Corporate Innovation Subsidiaries:

A Framework for Knowledge Transfer

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August 2019

This dissertation is submitted for the degree of Doctor of Philosophy

I dedicate this thesis to my family.

Declaration

This dissertation is the result of my own work and includes nothing which is the outcome of work done in collaboration except as declared in the Preface and specified in the text.

It is not substantially the same as any that I have submitted, or, is being concurrently submitted for a degree or diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text. I further state that no substantial part of my dissertation has already been submitted, or, is being concurrently submitted for any such degree, diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text.

It does not exceed the prescribed word limit for the relevant Degree Committee.

Martha Caroline Amanda Geiger
Cambridge, August 2019

Acknowledgements

This Ph.D. would not have been possible without the unwavering support of multiple people. I want to use this opportunity to acknowledge and thank them.

First and foremost, I want to thank my supervisor, Prof Tim Minshall, who provided a perfect balance of freedom and guidance throughout my journey. I consider you a mentor, role model, and friend. Secondly, I owe gratitude to my advisor, Dr Letizia Mortara, and other researchers at the Institute for Manufacturing, who offered invaluable advice about my work and helped me grow as a researcher.

Thank you to all my friends at the IfM and at St. John's College for being great company throughout all the ups and downs of this journey. You know who you are and I am richer for having met you all.

I want to express my gratitude for St. John's College, the late Sandy Ross-Macdonald, and his family, thanks to whom I have not had to worry about my financial situation over the last three years. I hope to follow your generous example one day, by similarly being able to provide a maintenance grant for a graduate student.

Thank you to all practitioners, who helped me conduct my research by speaking to me or completing my survey. Clearly, you provide the foundation of this work.

Finally, my deepest thanks goes to my family. Mami, Papi und Hendrik, danke, dass ihr immer für mich da seid. Ohne eure ermutigenden Worte, eure Großzügigkeit, und eure Liebe, wäre ich lange nicht hier angekommen.

Publications

Conference Papers

Cengiz, C. and Geiger, M. C. A (2019). Hybrid Organizations: The Influence of a Behavioral Dichotomy on Organizational Inclusiveness. In *Academy of Management 2019 Annual Meeting: Understanding the Inclusive Organization, AOM 2019.*

Geiger, M. C. A. and Cengiz, C. (2019). Behavioral Dichotomy in Hybrid Organizations and the Influence on Knowledge Transfer. In *EURAM 2019 Annual Conference.*

Geiger, M. C. A., Minshall, T., and Mortara, L. (2018). Exploring the Evolution of Automotive Corporate Innovation Outposts in Silicon Valley. In *R&D Management Conference 2018.*

Lô, A. and Geiger, M. C. A. (2019). MNC R&D Subsidiaries: An Interactive Approach to Dual Embeddedness Evolution. In *EURAM 2019 Annual Conference. (Nominated for Best Paper Award.)*

Lô, A. and Geiger, M. (2019). Unveiling the Influence of Internal Embeddedness on External Embeddedness in MNCs' R&D Subsidiaries. *International Business Review*, Under review.

Abstract

To remain abreast of ongoing rapid transformations in the industry, incumbent automotive manufacturers have been establishing so-called corporate innovation subsidiaries in prominent innovation clusters, such as Silicon Valley, Tel Aviv, and Beijing, since the mid- to late 1990s. This study is concerned with the transfer of knowledge from these innovation subsidiaries into their respective headquarters.

Reviewing previous work in the field of international business, particularly the topics of internationalisation, transfer of knowledge, and subsidiary-headquarters relations, shows a clear gap in the literature: a lack of a holistic approach to reverse, intra-firm knowledge transfer, considering factors not in isolation, but on an aggregate level, including interactions between them. To address this gap, an initial conceptual framework is developed, providing an integrated overview of the factors affecting knowledge transfer. This framework is modified through two phases of in-depth qualitative case studies of automotive corporate innovation subsidiaries.

Results reveal that, while the conceptual framework developed from the literature is highly applicable to the research context, there appear to be deeper, underlying issues at work that pose a fundamental obstacle to knowledge transfer from innovation subsidiaries to their headquarters:

- Knowledge transfer is not linear as previously suggested by the literature;
- Roles of actors are less clear-cut than previously suggested;
- Considering global networks of subsidiaries brings added complexities.

