Alliances or Acquisitions? A Framework-Based Application to Governance Choices in the Automotive Industry Transformation

Noel Bennet Lesse

Dissertation written under the supervision of
professor Pedro Parada

Dissertation submitted in partial fulfilment of requirements for the MSc in Management with Specialization in Strategy, Entrepreneurship and Impact, at the Universidade Católica Portuguesa, 26.05.2026.

Abstract

The automotive industry is transforming fundamentally. Electrification, autonomous driving, connectivity, and digitalization are leaving the industry with structural characteristics traditionally associated with high-tech industries, including distributed knowledge, rapid innovation cycles, and high technological uncertainty. Under such conditions, firms in high-tech industries increasingly prefer strategic alliances over acquisitions. Whether this logic also applies to the transforming automotive industry has hardly been investigated to date.

This study closes this gap by deriving a five-dimensional governance framework from existing literature and applying it to two contrasting cases. The central research question is: *Under what conditions do incumbent automotive firms prioritize collaboration over ownership when building critical capabilities, and how can this choice be explained through an integrated governance framework?* The study follows a qualitative, theory-driven approach based on secondary data.

The framework is applied to the strategic alliance between Mercedes-Benz and NVIDIA and General Motors' acquisition of Cruise. In the first case, all five dimensions consistently point to an alliance as the rational form of governance, aligning with the actual decision. A slight majority also favored an alliance in the second case, yet GM opted for an acquisition. The decisive factor was GM's subjective perception of Cruise's knowledge as unique, outweighing the structural signals from the other dimensions. Its subsequent failure retrospectively confirms the framework's predictive logic.

The study demonstrates that not all dimensions are weighted equally and that subjective perception can override structural signals. Influential internal strategic considerations cannot be fully captured by a framework based on secondary data.

Author: Noel Bennet Lesse

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Keywords: Strategic alliances, Acquisitions, Governance choice, Automotive industry transformation, Knowledge distribution, Uncertainty, Governance framework

Resumo

A indústria automóvel atravessa uma transformação fundamental. Eletrificação, condução autónoma, conectividade e digitalização conferem ao setor características de indústrias de alta tecnologia, como conhecimento distribuído, ciclos de inovação rápidos e elevada incerteza tecnológica. Nessas condições, as empresas tecnológicas tendem a preferir alianças em vez de aquisições, mas a sua aplicação à indústria automóvel permanece pouco explorada.

Este estudo colmata essa lacuna ao desenvolver um quadro de governança de cinco dimensões e aplicá-lo a dois casos contrastantes. A questão central é: *em que condições as empresas automóveis incumbentes priorizam a colaboração em detrimento da propriedade na construção de capacidades críticas?*

O estudo adota uma abordagem qualitativa baseada em dados secundários. O quadro aplica-se à aliança entre Mercedes-Benz e NVIDIA e à aquisição da Cruise pela General Motors. No primeiro caso, as cinco dimensões favorecem uma aliança, em linha com a decisão real. No segundo, uma ligeira maioria também apontava para uma aliança, mas a GM optou pela aquisição. O fator decisivo foi a perceção da GM de que o conhecimento da Cruise era único e sobrepunha-se aos sinais estruturais. O fracasso posterior confirma, retrospetivamente, a lógica preditiva do quadro.

O estudo demonstra que as dimensões não têm o mesmo peso e que as perceções subjetivas podem sobrepor-se aos sinais estruturais. Considerações estratégicas internas não são plenamente captadas por um quadro baseado em dados secundários.

Autor: Noel Bennet Lesse

Título: Alianças ou aquisições? Uma abordagem baseada num quadro conceptual para as escolhas de governação na transformação da indústria automóvel

Palavras-chave: Alianças, aquisições, opções de governação, transformação da indústria automóvel, difusão do conhecimento, incerteza, quadro de governação

Acknowledgement

First and foremost, I want to give appreciation to my supervisor , Professor Pedro Parada, for his guidance and support during the development of this thesis. His experience and insights in regard to academic writing as well as his deep subject-specific knowledge helped me a lot during the dissertation process.

I also want to extend my gratitude to all professors and academic staff at Católica Lisbon School of Business and Economics as well as at the University of Florida, Warrington College of Business, who accompanied me throughout my master's studies and continuously broadened my knowledge and perspective.

Furthermore, I want to thank my family and friends for encouraging me and believing in me during this challenging time, as well as to all my fellow students with whom I had the pleasure of working and learning jointly along the way.

Besonders möchte ich euch, Mama und Papa, danken. Ohne euch hätte ich viele Entscheidungen im Laufe meiner akademischen Laufbahn nicht so treffen können wie ich sie getroffen habe und ich würde ganz sicher nicht da stehen, wo ich heute stehe.

Disclosure of AI Usage

While preparing this dissertation, AI-based writing tools were used in a supplementary way:

AI tool	Use case	Chapter
Grammarly & DeepL	- Grammar and spell checking - Linguistic consistency - Translation assistance	- Abstract - Introduction - Literature Review - Application to the Automotive Industry - Discussion - Conclusion
ChatGPT & Claude AI	- Structuring arguments - Summarizing complex academic texts - Paraphrasing - Textual Concision - Source identification support	- Abstract - Introduction - Literature Review - Application to the Automotive Industry - Discussion - Conclusion

The intellectual content and conclusions of this work are the sole product of the author's independent research and analysis.

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List of Abbreviations

AI	Artificial Intelligence
AV	Autonomous Vehicle
Cruise	Cruise Automation
EU	European Union
EV	Electric Vehicle
GM	General Motors
High-tech	High-technology
ICT	Information and Communication Technology
M&A	Mergers and Acquisitions
Mercedes	Mercedez-Benz
OEM/OEMs	Original Equipment Manufacturer(s)
R&D	Research and Development
USD	United States Dollar

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1. Introduction

The automotive industry is undergoing one of the most profound transformations in its history. The growing importance of electrification, autonomous driving, connectivity, and digitalization is fundamentally changing the competitive landscape, forcing established OEMs to access capabilities, including AI and software engineering, that lie outside their traditional competency base (Koelmel et al., 2025; He et al., 2020). Traditional and structural characteristics of the high-technology sectors, such as distributed knowledge, rapid innovation cycles, and significant technological uncertainty, are becoming increasingly noticeable in the current automotive industry. Consequently, the governance question of how to access these capabilities has emerged as a fundamental strategic decision for incumbent firms. Over the years, academic research on the governance choice between strategic alliances and acquisitions has generated important insights, particularly in high-tech industries such as biotechnology and semiconductors, where alliances have become the preferred governance form under conditions of uncertainty or distributed knowledge (Hagedoorn, 2002; Powell et al., 1996). However, despite the automotive industry's growing alignment with the characteristics of the high-tech industry, the insights gained have not yet been applied to the automotive sector. Existing frameworks focus primarily on statistical prediction rather than on providing an analytical tool applicable to a specific transformational industry context. By developing and applying a five-dimensional governance framework that synthesizes insights from multiple relevant perspectives (Resource-Based View, Transaction Cost Economics, Knowledge-Based View, Relational View and Dynamic Capabilities perspectives), this thesis aims to bridge this gap. Moreover, to assess the analytical coherence and practical relevance of the framework, it is applied in a qualitative, theory-driven way, based on secondary data, to two contrasting governance decisions in the automotive industry, (1) the strategic alliance between Mercedes-Benz and NVIDIA and (2) General Motors' acquisition of Cruise, as the industry currently undergoes a technological transformation, thereby offering both theoretical synthesis and contextual application. The central research question of this thesis is: *Under what conditions do incumbent automotive firms prioritize collaboration over ownership when building critical capabilities, and how can this choice be explained through an integrated governance framework?* Chapter 2 reviews the relevant literature on acquisitions, strategic alliances and governance choice in high-tech industries. Chapter 3 outlines the methodological approach. Chapter 4 develops the five-dimensional governance framework. Chapter 5 contextualizes the automotive industry, applies the framework to the two selected cases, and synthesizes the

findings through a cross-case comparison. Chapters 6 and 7 discuss the implications and conclude the thesis.

2. Literature Review

The decision between a strategic alliance and an acquisition is among the most important governance choices a company can make regarding growth and access to external resources.

Thereby, the fit of the respective governance-types depends on the kind of resource, internal capabilities of the firm and existing relationships between the potential partners (Wang & Zajac, 2007; Srivastava & Yayavaram, 2026). Despite the decision's strategic importance, many companies struggle to evaluate the two options. Decision-makers often treat alliances and acquisitions as interchangeable, without comparing or discussing their respective advantages and disadvantages (Dyer et al., 2004; McCann et al., 2016; Srivastava & Yayavaram, 2026).A bias influencing the high failure rate of the respective deals. This tendency is reinforced by the internal separation of alliance and M&A functions, as a systematic comparison of both options rarely occurs in practice (Dyer et al., 2004).

Apart from these structural factors, Mellewigt et al. (2017) introduce a mechanism-based approach that shifts the focus from structural characteristics to the relational dynamics arising from prior partner-specific experiences. They identify partner-specific trust, routines and value certainty as three fundamental mechanisms through which prior cooperation experience shapes subsequent governance decisions. Critically, these mechanisms may even pull in opposing directions. While trust lowers the perceived need for hierarchical control and thereby favors alliance formation, increasing value certainty about a partner's resources reduces informational uncertainty and makes acquisition more attractive (Mellewigt et al, 2017).

Governance decisions are therefore rarely the product of a single factor but reflect the interplay of resource characteristics, relational dynamics and strategic priorities. The relative attractiveness of governance forms depends on trade-offs between control, risk, flexibility, and speed (Ego, 2023). The following literature review examines these dimensions first from the perspective of acquisitions and then from a strategic alliance perspective, before synthesizing

findings from high-tech industries, which are most comparable to the transformative pressures in the automotive industry.

2.1 Acquisitions

Acquisitions refer to the merger of two or more independent companies into a new, unified entity, either through a merger of equal partners or through the acquisition of one company by another. (De Man & Duysters, 2005). They are particularly attractive as a growth strategy when companies operate in similar product markets and have similar resource bases, as the consolidation of overlapping assets and processes enables significant efficiency gains (Wang & Zajac, 2007).

2.1.1 Strategic Motives & Capability Access

The type of resource desired strongly influences the most suitable form of governance. Dyer et al. (2004) classify synergies based on the degree of coordination required. Reciprocal synergies, which involve the highest degree of mutual dependence and an intensive knowledge exchange, are most frequently achieved through full acquisitions, while lower levels of interdependence typically favor alliance agreements (Dyer et al., 2004; Moeen & Mitchell, 2020; Srivastava & Yayavaram, 2026; Ego, 2023).

