new paths for research discussed.

9.1 Conclusions

This thesis is the result of thorough investigation undertaken to explore the feasibility of outsourcing coordination of supplier involvement in CPD projects. Previous chapters outlined the thesis’s background and problem statement, details of appropriate methodology and the findings from the case study. In the following, the main research question of this thesis will be addressed and answered according to the findings and analysis from interviews and theory.

RQ: What are characteristic risk factors in outsourcing coordination activities in collaborative product development projects?

The risk analysis conducted followed an iterative cycle that included reviewing corporate documents and conducting interviews. It provided an integral understanding of pertinent risk factors in outsourcing coordination of supplier involvement in CPD projects. In fact, a total of 10 risk factors were identified in the given case study context and assigned to three comprehensive risk categories: ‘Relational Governance’, ‘Operational Performance’, and ‘Organizational Environment’.

The first risk category covers risk factors pertaining to the management of the outsourcing arrangement and relates to elementary requirements such as cooperation, communication and coordination for effective work procedures between the different actors involved. ‘Information management deficiencies’, the first risk factor within this category, refers to the mechanism required for a seamless and timely exchange of information across functional, divisional and organizational boundaries. The research has shown, however, that important information can be missed or lost due to the fact that communication should in principle only be made through a defined person from each party of the outsourcing arrangement. The risk factor ‘Limited directive authority’ discusses the level of authority granted to Audi employees and employees of the service provider to direct and coordinate work in an effective and efficient manner. In fact, the work must be carried out independently on the basis of performance specifications and without any work-related instructions with regards to scope and content. ‘Constrained access to face-to-face meetings’, the third identified risk factor, focuses on the fact that it is not permissible for employees of the external service provider to deputise for employees of the case company. This bears the risk that personal communication – vital to ensure coordination and control of activities between the outsourcing partners – is significantly limited or rendered impossible. The risk factor ‘Intellectual property theft’ centres around the infringement of important proprietary rights. It was discovered that important in-house knowledge might find its way to competitors when...
the service provider runs similar projects with other car manufacturers or staff of the service provider migrate to the competition.

The risk category ‘Operational Performance’ covers risk factors associated with the ability to deliver the service of coordinating supplier involvement to the desired outcome and can refer to all parties in the outsourcing initiative. The first risk factor identified within this category, ‘Inadequate capabilities and capacities for task-completion’, focuses on the service providers’ readiness to execute the outsourcing project successfully. In fact, it was found that the service provider may not possess the expert knowledge and unique infrastructure needed within the area of powertrain and vehicle technologies. The risk factor ‘Delayed decision-making’ refers to the hindrance of timely and efficient decision-making in the outsourcing arrangement. The investigation has shown that the external service provider may not exercise any approval and decision rights due to corporate regulations and policies, resulting in unforeseen delays in the execution of the development project. The risk ‘Increased complexity and workload’ addresses the difficulties in defining the work packages and expected results in the written agreement of the outsourcing initiative. In fact, the fragmented process landscape makes it a time-consuming task for the responsible development department to outline the performance specifications in a comprehensive manner. The risk factor ‘IT-System incompatibility and access limitations’ refers to restrictions on systems and tools used to facilitate communication, cooperation, and organizational integration in CPD projects. The results of the research have confirmed that the given compatibility requirements are not met and access rights to corporate systems are limited by corporate regulations.

The third risk category, ‘Organizational Environment’, refers to alignment requirements arising from culture, politics and standards of practice that the service provider needs to comply and work with. The risk factor ‘Unfamiliarity with and deviation from internal workings’ discusses possible drawbacks arising from misalignments between organizational structures, working practices and corporate cultures. It was found that poor alignment or simply lack of understanding may introduce periods of conflict, lowered productivity and ultimately hamper successful execution of the project. The last risk factor, ‘Inefficient workflows’, focuses on potential consequences of ill-defined workflows and procedural rules that may lead to delayed and miscommunicated information, confusing tasks and long iteration cycles in the outsourcing arrangement.