This study makes two contributions. Firstly, a holistic conceptual framework for knowledge transfer from corporate innovation subsidiaries to their headquarters is developed, illustrating the various factors affecting this transfer, as well as their interconnections. Secondly, by considering not only the dyadic knowledge transfer between a single corporate innovation subsidiary and its headquarters, but by discussing global networks of such subsidiaries, this study contributes to the literature on global innovation (manufacturing, engineering, and R&D) networks.

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Chapter 1

Introduction

1.1 Research Context

The automotive industry is currently facing an era of extreme volatility and transformation. Contemporary issues, such as rapid technological advancement, climate change, and the market entrance of new, less traditional players, such as Tesla, Apple, and Google, have thrown the automotive industry into a state of change that incumbent Original Equipment Manufacturers (OEMs) are struggling to remain abreast of (Butler and Martin, 2016; Diehlmann and Häcker, 2013; Holweg and Oliver, 2016). One strategy for keeping informed about potentially disruptive trends involves establishing a corporate innovation subsidiary in a prominent innovation cluster, such as Silicon Valley, Tel Aviv, Beijing, or others (Lazzarotti et al., 2013). Indeed, the first automotive OEMs started establishing such innovation subsidiaries in Silicon Valley in the mid- to late 1990s (Berger and Brem, 2017; Butler and Martin, 2016; Nelson, 2014). Since then, a total of 15 automotive OEMs and Tier 1 suppliers from around the globe have established a presence in Silicon Valley, many of whom have also set up similar subsidiaries in other innovation clusters, including Tel Aviv, Beijing, Berlin, and Seoul.

Colloquially, these subsidiaries are often known as innovation outposts, hubs, labs, think tanks, or similar, but, for consistency, the term *corporate innovation subsidiary* will continue to be used throughout this thesis. Research has shown that corporate innovation subsidiaries are usually established with a predominantly exploratory purpose, enabling the company to gain insights into the technologies that may be harvested from a region (Berger and Brem, 2016, 2017). Over time, many of these subsidiaries grow in size and scope to enable more prototyping work to be carried out with a wider range of external partners, such as start-ups and universities, thus providing a valuable source of innovation for the parent company (Berger and Brem, 2016, 2017).

Corporate innovation subsidiaries are generally distant from their respective company headquarters, both in terms of purpose (innovation and knowledge creation, often in collaboration with external partners), and in terms of distance (on the periphery of the organisation, often in a foreign country). Ideally, this should allow the organisation to effectively source knowledge from an innovation cluster, as the subsidiaries have access to the resources of a multinational automotive OEM, coupled with the agile, risk-embracing mindset of a start-up company. However, initial observations show that, in practice, these subsidiaries struggle with transferring knowledge sourced in their local environment to their respective company headquarters.

Note that, when referring to "knowledge transfer", this thesis considers technological knowledge embedded in projects conducted at the subsidiaries. Thus, the transfer of knowledge is, in this context, synonymous to the transfer of projects, often in the form of proofs of concept (POCs) or prototypes, from the subsidiaries to their respective headquarters. Additionally, in discussing the transfer of knowledge, this thesis does not place focus on the transfer outcome. Instead, the process of transfer is examined, with particular emphasis on obstacles that impede, as well as measures that help, the process. This focus is chosen for multiple reasons. Firstly, success of knowledge transfer and, more broadly speaking, the value of a corporate innovation subsidiary, are multi-faceted and complex. Does success imply that a project must achieve market success? Is success solely financially driven? Does achieving a shift in employee mindset qualify as value? If so, how can it be measured? Secondly, initial interviews revealed that the case companies are reluctant to discuss examples of specific projects and the outcome of their attempted transfer to headquarters. To avoid this ambiguous and confidential topic, this thesis examines the process of knowledge transfer and why corporate innovation subsidiaries struggle with it, rather than emphasising examples of knowledge transfer successes and failures.