The nature of the resource itself also plays a crucial role. Tangible assets, such as production facilities, can be assessed and transferred with relative reliability. Due to that acquisitions are particularly well-suited in this context. However, intangible resources, especially knowledge that relies largely on human capital, should be treated with caution. (Dyer et al. 2004; McCann et al., 2016). Acquiring a company, whose value largely depends on its employees, carries the risk that key personnel will become demotivated or leave, hence, jeopardizing the capabilities that gave the acquisition its strategic value (Dyer et al. 2004; Ego, 2023). In cases, where certain knowledge is closely linked to individuals or processes, a full acquisition may be the only viable option, as it is the only way to internalize the knowledge along with the context in which it unfolds its value (De Man & Duysters, 2005; Carayannopoulos & Auster, 2010).

2.1.2 Control Advantage & Resource Internalization

Another key reason for acquisitions involves gaining full control over the shared resource pool. In cases of significant overlap in resources and where the goal is operational restructuring, a full acquisition grants the acquirer sole decision-making authority. Redundant assets can be merged or sold without having to obtain a partner’s consent. The similarity of resources

furthermore, enables economies of scale and scope. Alliances, on the other hand, require joint governance structures that can slow down or prevent decisive action (Dyer et al., 2004; Wang & Zajac, 2007; Srivastava & Yayavaram, 2026). Competitive considerations further reinforce this effect. An alliance with a company operating in similar markets carries the risk of unintentionally strengthening a direct competitor through the transfer of knowledge. Meanwhile, a full acquisition eliminates this risk, as the target company ceases to exist as an independent competitor (Wang & Zajac, 2007; Srivastava & Yayavaram, 2026; Ego, 2023).

2.1.3 Integration Risks, Irreversibility & Commitment

Regardless of the previously mentioned advantages, acquisitions carry inherent risks. The commitment is largely irreversible, which significantly increases risk exposure in uncertain environments. The root cause lies in information asymmetry, as prior to the acquisition, the acquiring company typically has only incomplete insight into the target's actual resource quality, operational processes and internal capabilities. Without prior collaboration, due diligence can only partially bridge this information gap, leaving the acquirer to make a significant investment while uncertainty remains (Mellewigt et al., 2017; McCann et al., 2016; Srivastava & Yayavaram, 2026; Ego, 2023).

Two external factors further complicate this. Market uncertainty makes large, irreversible commitments particularly risky, , because the expected income may not materialize as planned (Dyer et al., 2004; Moeen & Mitchell, 2020) However, competitive pressure could nullify this logic. When competitors actively acquire capabilities, companies may feel forced to respond accordingly, even if they lack an ideal resource fit, just to internalize critical knowledge and limit competitors' access to the same resources (Dyer et al., 2004).

Furthermore, relying too heavily on one's own acquisition-specific capabilities poses another risk. Prior acquisition experience helps build expertise and thus facilitates the evaluation of targets and the management of integration processes. However, relying too much on this expertise can narrow the strategic view and lead to defaulting to acquisitions even in situations where an alliance would be the more appropriate choice (Dyer et al., 2004).

At the organizational level, acquisitions face two structural barriers to innovation. First, integration processes require significant management resources, systematically preventing innovation beyond the immediate post-merger phase. Second, the *"Indigestibility"* argument suggests that full acquisitions force acquirers to absorb unwanted knowledge and redundant resources beyond what can be effectively integrated. (De Man & Duysters, 2005;

Carayannopoulos & Auster, 2010). However, prior collaboration with the target company can mitigate some of these integration risks, as partner-specific knowledge gained over time reduces information asymmetry, enables a more accurate assessment, and accelerates post-acquisition integration (Mellewigt et al., 2017; Ego, 2023).

2.2. Strategic Alliances

Strategic alliances are cooperative agreements between two or more independent organizations that share resources while maintaining their organizational identities (De Man & Duysters, 2005). They thus take a hybrid position on the spectrum of interorganizational relationships, falling between traditional market transactions on the one hand and full integration on the other (Hagedoorn, 2002). They typically emerge when neither of the mentioned forms represent the most efficient solution for the exchange of resources. They combine the coordination benefits of a hierarchy with the flexibility of market-based arrangements (Hennart, 1988; Ego, 2023).

2.2.1 Resource Complementary & Collaborative Value Creation

Dyer and Singh (1998) show that strategic alliances become particularly attractive when firms have different but complementary resources or capabilities that, when combined, generate significantly more value than when used independently. A logic that remains supported by more recent research on interfirm knowledge acquisition (Srivastava & Yayavaram, 2026). The key mechanism is that complementarity creates interdependence. Each partner needs what the other has, which naturally makes the relationship more stable. As collaboration and therefore also interdependence deepen, both partners become increasingly willing to make relationship-specific investments in shared systems, coordinated processes, and shared infrastructure, enhancing coordination efficiency and enabling collaborative value creation that neither company could generate on its own and that competitors cannot easily replicate. (Dyer & Singh, 1998).

The overlap in expertise between two companies plays an important role in determining which form of governance promises the greatest strategic value. Where knowledge bases vary significantly, integration challenges and perceived value differences make a full acquisition difficult and alliances offer the lower-risk alternative. However, as knowledge becomes more interrelated, integration becomes more feasible and the strategic value of an acquisition increases. (Carayannopoulos & Auster, 2010; Srivastava & Yayavaram, 2026).

2.2.2 Risk Sharing & Flexibility

An immense advantage alliances hold over acquisitions lies in their greater structural flexibility. (Wang & Zajac, 2007; Moeen & Mitchell, 2020) While acquisitions demand significant, hardly reversible, upfront commitments, alliances allow companies to match their scope of commitment and investment to the trust they have in their partner and the market. This is essentially valuable in times characterized by uncertainty, when the expected value of cooperations remains unclear. Limiting the initial risk, while retaining the option to deepen the relationship later, represents the rationally superior choice (Wang & Zajac, 2007; McCann et al., 2016, Ego, 2023). In this regard, relationship-specific investments are only made if the companies are sufficiently convinced that the partnership will be long-lasting and that appropriate safeguards against opportunistic behavior are in place. Without these conditions, companies will rationally hold back on their investments because assets tailored to a specific partnership lose most of their value if the relationship ends prematurely, exposing the investing company to significant losses (Dyer & Singh, 1998). Furthermore, alliances offer the possibility to share the risk associated with capital-intensive projects and accelerate development cycles by providing access to complementary capabilities and expertise. This represents a significant competitive advantage in industries, where technological progress rapidly drives down prices and increasingly shortens product lifecycles (De Man & Duysters, 2005; Srivastava & Yayavaram, 2026).

2.2.3 Governance & Knowledge Access Mechanisms

Effective governance of alliances determines whether collaborations add value or lead to conflicts and opportunism for a company. Dyer and Singh (1998) differentiate between formal safeguards, such as equity stakes or financial hostages and informal safeguards, such as trust and reputation. While formal mechanisms create financial incentives for compliance, similar to a bond losing value when a partner behaves opportunistically, informal mechanisms reduce the attractiveness of opportunistic behavior by ensuring that the long-term costs of an exit outweigh the short-term gains. In practice, informal safeguards prove more effective over time, as they reduce the transaction costs and are harder for competitors to imitate. However, their development requires repeated interaction, which is why alliances normally start with formal safeguards and loosen them with growing mutual trust towards informal ones. (Dyer & Singh, 1998; Williamson, 1983; Gulati, 1995).

Partner-specific trust, defined as the belief that a partner will honor commitments and will not act in self-interest at the other's expense, plays a central enabling role (Mellewigt et al., 2017). Trust accelerates communication, reduces the need for costly monitoring, and lowers the perceived risk of sharing knowledge, acting as a catalyst for alliance formation by reducing the need for hierarchical control, in situations where, without trust, a company would otherwise seek a full acquisition as a safeguard (Mellewigt et al., 2017). Partner-specific routines further improve coordination and facilitate joint learning. However, their impact on governance choices is ambiguous. While routines enhance operational efficiency and deepen interdependence, they can also raise concerns about knowledge leakage and lock-in, which may push companies toward acquisition to secure the relationship more permanently (Mellewigt et al., 2017).

The sharing of knowledge is a key mechanism through which alliances generate competitive advantages, even though it simultaneously entails vulnerability through unintended spillovers. An effective governance design, which balances openness with the appropriate safeguards, is therefore a mandatory prerequisite for value creation (Dyer & Singh, 1998). Moreover, in knowledge-intensive environments, alliances bear two strategic functions. On the one hand, they enable cost-efficient exploration of the technological landscape without committing to a specific direction. On the other hand, they offer targeted access to specific knowledge components, while excluding redundant resources. Companies that embed this logic through their own alliance function can establish a structural advantage, which is not replicable through individual transactions (Dyer & Singh, 1998; De Man & Duysters, 2005).

Ultimately, the choice of a governance form affects the organization. Companies that repeatedly enter into alliances develop trust, networks and collaborative routines, whereas experiences with acquisitions create and strengthen expertise in valuation and integration, therefore making future acquisitions more likely. Governance decisions are thus not only the result of rational situational analysis, but also of path-dependent organizational learning processes (Carayannopoulos & Auster, 2010; Hoffmann & Schaper-Rinkel, 2001; Srivastava & Yayavaram, 2026; Ego, 2023).

2.3 Evidence from High-tech Industries

Knowledge-intensive industries follow a governance logic that fundamentally differs from that of traditional capital-intensive sectors and is becoming increasingly relevant as the automotive industry undergoes its transformation. Electrification, software integration, and digitalization are presenting OEMs with the same structural challenges that have shaped high-tech industries

for decades (He et al., 2020). In such industries, the primary source of innovation is shifting from individual companies to collaborative learning networks, as collaborations combine risk-sharing, technology access and complementary capabilities into an integrated strategic response to structural resource gaps (Powell et al., 1996). The following sections examine this pattern through the lens of alliance dominance in high-tech industries, before analyzing the underlying mechanisms of uncertainty, distributed knowledge and speed and experimentation logic as structural drivers.

2.3.1 Why Alliances dominate in High-Technology

The intensity of strategic alliances within an industry correlates positively with its technological knowledge intensity, because the more dynamic and complex the knowledge base, the stronger the structural tendency towards interorganizational collaboration (Powell et al., 1996).