9.2 Limitations and Future Work

Based on the research presented in this thesis, it is possible to identify streams for future work. In the following, the paths for further research that were derived from the limitations of the research and the methodological choices made are presented.

The choice of a single case study design as a research strategy and the reliance on qualitative data limited the reliability and significance of the findings. Future work should therefore focus on testing the findings of this thesis on other OEMs in the automotive industry. The
study was further limited to the perspective of car manufacturers. In other words, the research has taken the focal firm’s point of view in CPD projects. Hence, the identification of risk factors was confined to risks arising from the external service provider, the business environment and the buyer organization itself. Further research is needed that takes the perspective of the supplier into account as well. Moreover, the thesis’ unit of analysis was limited to the BMG approval process. Future research should investigate whether or not identified risk factors are similar in nature for other integral processes within new vehicle development projects. Another limitation of this thesis was the sample size that constrained the options during data collection and analysis. Future plans should therefore include extending the sample to capture data from individuals who interact with different processes in new vehicle development projects as well as individuals who work in other technical development departments.
List of References


Appendix A: SIPOC Process Modelling Template

Process Description:  
Process Responsible:  
Process Goal:  
Supportive Documents:  
Supportive IT-Systems:

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Input</th>
<th>Process</th>
<th>Output</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix B: Interview Guide for Structured Interviews

Interviewee: ____________________________
Department: ____________________________
Role: ____________________________
Interview Date: ____________________________

1. Introduction

Welcome interview partner
- Own presentation
- Interview background and purpose
- Interview procedure

2. Interview Questions

Question 1: For which process (or process step) within build sample approval process are you responsible?

Question 2: Where in the approval procedure can the process (or process step) be positioned?

Question 3: What is the purpose of the process (or process step)?

Question 4: Are there any metrics (e.g. KPIs) that measure the objectives of the process (or process step)?

Question 5: What and who triggers the process (or process step) to be executed (e.g. email, fax or call)?

Question 6: What output factors⁸ are resulting from the process (or process step)?

Question 7: Who is the customer of these output factors? Put differently, are there any downstream process participants in form of roles, organizational units or committees?

Question 8: What are the steps (or tasks) involved in the process (max. 5-8 steps)?

Question 9: What is the sequence of steps (or tasks) needed to perform the process? (incl. decisions made such as “either-or”, “if-then” and concurrent activities “and”)

⁸ This can be tangible things such as components or assemblies or intangible things such as processed information in form of a document (e.g. strength calculation, order confirmation)
Question 10: How long does the execution of the steps (or tasks) take?

Question 11: Are there any other participants involved in executing the process? If yes, who?

Question 12: What input factors (e.g. material, information, documents, tools, etc.) are needed to execute the process (or process step)?

Question 13: Who provides these input factors? Put differently, are there any upstream process participants in form of roles, organizational units or committees?

Question 14: How is communication between the process participants being handled (by email, IT systems or phone)?

Question 15: Are there any tools involved in executing the process (or process step)? If yes, which tools?

Question 16: Are there any challenges in executing the process (or process step)? If yes, why?

3. Interview Closing
Appendix C: SIPOC Process Modelling Diagrams

**Planning of BMG approval**

**Manager (technical project manager responsible for component)**

**Completed workflow planning and scheduling**

**None**

**System A, System C**

---

**Planning of BMG approval**

**Manager (technical project manager responsible for component)**

**Completed workflow planning and scheduling**

**None**

**System A, System C**

---

**Execution of BMG sub-approval**

**Auditor (e.g. for vehicle safety)**

**Issuance of BMG sub-approval for respective field of responsibility**

**BMG sub-approval template, clearance criteria**

**System A, System B, System C**

---
### Process Description: Preparation of issuance procedure
- **Process Responsible:** Manager (technical project manager responsible for component)
- **Process Goal:** Review and supply of BMG approval document for issuance
- **Supportive Documents:** BMG approval template
- **Supportive IT-Systems:** System A, System B, System C

**Auditors:**
- Testing
- Laboratory
- Vehicle Safety
- EMC
- Integration
- Miscellaneous

**Activities:**
- Conceptual preparation of BMG approval document
- Obtaining relevant signatures and respective documentation
- Transferring final document into approval system
- Performing plausibility check and, if necessary, final adjustments