Why these automotive corporate innovation subsidiaries continue to have difficulties with the transfer of knowledge to headquarters, despite many of them having over 20 years of experience, poses an interesting issue that warrants further investigation, thus calling for the following research question:

How is knowledge transferred from a corporate innovation subsidiary located in an innovation cluster to its company headquarters?

In the interest of gaining a comprehensive understanding of the factors affecting this knowledge transfer, as well as reasons for why knowledge is not easily transferred

from the corporate innovation subsidiaries in question to their respective headquarters, and how these challenges are dealt with in practice, the following sub-questions provide additional scope to this study:

1. What are the obstacles impeding the knowledge transfer from a corporate innovation subsidiary located in an innovation cluster to its headquarters?
2. How are these obstacles managed in practice?

1.2 Research Objectives

To answer the above questions and make a contribution to knowledge, one must first understand the research context more broadly, thus leading to the following research objective:

1. Understanding what a corporate innovation subsidiary is and what it does.

Subsequently, a further, more specific research objective helps focus the data collection necessary for answering the research sub-questions:

2. Identifying critical obstacles to the knowledge transfer from a corporate innovation subsidiary to its headquarters, as well as the measures that have been put in place to facilitate the process.

Finally, to direct data analysis and illustration, this thesis aims to develop a holistic conceptual framework that considers factors affecting knowledge transfer not in isolation, but on an aggregate level, including interactions between them. Thus, a third research objective is identified:

3. Developing a framework that conceptualises the knowledge transfer process from a corporate innovation subsidiary to its headquarters.

Achieving these research objectives contributes to the field of international business from both a theoretical and a practical perspective, as will become evident throughout this thesis.

1.3 Research Approach

The aim of this thesis is to contribute to the literature on international business, particularly the topics of internationalisation, transfer of knowledge, and subsidiary-headquarters relations, by developing a framework that conceptualises the knowledge transfer from corporate innovation subsidiaries located in innovation clusters

to their headquarters. Consequently, the nature of this research is exploratory and applies an abductive research strategy, i.e., following an iterative loop between theory and empirical data (*theory matching* or *systematic combining*), to guide the researcher to her conclusions (Dubois and Gadde, 2002). As will be elaborated upon further in Chapter 3, following an abductive, rather than an inductive approach, is favourable to this particular research context, given that the complex social situation of multinational automotive OEMs having innovation subsidiaries located in innovation clusters calls for a preliminary framework and structure based on existing literature, in order to bring an initial order to the problem. The resulting preconceptions of the researcher rule out the use of pure inductive grounded theory as laid out by Glaser and Strauss (1967), and point instead towards an iterative theory matching process.

Following recommendations of Yin (2003) and Baxter and Jack (2008), this research adopts the case study approach as the most appropriate method. The study has been conducted in two distinct phases, which guide the structure of this thesis:

Phase 1: Eight in-depth case studies of automotive corporate innovation subsidiaries located in Silicon Valley (and their respective headquarters);

Phase 2: Further in-depth case studies of the global network of corporate innovation subsidiaries of case Companies A, B, and C.

After developing an initial conceptual framework based on the knowledge transfer literature, findings from the case studies in Phases 1 and 2 are used to modify this initial framework. In keeping with the abductive approach of theory matching, this thesis culminates in a discussion of how the literature reviewed in Chapter 2 matches the data collected in Phases 1 and 2. It is found that, while the conceptual framework developed from the literature certainly applies to the research context, there appear to be deeper, underlying issues at work that pose a fundamental obstacle to knowledge transfer from corporate innovation subsidiaries to their respective headquarters.

Thus, the thesis provides two main contributions to knowledge. Firstly, a conceptual framework for the knowledge transfer from corporate innovation subsidiaries located in innovation clusters to their respective headquarters is developed and refined through multiple phases of in-depth case studies. Developing this framework addresses the identified literature gap of a lack of holistic approaches to reverse, intra-firm knowledge transfer. Furthermore, by considering not only the dyadic relationship and knowledge transfer between a single corporate innovation subsidiary

and its headquarters, but by also discussing the challenges that arise when trying to manage knowledge transfer across a global network of such subsidiaries, this study contributes to the literature on global innovation (i.e., manufacturing, engineering, and research and development (R&D)) networks.