This is most evident in biotechnology, where no single organization could bring together the full range of required competencies, from basic research to regulatory expertise and marketing. This gap lead universities, specialized firms and pharmaceutical companies to rely on collaborative governance forms. The value of these small specialized biotech firms rested primarily on human capital-intensive skills that are difficult to transfer. Consequently, full acquisitions would have increased the risk of demotivating or losing key personnel, thereby destroying the very capabilities that made the target strategically valuable (Powell et al.,1996; Dyer, Kale & Singh, 2004).

In knowledge-intensive industries, collaboration is not a sign of limited resources but a structural feature of industrial leadership. Companies that succeed in such industries actively choose interdependence over autonomy, as the ability to learn is more valuable in the long run than complete control over resources (Powell et al., 1996).

Hagedoorn (2002) documents this trend empirically. Joint R&D activities were long considered one of the least likely forms of interorganizational collaboration, as companies traditionally view their research and development as their most strategically sensitive area. Nevertheless, R&D partnerships developed into a key strategic instrument since the early 1960s. This demonstrates how strong structural pressures can drive forward collaboration in knowledge-intensive industries. Hagedoorn (2002) states four drivers of this shift: increasing technological complexity, growing uncertainty in R&D processes, increasing project costs and shorter innovation cycles that require a fast integration of external knowledge. The data reflects this clearly. The number of newly formed R&D partnerships rose from just a few per year in the

1960s to over 500 annually by the late 1980s. During the same period, the share of joint ventures in all R&D partnerships decreased from nearly 100% to less than 10 percent, as they were replaced by more flexible contractual agreements that allow companies to collaborate with multiple partners without entering into long-term commitments. A structural necessity in industries characterized by pressure to innovate, technological change, and shorter product cycles (Hagedoorn, 2002). A systematic review by De Man and Duysters (2005) confirms this trend and concludes that alliances consistently have a positive effect on innovation performance, whereas acquisitions show a neutral to negative effect. This is supported by the decline of patents and product innovations that are associated with M&A transactions. This contrast is particularly noticeable in technology-intensive sectors (De Man & Duysters, 2005).

As digitalization advances, innovation is increasingly emerging within collaborative ecosystems rather than within individual firms, forcing companies to complement their expertise through cross-industry alliances as competition shifts from firms to ecosystems. A pattern that is no longer limited to digital industries but is increasingly affecting traditional sectors undergoing similar transformation (He et al., 2020).

2.3.2 Role of Uncertainty & Distributed Knowledge

The fact that alliances play a dominant role in high-tech industries cannot only be proven empirically, but also explained in functional terms. The nature of technological uncertainty can be identified as a key driver. To be precise, when new discoveries fundamentally challenge existing methods and technologies, established companies can lose the competitive edge they have built over decades. Such moments of technological disruption can redefine the knowledge structure of an entire industry and change the strategic position of all market players at once. (Powell et al., 1996).

This uncertainty is further intensified by the structural distribution of knowledge. Scientific breakthroughs require a range of intellectual and technical skills that systematically exceed the capabilities of individual organizations, making external knowledge acquisition not a strategic option, but an organizational necessity (Powell et al., 1996; Carayannopoulos & Auster, 2010). This is not a theoretical assumption, as the development of an animal model for Alzheimer disease alone involved 34 scientists from six different types of organizations (Powell et al., 1996).

Given the combination of uncertainty and distributed knowledge, internal and external knowledge sources are not substitutes but structural complements. Internal capabilities are

essential for evaluating externally generated knowledge and putting it to use, while network collaborations provide access to resources and information that cannot be produced internally (Powell et al., 1996). Knowledge that is deeply rooted in organizational routines and context-specific learning processes loses its strategic value when removed from its original context, making alliances a structurally superior governance form, as they provide access without threatening contextual embeddedness (Carayannopoulos & Auster, 2010; Srivastava & Yayavaram, 2026).

Under such conditions of radical technological disruption, market uncertainty further increases the attractiveness of alliances, as collaborative structures limit commercial risk while irreversible acquisitions bear the full downside exposure. Empirical findings show that companies in dynamic, knowledge-intensive environments prefer alliances even when the primary goal is to acquire external knowledge, as maintaining strategic flexibility takes priority over irreversible commitments. Highly specialized knowledge, as well as knowledge already distributed across a broad network of partners, is particularly unsuitable for full internalization through acquisition (Mellewigt et al., 2017; Carayannopoulos & Auster, 2010).

The combined effect of uncertainty and distributed knowledge is therefore structural in nature. It makes alliance not a preference but a rational necessity. Companies that rely on full internalization in such environments not only risk integration problems but also jeopardize the strategic value of the resource itself (Powell et al., 1996; Carayannopoulos & Auster, 2010).

2.3.3 Speed & Experimentation Logic

Beyond uncertainty and distributed knowledge, a third structural driver of alliances' dominance in high-technology industries is the demand for speed and experimentation. March (1991) differentiates between exploitation, which involves deepening existing capabilities with predictable returns, and exploration, which entails experimenting with new alternatives whose returns are uncertain but potentially generate transformative outcomes. Exploration is costly and often yields no results, but it is the only way to achieve technological leadership in rapidly evolving fields. Alliances, as reversible and flexible governance structures, limit the financial risks associated with exploratory activities while maintaining the option to transition to more integrated governance forms at a later stage. In explorational phases, this flexibility provides an advantage over irreversible acquisitions. Especially in the context of the biotechnology industry, the speed advantage of alliances can be seen, as collaborative structures have reduced the time from discovery to market entry from seven to eleven to four to eight years there.

(Powell et al., 1996; Kogut, 1991; Mellewigt et al., 2017; March, 1991; Moeen & Mitchell, 2020; McCann et al., 2016).

The accumulated experience in collaboration becomes a strategic resource. Companies that enter into external partnerships early on develop routines and a reputation as a reliable partner. This facilitates and accelerates subsequent cooperation. Empirically, a self-reinforcing effect can be observed. Organizations with comprehensive experience in alliance forms tend to pursue further alliances, even when acquisitions seem more appropriate. This is due to the fact that alliance experience fosters social networks and cooperation routines that reduce the perceived necessity for irreversible commitments (Powell et al., 1996; Carayannopoulos & Auster, 2010; Ego, 2023).

In technologically dynamic industries, flexible alliances function as strategic real options. By establishing a broad portfolio of cooperation partners, companies increase their chances of getting early access to promising technological innovations while simultaneously decreasing the risk of completely missing them. In technology-intensive markets characterized by short price cycles, speed to market is a decisive strategic advantage. Collaborative structures that combine their development capabilities can, in comparison to fully integrated, but more complex organizational structures, shorten innovation cycles drastically (De Man & Duysters, 2005).

Digital transformation is intensifying these pressures, creating direct parallels with challenges faced by traditional industries such as the automotive sector. Flexible, agile, and sometimes ad hoc collaborations with shorter lifecycles are increasingly replacing long-term, rigid partnership models. Firms must rapidly identify suitable partners, build capabilities, and transition to new partners as the strategic environment evolves. This level of flexibility is unattainable through irreversible acquisitions (He et al., 2020). As chapter five demonstrates, the automotive industry currently faces this structural pressure, making the choice of governance form a practical rather than theoretical concern.

3. Methodology

Following the theoretical foundations established in the preceding chapters, this chapter outlines the methodological approach of the thesis and explains how the literature-derived framework is applied to the selected industry cases. The chapter first discusses the overall research approach and research design, before justifying the case selection, data sources and analytical procedure. Finally, the methodological limitations of the study are addressed.

3.1 Research Approach

This thesis follows a qualitative and deductive research approach. The objective is not to statistically test causal relationships or generate generalizable quantitative findings, but rather to develop a structured analytical understanding of governance choices between strategic alliances and acquisitions within the context of the automotive industry transformation.

A qualitative approach is particularly suitable for this study, because governance decisions between alliances and acquisitions are complex and context-dependent phenomena that require interpretive analysis rather than statistical measurement. While qualitative research is often associated with an inductive stance, Bell et al. (2022) acknowledge that theory can be embedded in a qualitative research design from the beginning, which is consistent with the present study.

Moreover, this thesis follows a deductive logic, with the existing literature serving as the starting point for the analysis (Bell et al., 2022). The relevant literature on alliances, acquisitions and governance choice in high-tech industries is reviewed first. Based on this, a multidimensional governance framework is derived. The framework is then applied to two selected cases from the automotive industry to assess whether the observed governance decisions align with the theoretical predictions of the framework.

The study does not seek to generate entirely new theory but to contribute through theory integration and contextual application rather than primary empirical discovery.

3.2 Research Design

The research design is based on a qualitative comparative case study approach.

Case study research can serve different purposes depending on the research objective, ranging from description to theory testing and theory generation (Eisenhardt, 1989; Bell et al., 2022). This thesis seeks to explain how different configurations of governance-relevant conditions influence incumbent automotive firms' decisions between strategic alliances and acquisitions

when building critical technological capabilities. Thus, making a case study design particularly appropriate. Those decisions are heavily influenced by technological, competitive and organizational conditions. Since these factors cannot be meaningfully separated from their broader industry environment, a case-based approach that accounts for this contextual embeddedness is particularly appropriate.

A comparative design is chosen, because comparing two contrasting cases allows for a better understanding of the conditions under which the framework holds and where tensions or gaps emerge. As Bell et al. (2022) note, the comparative design embodies the logic of comparison, which implies that social phenomena are better understood when examined across meaningfully contrasting cases. Both selected cases have one incumbent automotive player, which face similar structural pressures. Yet the chosen governance forms differ fundamentally, as in one case an alliance structure was chosen, while in the other case an acquisition was preferred. This contrast makes them particularly suitable for evaluating the framework's analytical relevance.

The research design is therefore structured into four consecutive steps: (1) A structured review of the relevant academic literature concerning strategic alliances, acquisitions and governance choice in high-tech industries (2) the derivation of a conceptual framework integrating the central theoretical insights from the literature into five dimensions; (3) the application of the framework to two selected automotive industry cases; (4) a cross-case comparison analyzing how the individual framework dimensions influenced the respective governance decisions.

Furthermore, the analysis follows a two-phased procedure consistent with the within-case and cross-case logic described by Eisenhardt (1989). First, each case is analyzed individually through the five framework dimensions. Second, a cross-case comparison identifies similarities, differences, and potential explanatory mechanisms, following a dimension-based pattern-matching logic. The two cases are used to assess whether the respective governance decisions align with the framework's predictions or reveal potential tensions and gaps, following Eisenhardt's (1989) replication logic.