**Output:**
- Final BMG approval document

**Customer:**
- Approver (business unit manager)
<table>
<thead>
<tr>
<th>Supplier</th>
<th>Input</th>
<th>Process</th>
<th>Output</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Manager (technical project manager responsible for component)</td>
<td>- BMG approval document</td>
<td>Activities: - Signing off the BMG approval package - Reporting to involved parties and committees - Closing of BMG approval workflow</td>
<td>- Admitted BMG approval document</td>
<td>- Component supplier - Steering committee (vehicle development)</td>
</tr>
</tbody>
</table>

**Process Description:** Issuance of BMG approval

**Process Responsible:** Approver (business unit manager)

**Process Goal:**

**Supportive Documents:** Issuance of BMG approval package

**Supportive IT-Systems:** BMG approval template

System A, System B

Activities:
- Signing off the BMG approval package
- Reporting to involved parties and committees
- Closing of BMG approval workflow

Customer
- Component supplier
- Steering committee (vehicle development)
## Appendix D: Responsibility Assignment Matrix

<table>
<thead>
<tr>
<th>ID</th>
<th>Activity</th>
<th>Manager</th>
<th>Auditor</th>
<th>Approver</th>
<th>Steering Committee</th>
<th>Component Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Establishing schedule including target dates</td>
<td>R</td>
<td>S</td>
<td>I</td>
<td>A</td>
<td>--</td>
</tr>
<tr>
<td>2</td>
<td>Planning of tasks, test environments and assignment details</td>
<td>R</td>
<td>S</td>
<td>I</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>3</td>
<td>Clarifying requirements and documentation for BMG approval</td>
<td>R</td>
<td>I</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>4</td>
<td>Communicating relevant information to parties involved</td>
<td>R</td>
<td>--</td>
<td>--</td>
<td>S</td>
<td>--</td>
</tr>
<tr>
<td>5</td>
<td>Preparing and executing tests (optional)</td>
<td>I</td>
<td>R</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>6</td>
<td>Checking compliance with clearance criteria and, if necessary,</td>
<td>A</td>
<td>R</td>
<td>--</td>
<td>--</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>conferring with component supplier</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Transferring final document into sub-approval system</td>
<td>I</td>
<td>R</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>8</td>
<td>Issuing BMG sub-approval</td>
<td>A</td>
<td>R</td>
<td>--</td>
<td>--</td>
<td>I</td>
</tr>
<tr>
<td>9</td>
<td>Coordinating BMG approval workflow</td>
<td>R</td>
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<td>I</td>
<td>--</td>
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</tr>
<tr>
<td>10</td>
<td>Monitoring and reporting progress</td>
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<td>I</td>
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<td>I</td>
</tr>
<tr>
<td>11</td>
<td>Managing change requests</td>
<td>R</td>
<td>S</td>
<td>I</td>
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<td>I</td>
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<tr>
<td>12</td>
<td>Providing support and, if necessary, undertaking problem management</td>
<td>R</td>
<td>I</td>
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<td>--</td>
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</tr>
<tr>
<td>13</td>
<td>Performing preliminary plausibility checks</td>
<td>R</td>
<td>I</td>
<td>--</td>
<td>--</td>
<td>I</td>
</tr>
<tr>
<td>14</td>
<td>Conceptual preparation of BMG approval template</td>
<td>R</td>
<td>--</td>
<td>I</td>
<td>I</td>
<td>--</td>
</tr>
<tr>
<td>15</td>
<td>Obtaining relevant signatures and respective documentation</td>
<td>R</td>
<td>S</td>
<td>I</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>16</td>
<td>Performing plausibility check and, if necessary, final adjustments</td>
<td>R</td>
<td>S</td>
<td>I</td>
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<td>I</td>
</tr>
<tr>
<td>17</td>
<td>Transferring final document into approval system</td>
<td>R</td>
<td>--</td>
<td>I</td>
<td>--</td>
<td>I</td>
</tr>
<tr>
<td>18</td>
<td>Signing off the BMG approval package</td>
<td>I</td>
<td>--</td>
<td>R</td>
<td>--</td>
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</tr>
<tr>
<td>19</td>
<td>Reporting to involved parties and committees</td>
<td>I</td>
<td>--</td>
<td>R</td>
<td>S</td>
<td>--</td>
</tr>
<tr>
<td>20</td>
<td>Closing of BMG approval workflow</td>
<td>I</td>
<td>--</td>
<td>R</td>
<td>A</td>
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</tr>
</tbody>
</table>