1.4 Thesis Structure

This thesis consists of six main chapters, and a section of appendices, as illustrated in Figure 1.1. The first three chapters provide an overview of the research background, including this introduction, a literature review of multinational subsidiaries and knowledge transfer (culminating in the initial conceptual framework), and a discussion of the research approach, including theory on research philosophy and methodology. Chapters 4 and 5 present the data collected from the two phases of empirical research, resulting in cross-case conclusions and modifications of the conceptual framework. Finally, Chapter 6 provides a discussion of the research findings and culminates in a discussion of the study's implications for practice, as well as its limitations and resulting avenues for potential future research.

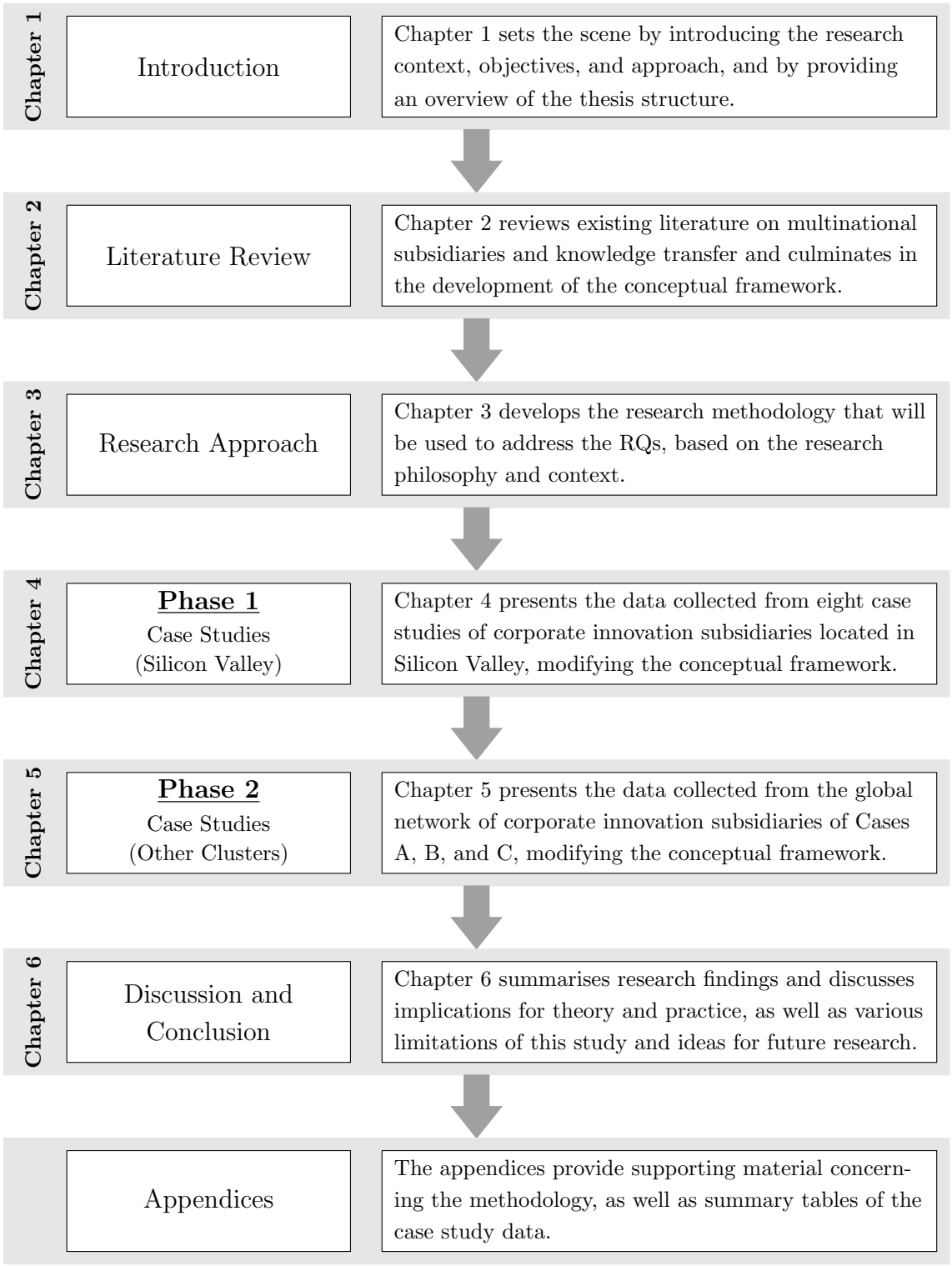


Figure 1.1: Structure of this thesis

Chapter 2

Literature Review

The purpose of this chapter is to provide a theoretical foundation for this thesis. In order to contextualise and conceptualise the topic of corporate innovation subsidiaries located globally in innovation clusters[1], the international business literature is reviewed. In an effort to characterise the field, Werner (2002) and Werner and Brouthers (2002) review studies in the top international management journals and categorise them into three broad areas:

1. Pure international management studies, concerning the management of corporations in a multinational context;
2. Comparative management studies, consisting of cross-cultural and cross-national studies;
3. Foreign domestic studies, focussing on management within a nation outside of North America (given that much research has a North American bias).

Focussing more narrowly on the first category, pure international management, 12 distinct topics emerge from Werner's (2002) review: global business environment; **internationalisation**; entry mode decisions; international joint ventures; foreign direct investment; international exchange; **transfer of knowledge**; strategic alliances and networks; multinational enterprises; **subsidiary-headquarters relations**; multinational team management; and expatriate management.

[1]Note that an *innovation cluster* refers to a geographical region that *"favours the creation and development of high potential entrepreneurial ventures and is characterised by heightened mobility of resources, including people, capital and information"* (Engel and del Palacio, 2011, p.27). While the literature on innovation clusters and their dynamics is extensive, it is not reviewed further in this thesis, given the importance of the concept of innovation clusters as a contextual, rather than an analytical factor. Furthermore, the term *innovation cluster* is often considered to be synonymous with the term *innovation ecosystem*. Indeed, multiple interviewees make references to the *Silicon Valley ecosystem*, as will become evident in Chapter 4. In these instances, the *Silicon Valley ecosystem* refers to the Silicon Valley regional cluster.