3.3 Case Selection

The thesis analyzes two cases from the automotive industry: (1) the strategic alliance between Mercedes-Benz and NVIDIA and (2) the acquisition of Cruise by General Motors.

The automotive industry was selected because it currently exhibits many of the structural characteristics traditionally associated with high-tech industries, including distributed knowledge, rapid technological change, high uncertainty and increasing dependence on external capabilities. As discussed in the preceding literature review, these characteristics significantly influence governance choices between alliances and acquisitions.

Both cases occurred within a similar time period, address similar technological challenges in autonomous driving and software integration and involve incumbent automotive firms seeking access to critical external capabilities. Despite these similarities, the firms chose fundamentally different governance forms, making the cases particularly suitable for evaluating the framework's analytical relevance across contrasting governance decisions. Selecting two cases with highly contrasting outcomes allows for a better understanding and assessment of where the framework holds and where it reaches its limits (Eisenhardt, 1989; Bell et al., 2022).

This thesis applies the derived framework to two polar governance types, following the theoretical sampling logic of Eisenhardt (1989), suggesting that selecting cases with opposing outcomes enables governance-relevant characteristics to be observed more clearly. The case selection does not aim at statistical representativeness but follows a theoretically informed logic. The two cases are therefore used to assess whether the respective governance decisions align with the framework's predictions or reveal potential tensions and gaps, following Eisenhardt's (1989) replication logic.

3.4 Data Sources

The analysis is based exclusively on secondary data.

A company’s decision as to whether to opt for an acquisition or an alliance typically includes strategically sensitive information. Access to such information, as well as to internal assessments or decision-makers, is often limited, as access to elite informants is widely recognized as methodologically challenging in business research (Welch et al., 2002). Although internal information regarding the respective decision-making processes are only partially observable through public sources. Many governance-related factors, such as technological uncertainty, capability requirements and strategic positioning, can be meaningfully examined

using publicly available company and industry materials. For this reason, secondary data is appropriate in this context.

For similar reasons, collecting primary data through interviews or surveys was not considered the most appropriate approach. Identifying and accessing senior executives who played a key role in governance decisions may be difficult in strategically sensitive corporate contexts and may require disproportionate time and effort (Welch et al., 2002). Furthermore, retrospective interviews with senior managers may provide little additional insight beyond the organization's official statements, as the views expressed by these managers may reflect positions that can also be inferred from the company's public communications (Welch et al., 2002). The use of publicly available data is therefore consistent with established practice in strategy and governance research, where secondary data is frequently used to analyze strategic behavior and governance structures (Eisenhardt, 1989; Bell et al., 2022)

On this basis, the use of secondary data sources represents a methodologically appropriate approach to analyzing governance decisions in highly confidential corporate contexts.

The analysis of this thesis draws on a variety of publicly available documentary data sources, including organizational press releases, public executive statements, industry and consulting reports and news media sources. Bell et al. (2022) recognize such documentary sources as legitimate and widely used in qualitative business research, and also state that analyzing multiple sources in combination strengthens the robustness of the analysis through triangulation (Eisenhardt, 1989; Bell et al., 2022).

The collected material is neither treated as raw empirical data nor subjected to formal coding procedures. Instead, the sources are analyzed interpretatively and analytically to determine how the governance-relevant characteristics identified in the framework are reflected in the observed decision. This is consistent with the qualitative content analysis described by Bell et al. (2022), which systematically examines documents using predefined analytical categories.

3.5 Limitations

Several limitations need to be acknowledged.

First, the thesis is based exclusively on secondary data, which means that direct access to internal decision-making processes or confidential strategic assessments is not possible. The sources analyzed reflect the companies' public communications as well as the perceptions and assessments of the media, analysts and industry observers. Hence, they do not necessarily reflect the actual internal reasons for decision-making. Internal discussions, alternative options or personal influencing factors that have never been communicated publicly therefore remain invisible and cannot be captured by the framework.

Secondly, while Eisenhardt (1989) suggests four to ten cases for stronger empirical grounding, this study focuses on only two cases. Therefore, it does not aim for statistical generalization but rather serves as an analytical application of the developed framework to assess its relevance.

Thirdly, the deductive approach carries the risk of confirmation bias, as the selected cases are analyzed within a pre-established theoretical framework rather than examined inductively. As a result, alternative interpretations or explanatory factors may be overlooked.

Lastly, retrospective interpretation may introduce hindsight bias, as the governance decisions are assessed with knowledge of their eventual outcomes.

Despite these limitations, the comparative case study approach remains appropriate for the objectives of the thesis and allows for a context-sensitive application of the developed framework.

4. Framework

The preceding literature review has shown that neither acquisitions nor alliances are generally regarded as superior forms of management. The optimal choice depends on the interplay of environmental uncertainties, transaction characteristics and company-specific factors. Between full integration and purely contractual cooperation lies a continuum of organizational forms, ranging from strict control with little flexibility to maximum flexibility with minimal control. (Hoffmann & Schaper-Rinkel, 2001).

The existing literature approaches this question from a variety of theoretical perspectives, each of which illustrates a different aspect of the governance decision. The Resource-Based View emphasizes resource similarity and consolidation as primary drivers of governance choice (Barney, 1991; Wang & Zajac, 2007). Transaction Cost Economics focuses on uncertainty and the costs of irreversible commitments (Williamson, 1985; Mellewigt et al., 2017). The Knowledge-Based View directs attention to the transferability and embeddedness of knowledge (Grant, 1996; Powell et al., 1996; Carayannopoulos & Auster, 2010). The Relational View highlights the impact of trust, routines and prior experience in shaping governance decisions (Dyer & Singh, 1998; Mellewigt et al., 2017). Lastly, the Dynamic Capabilities perspective addresses the temporal logic of exploration, speed and optionality (March, 1991; Teece et al., 1997; Kogut, 1991). While each perspective generates unique and valuable insights, they tend to be used in isolation. However, this only captures one dimension of the governance decision and overlooks the other perspectives. Prior work, such as Villalonga and McGahan (2005), already used a multidimensional framework to identify firm-, transaction-, and inter-firm-level determinants of governance choice through empirical analysis. Nevertheless, such approaches focused primarily on explaining governance outcomes statistically, rather than providing an integrated framework applicable to specific industry contexts.

This gap is becoming particularly significant in the context of the automotive industry, which is currently facing technological uncertainty, distributed knowledge and substantial capital requirements (He et al., 2020; Hagedoorn, 2002). A conceptual framework that synthesizes insights from various theoretical lenses into a single analytical tool is therefore not only scientifically useful but also practically necessary for understanding governance decisions in this context.

The framework developed in this chapter does exactly that and is summarized in Figure 1. Drawing on the five theoretical perspectives identified in the literature review, it derives five

dimensions that collectively shape the governance decision between alliances and acquisitions. Each dimension corresponds to a distinct theoretical practice and carries a clear directional implication for the governance choice. Rather than relying on a single lens, the framework integrates complementary insights into a single, overarching tool explicitly designed for capital-intensive industries undergoing technological transformation.

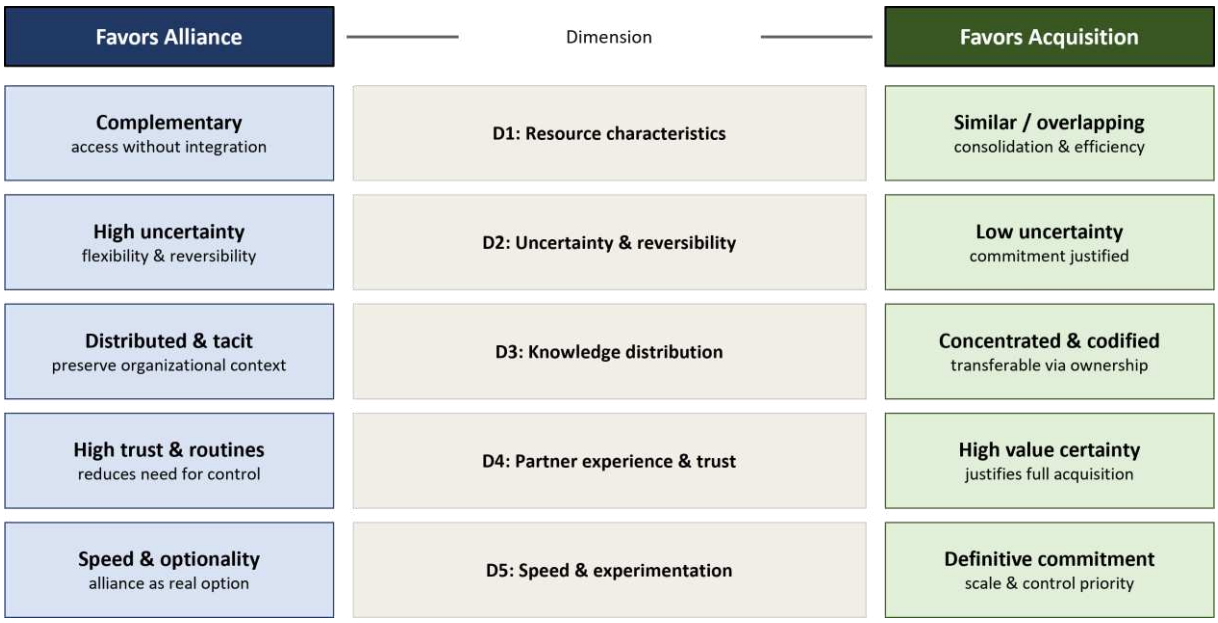

Figure 1: Five Dimensional Governance Decision Framework

The framework is normative, not deterministic. It serves as an analytical lens to highlight governance-relevant characteristics, rather than providing definitive answers. The dimensions should be viewed as a configuration, since their combined effect is more informative than any single dimension alone. For each dimension, the left side indicates conditions favoring alliance, the right side conditions favoring acquisition, and the center identifies the underlying dimension.

The following sections discuss each dimension in turn, before Section 4.6 addresses the interactions and inherent tensions between them.

4.1 First Dimension: Resource Characteristics

According to the resource-based view, the firm is regarded as a collection of heterogeneous resources whose strategic value depends on them being valuable, rare, inimitable and non-substitutable (Barney, 1991). Dyer and Singh (1998) extend this idea, arguing that competitive advantage also resides in interfirm relationships. Together, these views form the basis for the framework's first dimension.