R: Responsible  
S: Support  
A: Accountable  
I: Informed
<table>
<thead>
<tr>
<th>ID</th>
<th>Process Activity</th>
<th>Risk Category</th>
<th>Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Establishing schedule including target dates</td>
<td>Organizational Environment</td>
<td>• Inefficient workflows</td>
</tr>
</tbody>
</table>
| 2  | Planning of tasks, test environments and assignment details                      | Relational Governance, Organizational Environment | • Intellectual property theft  
|    |                                                                                 |                                         | • Inefficient workflows                                                     |
| 3  | Clarifying requirements and documentation for BMG approval                        | Relational Governance                   | • Constrained access to face-to-face meetings                                |
| 4  | Communicating relevant information to parties involved                           | Relational Governance                   | • Information mangement deficiencies                                       |
| 5  | Preparing and executing tests                                                    | Operational Performance                 | • Inadequate capabilities & capacities for task-completion                   |
| 6  | Checking compliance with clearance criteria and, if necessary, conferring with component supplier | Relational Governance, Operational Performance | • Limited directive authority  
|    |                                                                                 |                                         | • Inadequate capabilities & capacities for task-completion                   |
| 7  | Obtaining relevant signatures and respective documentation                        | Operational Performance                 | • IT-system incompatibility and access limitations                           |
| 8  | Issuing BMG sub-approval                                                         | Operational Performance                 | • Delayed decision-making                                                   |
| 9  | Coordinating BMG approval workflow                                                | Relational Governance, Operational Performance, Organizational Environment | • Limited directive authority  
|    |                                                                                 |                                         | • Increased complexity and workload                                         |
|    |                                                                                 |                                         | • Unfamiliarity with and deviation from internal workings                    |
| 10 | Monitoring and reporting progress                                                 | Relational Governance, Organizational Environment | • Unfamiliarity with and deviation from internal workings  
|    |                                                                                 |                                         | • Inefficient workflows                                                     |
| 11 | Managing change requests                                                          | Relational Governance, Operational Performance | • Constrained access to face-to-face meetings  
|    |                                                                                 |                                         | • IT-system incompatibility and access limitations                           |
| 12 | Providing support and, if necessary, undertaking problem management               | Relational Governance                   | • Limited directive authority                                                |
| 13 | Performing preliminary plausibility checks                                        | Operational Performance                 | • Inadequate capabilities and capacities for task-completion                 |
| 14 | Conceptual preparation of BMG approval template                                   | Organizational Environment              | • Unfamiliarity with and deviation from internal workings                    |
| 15 | Obtaining relevant signatures and respective documentation                        | Organizational Environment              | • Unfamiliarity with and deviation from internal workings                    |
|    |                                                                                 |                                         | • Inefficient workflows                                                     |
| 16 | Performing plausibility check and, if necessary, final adjustments                | Operational Performance                 | • Inadequate capabilities for task-completion                                |
| 17 | Transferring final document into approval system                                 | Operational Performance                 | • IT-system incompatibility and access limitations                           |
| 18 | Signing off the BMG approval package                                              | Operational Performance                 | • Delayed decision-making                                                   |
| 19 | Reporting to involved parties and committees                                      | Relational Governance                   | • Constrained access to face-to-face meetings  
|    |                                                                                 |                                         | • Unfamiliarity with and deviation from internal workings                    |
| 20 | Closing of BMG approval workflow                                                  | Operational Performance                 | • Delayed decision-making                                                   
|    |                                                                                 |                                         | • IT-system incompatibility and access limitations                           |