To conceptualise the research context of this thesis (knowledge transfer from multinationals' corporate innovation subsidiaries to company headquarters), the topics of internationalisation, transfer of knowledge, and subsidiary-headquarters relations (highlighted in bold in the above list) are particularly relevant and will thus be investigated in more detail.

This chapter culminates in the identification of a research gap, as well as in the development of a conceptual framework that integrates relevant concepts from the reviewed literature. This framework is used throughout the thesis to analyse the case studies in Phases 1 and 2 and is modified according to key findings, thus allowing the researcher to answer the research questions.

2.1 Multinational Subsidiaries

Much has been written on the global structure, strategy, and organisation of the Multinational Corporation (MNC), which is defined as *"an economic organisation that evolves from its national origins to spanning across borders"* (Kogut and Zander, 1993, p.625), i.e., it has operations in at least one other country besides its national origin. In particular, focus has been placed on foreign subsidiaries of MNCs and how these subsidiaries fit into the organisation as a whole (Bartlett and Ghoshal, 1986; Birkinshaw and Hood, 1998, 2000, 2001; Gupta and Govindarajan, 1991, 1994), where a subsidiary has been broadly defined as *"a value-adding entity in a host country [which can] perform a single activity (e.g., manufacturing) or an entire value chain of activities"* (Birkinshaw and Hood, 1998, p.774). The sections below review the literature on the phenomenon of multinational subsidiaries.

2.1.1 Definition and Typologies

The traditional view of an MNC involves the headquarters of the organisation, located at its national origin, as the organisation's primary focus (Dunning, 1981; Vernon, 1966). This view also suggests that competitive advantages for the firm are developed at headquarters and then leveraged globally by transferring technology to the firm's network of subsidiaries (Dunning, 1981; Vernon, 1966). However, the literature on this topic has shifted to acknowledge that foreign subsidiaries have since grown in size and capabilities and often play critical roles for the strategy of the MNC (Birkinshaw and Hood, 1998; Cantwell and Mudambi, 2005; Lagerström et al., 2019; Vrontis and Christofi, 2019). To understand and illustrate how multinational subsidiaries can help realise firm strategy, multiple authors have developed subsidiary role typologies, some of which are outlined in Table 2.1.