Building on this, Wang and Zajac (2007) identify resource characteristics as one of the most important factors in the choice of governance form, distinguishing between two scenarios. On the one hand, when firms have overlapping resource bases, acquisitions are preferable. Consolidating redundant assets increases efficiency, reduces the risk of nurturing a competitor through unintended spillovers, and provides sole authority over combined resources (Wang & Zajac, 2007). On the other hand, when resources are complementary, the logic shifts. Complementary resources create value because they differ from one another. Each partner contributes what the other lacks, making the collaboration stable and strategically attractive (Dyer & Singh, 1998). The nature of the resource determines the optimal form of ownership. While full ownership maximizes profit where consolidation is possible, alliances are preferred when the value of the resource depends on its original context.

4.2 Second Dimension: Uncertainty & Reversibility

The theory of transaction costs developed by Williamson (1985) assumes that the choice of governance form is essentially determined by the costs of organizing economic activities, with uncertainty being one of the key factors in deciding which form is most efficient. The central question arising from this, regarding the choice of corporate governance structure, is how much uncertainty is associated with a transaction and how much flexibility a company needs to retain.

As the previous literature review has shown, situations characterized by high market uncertainty and unpredictable technological developments generally favor alliances, as these enable firms to limit their initial commitments, adapt over time and exit the alliance if necessary (Mellewigt et al., 2017). Kogut (1991) further formalizes this logic from the perspective of real options by viewing an alliance as a phased investment that preserves the right to deepen the commitment once uncertainty has diminished, whereas an alliance represents the immediate and irreversible exercise of this option. Conversely, the irreversibility of an acquisition is less of a concern in situations where uncertainty is low and the operating environment is sufficiently predictable, which justifies full integration as the more efficient option (Williamson, 1985).

Therefore, the degree of uncertainty and reversibility of action associated with a governance decision directly determine which form is most appropriate.

4.3 Third Dimension: Knowledge Distribution

The knowledge-based view, as outlined by Grant (1996), considers knowledge to be the most strategically important resource a company can possess. Competitive advantages depend less

on the ownership of tangible assets and more on a company's ability to access and integrate knowledge that cannot easily be imitated by others.

The key question in this regard is where the relevant knowledge is located and how easily it can be transferred. As alliances facilitate access to knowledge without the need for a full internalization, they are generally the more appropriate option when the desired knowledge is tacit and distributed (Powell et al., 1996; Carayannopoulos & Auster, 2010). However, if the knowledge is more concentrated and can be codified, a full acquisition makes more sense, as it gives the acquiring company sole control and eliminates the risk of knowledge being passed on to competitors or alliance partners (De Man & Duysters, 2005).

Thus, the nature and distribution of knowledge play a decisive role in determining which governance structure best suits leveraging its value. Tacit and distributed knowledge favors an alliance, while concentrated and codified knowledge favors an acquisition.

4.4 Fourth Dimension: Partner Experience

The Relational View, as articulated by Dyer and Singh (1998), argues that competitive advantage can reside not only within firms but also in the relationships between them. Therefore, the quality and history of an interfirm relationship directly shape the most appropriate governance form (Dyer & Singh, 1998).

As the preceding literature review established, two factors influence this dimension. The first is partner-specific knowledge. Mellewigt et al. (2017) identify trust, routines and value certainty as three mechanisms through which prior cooperation experience shapes subsequent governance decisions. Critically, these mechanisms do not always point in the same direction. High trust reduces the perceived need for hierarchical control and thereby favors alliance, while increasing value certainty about a partner's resources reduces informational uncertainty and makes acquisition more attractive (Mellewigt et al., 2017). Limited prior experience with a potential partner, by contrast, favors a more cautious alliance arrangement as an initial governance form. The second factor is a firm's general governance track record. Firms with an alliance-heavy history tend toward further alliances, while those with strong acquisition experience are more likely to pursue future takeovers, reflecting path-dependent organizational learning (Carayannopoulos & Auster, 2010; Hoffmann & Schaper-Rinkel, 2001).

Consequently, partner-specific knowledge and governance experience jointly shape the governance choice through their effects on trust and value certainty.

4.5 Fifth Dimension: Speed & Experimentation

Building on March's (1991) distinction between exploration and exploitation, Teece et al. (1997) describe dynamic capabilities as a firm's ability to integrate, build and reconfigure competencies in response to rapidly changing environments, with the manner in which these capabilities are accessed constituting a key strategic decision.

Situations in which rapid access to new capabilities is required due to technological uncertainty generally favor alliances, as they keep the possibility open of deepening commitment at a later stage while limiting downside exposure in the short term (Kogut, 1991; March, 1991). Moreover, by maintaining a broad network of collaborative partners, companies can experiment in various technological directions simultaneously, thereby minimizing the risk of choosing the wrong development path, rather than committing themselves entirely to a single approach through an acquisition (De Man & Duysters, 2005). However, once the technology in question has matured and the strategic focus shifts to economies of scale, control and market foreclosure, acquisition becomes the more appropriate form (Kogut, 1991).

The strategic timing of access to capabilities thus determines which form of governance is more appropriate.

4.6 Framework Summary & Inherent Tension

The five dimensions outlined above are best understood not in isolation, but as an interlinked whole. Governance decisions are rarely based on a single dominant factor, which is why the combined signals from several dimensions are more meaningful than any single dimension taken in isolation (Hoffmann and Schaper-Rinkel, 2001).

Some aspects share similar causes and are likely to be structurally intertwined. Uncertainty and speed are both manifestations of technological dynamism, which means that environments characterized by one tend to exhibit the other as well (Mellewigt et al., 2017; March, 1991). Similarly, the distribution of knowledge and the speed are linked to the logic of access, as implicit and distributed knowledge facilitates precisely the kind of selective and flexible access that alliance agreements make possible (Powell et al., 1996; De Man & Duysters, 2005). The complementarity of resources and early-stage exploration follow the same pattern, as companies seeking capabilities they do not yet possess typically operate in situations where the technology is still under development and a full commitment would be premature (Wang & Zajac, 2007; Kogut, 1991).

Other combinations may have the opposite effect. The partners' experiences may contradict the uncertainty, as a deeper understanding of the relationship strengthens the case for an acquisition, even if the general circumstances would tend to favor a more flexible solution (Mellewigt et al., 2017). A similar tension can arise between partner experience and knowledge distribution, where high value certainty about a partner points toward acquisition, while the tacit and distributed nature of the underlying knowledge would favor preserving the cooperative context through an alliance (Mellewigt et al., 2017; Powell et al., 1996).

These tensions show that, while the framework does not make any decisions regarding governance, it does bring the underlying considerations to light. Whether certain dimensions consistently outweigh others, and how their interactions should be weighted in practice, remain open questions. The application to two automotive cases in the following chapter, however, should provide an initial indication of which dimensions prove most analytically decisive in a capital-intensive transformation context.

5. Application to the Automotive Industry

The preceding chapters established that governance decisions between alliances and acquisitions are shaped by a configuration of five dimensions: resource characteristics, uncertainty, knowledge distribution, partner experience and speed and experimentation. These dimensions were derived primarily from evidence in high-tech industries where technological complexity, distributed knowledge and rapid innovation cycles have historically driven a structural preference for collaborative governance forms. The question this chapter addresses is whether the automotive industry, as it undergoes its own fundamental technological transformation, is developing the same structural characteristics, and whether the framework developed in Chapter 4 can therefore meaningfully be applied to explain governance choices in this context. Two case studies are analyzed in turn through the lens of this framework, drawing on publicly available company statements, press releases and industry documentation, before a cross-case comparison synthesizes the findings.

5.1 Automotive Industry Context

For most of its history, the automotive industry operated as a capital-intensive but technologically relatively stable manufacturing sector. Competitive advantage was built on engineering expertise, manufacturing efficiency and established supplier networks, capabilities that changed incrementally over decades. Hagedoorn (2002) reflected this reality when classifying automotive as a medium-tech sector with below-average alliance intensity. This description is no longer adequate.

What Schumpeter described as creative destruction, a process in which technological innovations do not simply improve existing structures but replace them entirely, is now underway in the automotive sector (Koelmel et al., 2025). The four central drivers of this transformation are electrification, autonomous driving, connectivity and digitalization, and their importance lies not only in what they change but in what they demand. These are domains in which established OEMs have historically had no meaningful competencies. Software development, AI, data analysis and the management of digital ecosystems differ fundamentally from the mechanical engineering expertise on which traditional vehicle manufacturing was based (Koelmel et al., 2025). Entering these domains, therefore, represents a structural break rather than an extension of existing capabilities.

Electrification is the most immediate and visible of these drivers. Driven by regulatory pressure, particularly the EU's planned ban on internal combustion engines by 2035, OEMs are being forced to rapidly and comprehensively transform their entire product portfolio at scale. (Koelmel et al., 2025; Carrillo et al., 2024). PwC (2018) projects that over 55% of new car sales in Europe could be fully electrified by 2030. Beyond the powertrain, electrification is fundamentally transforming supply chains, as electric powertrains require significantly fewer components than internal combustion engines. This is putting traditional suppliers under pressure to restructure and is leading to a redistribution of value creation across the entire supply chain (Koelmel et al., 2025). The technological path is moreover not yet settled, as competing propulsion technologies create additional strategic uncertainty for OEMs concerning their investment decisions (Koelmel et al., 2025).

Autonomous driving adds a second level of complexity. Self-driving vehicles require the convergence of advanced sensor technology, AI-driven software and high-performance computing, capabilities that lie well outside the traditional competency base of automotive manufacturers (Koelmel et al., 2025; Grimm & Walz, 2024). McKinsey & Company (2024)

reports that the expected timelines for the introduction of Level 4 autonomous driving, where the vehicle can operate independently under defined conditions without requiring human intervention (National Highway Traffic Safety Administration, 2022), have been pushed back by an average of two to three years since 2021, highlighting just how technically challenging and uncertain this field remains. Connectivity and digitalization are further accelerating this trend. As the value of products shifts from physical vehicles to software, data, and integrated mobility services, OEMs must reposition themselves within digital ecosystems over which they do not yet have full control (Koelmel et al., 2025; Turienzo et al., 2023). The four drivers interact and amplify each other, meaning the transformation cannot be managed through isolated responses to each challenge in turn (Koelmel et al., 2025).

This technological transformation is further intensified by competitive pressure coming from two directions. Chinese OEMs have established integrated domestic value chains that give them structural cost advantages across all vehicle segments, and are now aggressively expanding into global markets (McKinsey & Company, 2024; Koelmel et al., 2025). Technology and ICT companies are simultaneously entering the mobility space as providers of software platforms and autonomous driving solutions, competing with established OEMs for control over the vehicle's digital architecture while also serving as potential partners (Koelmel et al., 2025; Carrillo et al., 2024). As He et al. (2020) observe, digital transformation makes it increasingly unrealistic for any single organization to maintain all relevant technologies and competencies internally, a logic that now applies to traditional automotive manufacturers as much as to any high-tech firm.

The structural implications of this transformation are immediately evident in the way OEMs approach external partnerships. The proportion of scope deals, transactions aimed at acquiring new capabilities rather than consolidating existing ones, rose from 45 percent in 2015 to 73 percent in 2022, illustrating a significant shift in strategic priorities (Bain & Company, 2023). A review of 309 automotive alliances established between 2018 and 2023 shows exponential growth in alliance activity, with nearly half of all partnerships connecting OEMs with ICT firms and the main motivations being knowledge building, electrification and new mobility services (Carrillo et al., 2024). In areas such as EV battery production, the capital requirements alone exceed what individual players can absorb, making risk-sharing through partnerships a structural necessity rather than a strategic preference (Bain & Company, 2023). As uncertainty remains high, the formation of alliances has evolved from an occasional strategic tool into an organizational necessity. Partnerships are increasingly being used to explore several

technological avenues simultaneously, with the option to deepen the commitment as soon as a clearer direction emerges (Bain & Company, 2025; Carrillo et al., 2024).

The automotive industry, therefore, faces the same structural constraints that were identified in the previous literature review as historical drivers of the dominance of alliances in high-tech sectors. This parallel makes the automotive sector a particularly relevant and instructive context for applying the governance framework developed in Chapter 4. The following case studies examine whether the framework's predictions are reflected in the governance decisions of two major OEMs facing this transformation.

5.2 Case Study: The Mercedes-Benz and NVIDIA Alliance

In June 2020, Mercedes-Benz and NVIDIA announced a groundbreaking partnership to develop a software-defined computing architecture for automated driving across the entire Mercedes-Benz vehicle fleet. The partnership, described by NVIDIA CEO Huang as *"the biggest partnership of its kind in the transportation industry,"* was built on the NVIDIA DRIVE platform and set to be rolled out across all next-generation Mercedes-Benz vehicles from 2024 onwards (NVIDIA, 2020a). Rather than a traditional supplier relationship, the cooperation constitutes a strategic alliance in which both companies jointly develop AI and automated vehicle applications, share engineering resources and co-invest in the technological infrastructure required for software-defined mobility. The alliance does not involve cross-ownership between the two companies, preserving the independence and strategic flexibility of both parties (NVIDIA, 2020a).

The case is suitable for this thesis, as it represents a governance decision made under conditions earlier in the literature review classified as relevant. Precisely, the conditions are the technological uncertainty and Mercedes-Benz's fundamental capability gap. The transition towards software-defined vehicles and autonomous driving requires competencies in AI, chip architecture and software engineering. All lying outside of the traditional automotive engineering field (Koelmel et al., 2025; Bain & Company, 2023). The governance question was therefore not whether to access these capabilities externally, but how.

5.2.1 Framework Application

D1: Resource Characteristics

The combination of resources between Mercedes-Benz and NVIDIA is clearly complementary. Mercedes-Benz has a global fleet of premium vehicles. In 2019, almost 2.4 million cars and more than 438,000 vans were sold worldwide. Furthermore, they have a production network with over 40 sites across four continents, making the company one of the world's best-known luxury brands (Mercedes-Benz, 2020). NVIDIA contributes AI computing architecture, the DRIVE software stack, and chip technology specifically designed for automated-driving AI applications, capabilities that Mercedes-Benz does not possess internally and could not realistically develop at the required speed and scale on its own (NVIDIA, 2020a). Huang explicitly described this complementarity: *"It's the perfect partner for us given its long record of innovation and our strong technical relationship"* (NVIDIA, 2020a). Industry analysts confirmed this logic from the outside: *"With NVIDIA's leadership in accelerated computing and Mercedes-Benz's global leadership in luxury consumer vehicles,"* neither partner duplicates what the other brings (The Futurum Group, 2020). Following the D1 logic, this complementarity strongly favors alliance over acquisition as the form that enables access without requiring consolidation of fundamentally different resource bases.

D2: Uncertainty & Reversibility

The alliance was formed at a moment of pronounced technological and regulatory uncertainty. Autonomous driving in 2020 was far from a settled technology. Huang himself acknowledged that making all cars autonomous *"would not take just a couple of years but could take even a decade, involving obstacles that were hard to imagine at the time"* (Moor Insights & Strategy, 2020). On the regulatory side, Hodgson (2020) noted that *"predicting the pace of regulatory development over the course of the next 10 years is fraught with difficulties"*. Källenius captured this uncertainty from Mercedes-Benz's own perspective when describing the path forward as a journey: *"NVIDIA's AI computing architecture will help us streamline our journey towards autonomous driving"* (NVIDIA, 2020a). The absence of cross-ownership in the Mercedes-NVIDIA cooperation is relevant here. An acquisition would have committed both parties to an irreversible organizational structure at a point where neither the technology nor the regulatory environment had settled. The alliance format, by contrast, allows both partners to adjust the collaboration over time without unwinding the broader strategic relationship. Bain & Company (2025) confirms that under such conditions, firms increasingly look for collaborative structures

that keep their options open. High uncertainty combined with the absence of cross-ownership points clearly toward alliance as the rational governance choice in this context.

D3: Knowledge Distribution

The knowledge required for software-defined vehicles and autonomous driving in 2020 was spread across a broad ecosystem of specialist players rather than being concentrated in a single entity. McKinsey & Company's mapping of the mobility startup and investment ecosystem identified more than 1,000 companies active across ten technology clusters, including dedicated clusters for autonomous solutions and sensors/semiconductors, illustrating that the relevant software knowledge for autonomous driving was spread across a wide range of actors simultaneously pursuing similar capabilities (see Appendix A; McKinsey & Company, 2018). This fragmentation has only deepened since. The 2025 AV Summit Ecosystem Map shows that the automotive sector's cluster for autonomous driving (AD) and advanced driver-assistance systems (ADAS) alone includes companies such as Waymo, Aurora, Mobileye, Bosch, and NVIDIA, among others. This confirms that the relevant expertise has never been held exclusively by a single player, but has instead been structurally distributed across a broad competitive ecosystem. (see Appendix B; Autonomy, 2025). Acquiring NVIDIA would have given Mercedes-Benz access to one approach to autonomous-driving software, but not to the underlying knowledge, which was simultaneously being developed by a large number of competing and complementary actors. Hence, an alliance represents the more appropriate governance form for accessing knowledge that is structurally distributed and cannot be fully captured through ownership of a single actor.

D4: Partner Experience

The 2020 alliance was far from a cold-start partnership, as the working relationship between Mercedes-Benz and NVIDIA can be traced back to the Consumer Electronics Show in January 2017, when Huang publicly stated that *"Mercedes-Benz and NVIDIA share a common vision of the AI car"* (Buckley, 2017). In 2018, the two companies collaborated on the development of the Mercedes-Benz User Experience, the automaker's next-generation AI-powered infotainment system powered by NVIDIA processors (Wong, 2020). That same year, Daimler, Bosch and NVIDIA announced a joint effort to develop self-driving taxi technology, further deepening the operational relationship between the companies (Baldwin, 2018). By 2019, the collaboration had deepened further into full vehicle architecture, as Engadget reported that *"this isn't the first time the two companies have worked together — the partnership builds on longstanding, existing collaboration, and NVIDIA had already been helping Mercedes-Benz*

develop self-driving technology" (England, 2019). The 2020 strategic alliance was therefore the formalization of a relationship that had developed progressively over three years, providing sufficient trust to commit to a deep operational collaboration but not yet the level of value certainty that would justify full acquisition. Källenius captured this relational depth explicitly: *"Jensen and I know one another well and we have spent a great deal of time talking about the goals and potential of next-generation vehicle computing architecture"* (NVIDIA, 2020a). The second factor concerns the governance track record of both companies. Mercedes-Benz's own company history documents that its large-scale acquisition attempts have produced mixed results. The merger with Chrysler Corporation in 1998 and the subsequent stakes in Mitsubishi Motors and Hyundai Motor Company were all eventually divested or dissolved, with the majority stake in Chrysler sold in 2007 and the Asian partnerships gradually unwound thereafter (Mercedes-Benz Group, n.d.). By contrast, its alliance track record is considerably stronger, as the Renault-Nissan cooperation was described by Alliance Chairman Carlos Ghosn as producing results that *"have clearly benefitted both partners"* (PR Newswire, 2016). NVIDIA similarly has consistently pursued a partnership-based approach in the automotive domain. At the time of the alliance, the company already maintained partnerships with Audi, Toyota and Volkswagen, a network that has since expanded significantly (Wong, 2020). The path-dependent organizational learning of both companies therefore reinforces the alliance preference.

D5: Speed & Experimentation

In 2020, software-defined vehicles and autonomous driving represented a clear early-stage exploration context for Mercedes-Benz. Huang described the exploratory nature of this moment explicitly: *"We're breaking ground on several different fronts, from technology to business models"* (NVIDIA, 2020b). The speed dimension is equally reflected in Källenius' own framing of the cooperation, describing NVIDIA's AI computing architecture as the means to *"streamline our journey towards autonomous driving,"* suggesting that accessing NVIDIA's capabilities through alliance was seen as a faster route than building these capabilities internally (NVIDIA, 2020a). The alliance structure allowed Mercedes-Benz to explore multiple technological directions simultaneously without committing fully to a single path, consistent with the experimentation logic of the framework.

5.2.2 Governance Assessment

Across all five dimensions, there is a consistent preference for alliances as the rational form of governance for Mercedes-Benz in 2020. The absence of cross-ownership further confirms that both parties have deliberately chosen a flexible and reversible form of governance.

While all five dimensions point in the same direction, D2 and D3 emerge as the primary drivers of the governance decision. High technological and regulatory uncertainty made full ownership structurally unattractive, and the distribution of autonomous driving knowledge across hundreds of specialized actors meant that acquiring any single player would not have secured the complete capability base required. Together, these two dimensions establish the structural conditions under which alliance becomes not simply preferable but necessary.

The dimension that introduces the most notable counter-tension is D4. The working relationship between both companies, dating back to 2017, had built sufficient trust and value certainty that the question of governance form becomes analytically interesting. However, the financial realities make a full acquisition structurally implausible in either direction, as at the time of the alliance announcement, NVIDIA's market capitalization of approximately 220 billion USD was roughly five times that of Daimler AG at approximately 45 billion USD (MacroTrends, n.d.-a; MacroTrends, n.d.-b). Setting aside this financial asymmetry, the depth of collaboration accumulated over several years would, under different financial circumstances, have made an acquisition an increasingly rational consideration over time. That the alliance form nonetheless persisted points to the structural weight of D2 and D3. As Källenius noted as recently as 2026: *"You don't have to rush into the market. You don't have to be the first but you got to make sure that what you do is robust"* (Dignan, 2026). Therefore, the case illustrates how a convergence of high uncertainty and distributed knowledge can produce a stable and deepening alliance that evolves without converting to acquisition.

5.3 Case Study General Motors-Cruise-Acquisition

In March 2016, General Motors announced the acquisition of Cruise Automation, a San Francisco-based autonomous-vehicle software startup valued at over USD one billion (Primack & Korosec, 2016). The acquisition was justified by the goal of leveraging Cruise's software expertise and rapid development capabilities to further advance GM's autonomous vehicles (General Motors, 2016b). Mark Reuss, GM's Executive Vice President of Global Product Development, described the acquisition as providing *"a unique technology advantage that is unmatched in our industry"* (General Motors, 2016b). At the time, Cruise was fully integrated

into the corporate structure and has since been an official part of GM's newly established autonomous vehicle department, although it remained based in San Francisco and was allowed to continue operating as an independent unit

The decision made in this case regarding corporate governance is analytically significant for two reasons. First, it represents the opposite of the governance form adopted by the alliance between Mercedes and NVIDIA, as GM opted not to maintain organizational independence through a cooperative structure, but rather chose full integration through acquisition. Second, the decision was made during the same fundamental phase of transformation in the automotive industry, characterized by the shift toward electrification, autonomous driving, connectivity and digitalization, although about four years earlier than the alliance between Mercedes and NVIDIA. Despite facing comparable structural pressures, GM and Mercedes-Benz arrived at fundamentally different governance decisions, making the two cases particularly valuable for assessing the analytical relevance of the framework in the context of contrasting governance decisions.

5.3.1 Framework Application

D1: Resource Characteristics

General Motors contributed its globally leading vehicle production network spanning 30 countries and an established brand portfolio built on decades of automotive manufacturing expertise (General Motors, 2016a). Cruise, on the other hand, was a specialized autonomous vehicle software startup that had *"moved quickly to develop and test autonomous vehicle technology in San Francisco's challenging city environment"* since its founding in 2013 (General Motors, 2016b). While Mark Reuss, GM executive vice president, described Cruise's contribution as providing *"a unique technology advantage that is unmatched in our industry,"* GM had already been developing its own autonomous driving capabilities prior to the acquisition, having tested its "Super Cruise" technology since 2012 (General Motors, 2015; General Motors, 2016b). Therefore, the acquisition did not represent access to entirely foreign capabilities, but rather an acceleration in an area where GM had made initial progress yet lacked the depth of a dedicated software organization, as Mary Barra, GM Chairman and CEO, noted when describing Cruise's expertise as something that *"would really accelerate our ability to lead from an autonomous perspective"* (Burden, 2016). According to the D1 logic, the resource constellation is neither purely complementary nor purely similar, providing rational arguments for both an alliance and an acquisition. Consequently, this ambiguity indicates that the first

dimension alone cannot explain the governance decision and suggests that other dimensions might have a greater impact.

D2: Uncertainty & Reversibility

The acquisition was made at a time of profound uncertainty across the automotive industry. At the World Economic Forum in January 2016, GM's own CEO Mary Barra acknowledged the scale of the transformation ahead: *"I believe the auto industry will change more in the next five to 10 years than it has in the last 50"* (Barra, 2016). Furthermore, according to McKinsey & Company's (2016) automotive outlook from 2016, *"automotive incumbents cannot predict the future of the industry with certainty"* and *"there is still no integrated perspective on how the industry will look in 10 to 15 years"*. According to the logic of the second dimension, high uncertainty favors alliance as a reversible governance form that keeps flexibility until conditions become clearer. GM's decision to pursue a full acquisition under these conditions directly contradicts this theoretical prediction. This contradiction suggests that D2 did not carry sufficient weight to determine the outcome and that another factor carried greater influence on GM's decision.

D3: Knowledge Distribution

As established in the Mercedes-NVIDIA case analysis through McKinsey & Company's mapping of over 1,000 companies across ten mobility technology clusters (McKinsey & Company, 2018) and the Autonomy AV Summit Ecosystem Map (Autonomy, 2025), the knowledge required for autonomous driving was structurally distributed across many actors. Since GM's acquisition took place just four years before the alliance between Mercedes and NVIDIA, it can be assumed that the circumstances were similar in 2016. Multiple established players, including Waymo, Uber, Tesla, Ford and Nissan, were simultaneously developing autonomous driving capabilities alongside large tech firms such as Intel, IBM and Nvidia, illustrating that the relevant knowledge was spread across a wide range of actors rather than held by any single player (Hepler, 2017). However, GM's own assessment of Cruise indicates otherwise, as Mark Reuss described Cruise as providing *"a unique technology advantage that is unmatched in our industry"* (General Motors, 2016b), suggesting that Cruise's knowledge was seen as concentrated and unique enough to justify a full integration through acquisition. This difference between the broader ecosystem structure and GM's internal assessment suggests that the perceived uniqueness of Cruise's knowledge played a meaningful role in tipping the governance decision toward acquisition.

D4: Partner Experience

Prior collaboration between GM and Cruise is absent. Founded in 2013, Cruise had existed for only three years at the time of the acquisition, leaving limited opportunity for a working relationship to develop (Primack & Korosec, 2016). Negotiations between the two companies first started with the intention of a potential strategic investment by GM in Cruise, but *"quickly morphed into an acquisition discussion with the entire agreement getting hashed out in less than six weeks"* (Primack & Korosec, 2016), giving evidence of missing partner-specific knowledge, which according to D4 favors acquisitions to keep control. However, the missing value certainty over Cruise's capabilities favors alliances, making the directional signal ambiguous. GM's governance track record reflects substantial experience with ownership-based governance structures in the automotive sector. However, in the technology sector, where Cruise can be classified, GM had no prior acquisition experience and only minimal alliance experience through the Lyft partnership announced just two months prior to the Cruise deal (General Motors, 2016c). The two factors therefore pull in different directions. The absence of prior trust points toward acquisition through the need for control, and GM's strong institutional familiarity with acquisitions reinforces this tendency, while the absence of value certainty argues for a more cautious alliance entry. D4 does not provide a clear directional signal but reflects a tension between the underlying factors.

D5: Speed & Experimentation

GM explicitly cited speed as the reason for acquiring Cruise. The official press release described the deal as aimed at adding Cruise's *"rapid development capability to further accelerate GM's development of autonomous vehicle technology"* (General Motors, 2016b). Mary Barra reinforced this logic directly by saying, *"We began to believe it could happen much faster if instead of an evolutionary path, we could have a revolutionary path"* (Knowledge at Wharton Staff, 2018). However, according to the logic of the fifth dimension, in the context of the early exploration phase, speed favors alliances as a flexible option that allows for rapid access to capabilities without requiring an irreversible and deep commitment. Full acquisition is the appropriate governance form when technology has reached competitive maturity. Yet Barra herself had stated just months before the acquisition that *"the auto industry will change more in the next five to ten years than it has in the last 50"* (Barra, 2016), an acknowledgment of profound uncertainty that stands in direct contradiction to the logic of accelerating development through full ownership and control. This contradiction between the uncertainty acknowledged by GM management itself and the irreversible management approach they chose suggests that

D5 does not support the decision to acquire the company, and indicates that other factors were more decisive in determining the final outcome.

5.3.2 Governance Assessment

After evaluating all five dimensions, the analytical conclusion speaks in favor of alliances as the rational governance choice and therefore away from the GM-chosen acquisition. D2 showed high uncertainty and D3 confirmed a broadly distributed knowledge landscape, both pointing toward alliance. D4 revealed a tension between the absence of prior trust, which according to the framework increases the need for control and points toward acquisition, and the missing value certainty over Cruise's capabilities, which argues against an irreversible commitment. D4 therefore does not provide a clear directional signal. Furthermore, D5 revealed a fundamental misalignment between the early-stage exploration stage of the industry and GM's choice of a hardly reversible commitment. While D4 introduced some pull toward acquisition through the absence of trust and GM's acquisition-oriented track record, the only dimension providing a substantive argument for full internalization is D3, specifically GM's own characterization of Cruise as providing *"a unique technology advantage that is unmatched in our industry"* (General Motors, 2016b). This perception of Cruise's knowledge as concentrated and unique appears to have been the dominant driver of the governance decision, one that carried sufficient weight to override the signals from D2, D4 and D5 simultaneously and neutralize all other considerations pointing towards an alliance as the governance choice. The acquisition ultimately failed to deliver on its original promise. After investing over ten billion USD, Cruise faced a major safety incident in October 2023, triggering regulatory investigations and the grounding of its entire fleet (Wayland, 2023). GM quit robotaxi operations entirely in December 2024, integrating Cruise into its internal operations (Kolodny & Wayland, 2024; Associated Press, 2024). The failure of the Cruise business model retrospectively illustrates the cost of choosing an irreversible governance form in an uncertain and early-stage technology environment. An alliance structure would have allowed GM to access Cruise's capabilities with greater flexibility, adjust or exit the collaboration as conditions evolved, and distribute risk across a broader portfolio of partnerships rather than concentrating over ten billion USD in a single acquisition. Hence, the GM-Cruise case lends retrospective support to the framework's prediction that high uncertainty and early-stage exploration call for reversible governance and suggests that the dimensions identified are analytically meaningful for distinguishing between governance contexts, even if two cases alone do not constitute robust verification.

5.4 Cross-Case Comparison

Both cases share a common industry context and a similar capability gap requiring external access to AI and software expertise, yet they arrived at fundamentally different governance outcomes.

D1 shows a first structural difference. In the Mercedes-NVIDIA case, the resource bases were unambiguously complementary with no meaningful overlap, pointing clearly toward an alliance. In the GM-Cruise case, the constellation was more ambiguous. GM had already been developing autonomous driving capabilities through Super Cruise since 2012, creating a partial overlap that provided rational arguments for both governance forms. D1 was therefore conclusive in the first case and inconclusive in the second.

Across D2, both cases faced similar levels of uncertainty. Yet Mercedes-Benz chose a flexible, reversible governance form, while GM chose an irreversible one. The second dimension of the framework was therefore coherent with the Mercedes-NVIDIA outcome but was overridden in the GM-Cruise case, suggesting that uncertainty alone is a necessary but not sufficient condition for alliance governance.

The most significant differentiation can be observed in D3. In both cases, the autonomous driving knowledge landscape was structurally distributed across multiple actors. However, while Mercedes-Benz interpreted this distribution as a reason to ally rather than acquire, GM perceived Cruise's specific knowledge as uniquely concentrated and unmatched. In the GM-Cruise case, the objective and subjective assessments diverged, with GM’s subjective assessment overriding the objectively observable ecosystem structure, leading towards an model in favor of acquisitions.

D4 shows a notably different configuration across the two cases. Mercedes-Benz and NVIDIA had built a progressive working relationship since 2017, building trust that reduced the need for hierarchical control and reinforced the alliance's preference. In the GM-Cruise case, there was no prior collaboration. The absence of trust increased the perceived need for control, providing a partial pull toward acquisition. However, the simultaneous absence of value certainty in a highly uncertain environment argued against an irreversible commitment. D4 therefore sent a clear signal toward alliance in the Mercedes-NVIDIA case, but produced an ambiguous signal in the GM-Cruise case.

Mercedes-Benz explicitly framed its cooperation as the beginning of an exploration phase, consistent with the early-stage experimentation logic that D5 associates with alliance governance. GM, on the other hand, framed the acquisition as a means to accelerate through full ownership, treating an explorational phase as if the technology had already reached competitive maturity. The misalignment between the industry conditions in 2016 and GM's chosen governance structure is a clear illustration of how a company can misread the stage of technological development and, as a result, choose an inappropriate governance form.

In the Mercedes-NVIDIA case, all dimensions aligned toward alliance and the observed outcome matched the framework's prediction. The GM-Cruise case revealed a more ambiguous tendency with a slightly bigger pull towards an alliance, yet acquisition was chosen. The subjective perception of knowledge concentration in Cruise appears to be the dominant factor for the final decision, hinting that not all dimensions weigh equally in the decision process. The most recent failure of the GM-Cruise case provides retrospective support for the framework's predictive logic and raises the question of whether a weighted approach to the five dimensions would better capture the dynamics of real governance decisions. A direction that deserves further investigation in future research.

6. Discussion

Building on the patterns identified in the cross-case comparison, the following discussion interprets the findings in relation to the research question, situates them within the existing literature, and draws theoretical conclusions. Based on the two cases, alliances emerge as the rational governance choice when multiple dimensions of the framework align. However, when a firm's subjective evaluation of a target identifies its knowledge as unique, this can override the structural signals from the other dimensions and falsely lead to favoring an acquisition, with potentially significant financial consequences. Overall, these findings are broadly consistent with the literature reviewed in Chapter 2. The dominance of uncertainty and distributed knowledge as alliance drivers aligns with Mellewigt et al. (2017) and Powell et al. (1996), while the path-dependent reinforcement of governance preferences through track record is consistent with Carayannopoulos and Auster (2010) and Hoffmann and Schaper-Rinkel (2001). However, the GM-Cruise case adds nuance by showing that subjective perception has a significant impact

on governance decisions and can override structural signals, a dynamic that Dyer et al. (2004) identify as a known bias in governance decisions. The cases suggest two theoretical contributions. First, governance decisions in transformation contexts are best explained through a multidimensional lens rather than a single one. Second, not all dimensions seem to carry equal weight in the decision process. Therefore, future research should develop a grounded approach to weighting individual dimensions when applying a multidimensional governance framework.

7. Conclusion

The two cases analyzed in this thesis, the Mercedes-Benz and NVIDIA alliance and the General Motors acquisition of Cruise, show that governance decisions between alliances and acquisitions follow a clear logic that can be understood through systematic analysis. The aim of this study was to examine under what conditions incumbent automotive firms prioritize collaboration over ownership when building critical capabilities, and how this decision can be explained using an integrated governance framework. The results suggest that collaboration is the rational choice when uncertainty is high, knowledge is distributed across a broad ecosystem of players, resources are complementary, and trust has already been established. When these conditions are present, but a firm's subjective perception of a target's knowledge as uniquely concentrated overrides them, acquisition may follow as a false positive decision, as the Cruise case demonstrates. The framework contributes theoretically by synthesizing five perspectives into an integrated governance framework and revealing that dimensions do not carry equal weight. The subjective perception of knowledge concentration can dominate governance outcomes, a dynamic that existing literature has addressed only partially and that merits further investigation. The findings of this thesis suggest that, in a managerial context, the governance decision should be evaluated systematically and objectively. Firms should be aware that the perception of a target's knowledge as uniquely valuable can create a narrowing effect, which limits the strategic view to a single option and obscures the broader ecosystem reality in which similar capabilities may already be emerging elsewhere. Furthermore, as Dyer et al. (2004) note, alliance and M&A teams typically operate in isolation, creating a structural risk of biased evaluations where each unit favors the governance form it is responsible for. Hence, firms should consider establishing a dedicated unit between these functions that evaluates both governance options against a structured set of criteria before a decision is made. The developed

framework can be used as an initial template for such a process. However, several limitations must be acknowledged. The framework is based on only two cases and relies exclusively on secondary data, which means that internal decision-making processes remain unclear to some extent. Future research should therefore expand the case base or try to get access to decision makers within the companies to better understand the internal underlying argumentation. Given that single dimensions seem to have greater influence on the decision than others, research should develop a weighted version of the framework. Also the framework should be enlarged by dimensions regarding the size of the companies, the characteristics of the decision-makers and the international and cultural experience of the firms, in line with the findings of Ego (2023), as these were not represented in the framework, but in retrospect seem to have an influence on the governance decision. Moreover, as the GM-Cruise case illustrates, GM appears to have believed it had already crossed the threshold from exploratory to a scale-up governance logic, an assessment that proved incorrect in hindsight. Future research should therefore also investigate criteria that indicate the different maturity phases and signals that indicate phase transitions. While the framework developed in this paper does not resolve the issue of governance, it does highlight the associated trade-offs. As the boundaries between automotive and technology industries continue to blur, governance decisions of this kind will only become more frequent and more consequential. This thesis hopes to contribute a small but structured step toward understanding them better.

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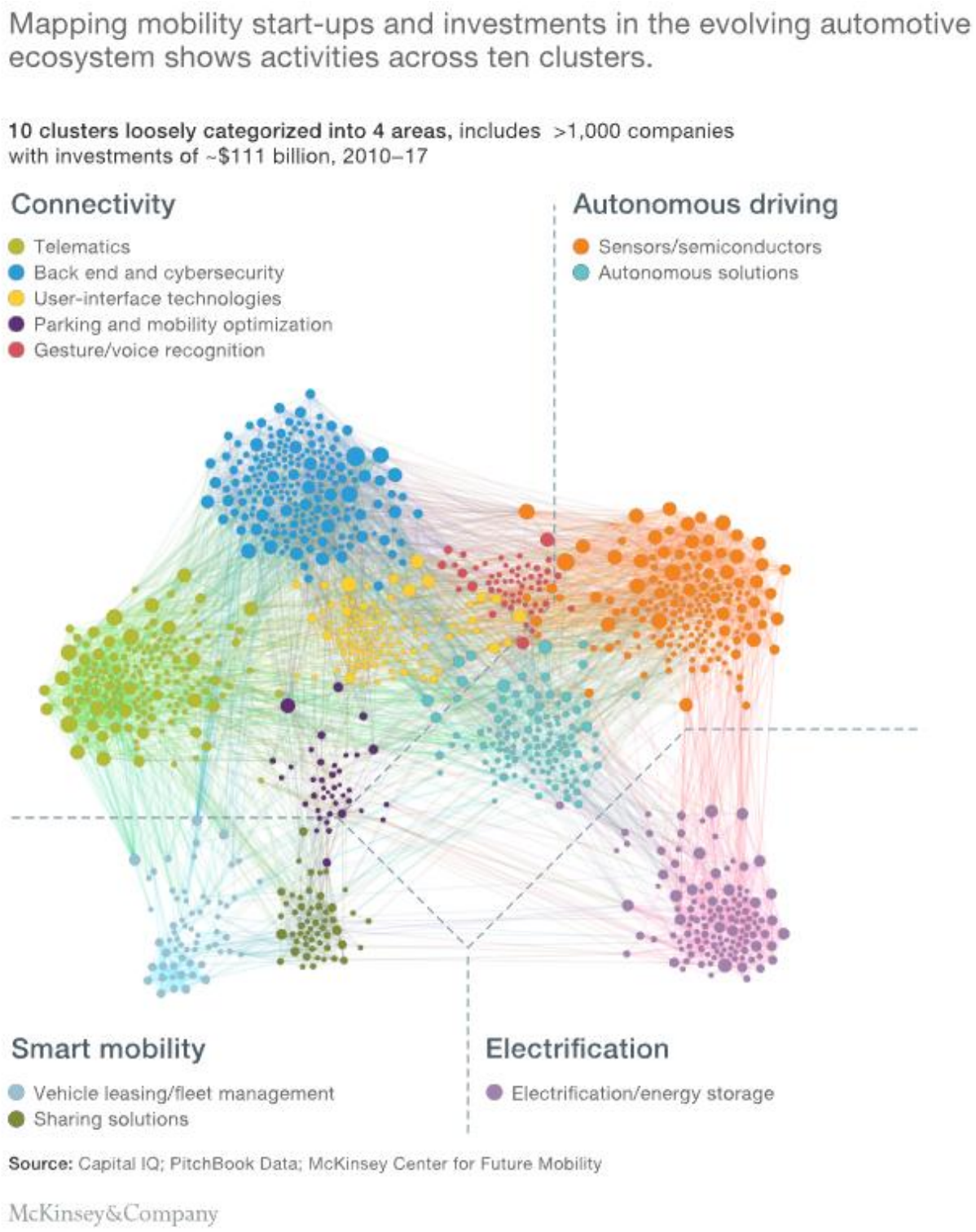
9. Appendix

Appendix A: McKinsey Mobility Startup and Investment Ecosystem Map



Appendix B: Automotive AD & ADAS Ecosystem map (Autonomy, 2025)