Authors (year)	Variables used	Typology of multinational subsidiary roles
Bartlett and Ghoshal (1986)	Strategic importance of local environment vs. competence of local organisation	**Strategic leader** (high strategic importance of local environment and high competence of local organisation); **black hole** (high strategic importance of local environment and low competence of local organisation); **contributor** (low strategic importance of local environment and high competence of local organisation); **implementer** (low strategic importance of local environment and low competence of local organisation)
Birkinshaw and Morrison (1995)	Based on previously published typologies (largely also included in this table)	**Local implementer**, **specialised contributor**, **world mandate**
Gupta and Govindarajan (1991, 1994)	Outflow of knowledge from subsidiary to rest of MNC vs. inflow of knowledge from MNC to subsidiary	**Global innovator** (high outflow, low inflow); **integrated player** (high outflow, high inflow); **local innovator** (low outflow, low inflow); **implementer** (low outflow, high inflow)
Jarillo and Martínez (1990)	Degree of integration of the subsidiary with the home organisation (low degree of integration = high degree of autonomy) vs. degree of localisation (how much work the subsidiary carries out locally)	**Autonomous subsidiary** (low degree of integration and high degree of localisation); **active subsidiary** (high degree of integration and high degree of localisation); **receptive subsidiary** (high degree of integration and low degree of localisation)
Rugman et al. (2011)	The four subsidiary roles developed by Bartlett and Ghoshal (1986) vs. value chain activities	Four by four matrix contrasting the subsidiary roles developed by Bartlett and Ghoshal (1986) (black hole, implementer, strategic leader, and contributor) against four main value chain activities (innovation, production, sales, and administrative support)
White and Poynter (1984)	Product scope of subsidiary (limited or unconstrained) vs. market scope of subsidiary (global or local) vs. value-added scope of activities carried out by subsidiary (narrow or broad)	**Product specialist** (global market scope and limited product scope); **strategic independent** (global market scope and unconstrained product scope); **miniature replica (adopter/adapter/innovator)** (local market scope, limited, medium, and unconstrained product scope, and narrow, medium, and broad value-add scope for adopter, adapter, and innovator, respectively); **rationalised manufacturer** (global market scope and narrow value-add scope); **marketing satellite** (local market scope and narrow value-add scope)

Table 2.1: Different typologies of multinational subsidiary roles

While Bartlett and Ghoshal (1986) mention that *"the organisational competence of a particular subsidiary can, of course, be in technology, production, marketing, or any other area"* (p.90), most subsidiary typologies acknowledge only aggregate subsidiary roles, rather than distinguishing between activities along the value chain. This is a common shortcoming of multinational subsidiary typologies, leading to theory in the field being developed for subsidiaries generally, rather than for specific types of subsidiaries, for example, innovation-specific subsidiaries. The focus of this thesis on corporate innovation subsidiaries suggests reviewing a further aspect of the international business literature: internationalisation, including global innovation (i.e., manufacturing, engineering, and research and development (R&D)) networks.

2.2 Global Innovation Networks

A network is a concept that describes a set of units, or nodes, as well as the interrelationship between them (Fombrun, 1982). In the context of organisations, networks have been researched both on an intra-organisational, as well as on an inter-organisational level. Previous studies on intra-organisational networks, particularly global intra-organisational innovation (i.e. manufacturing, engineering, and R&D) networks, are highly relevant to this thesis and are thus reviewed in the following sections.

2.2.1 International Manufacturing Networks

International manufacturing networks (IMN) have been studied increasingly, given the trends of higher global competition and access to lower cost resources and improved knowledge bases across the global economy (Ferdows, 1997a,b; Koren, 2010; Shi and Gregory, 1998). In a review of IMN, Cheng et al. (2015) categorise the literature in this field into two main focus areas: studies addressing the configuration of the network (i.e., size, location, scope, and specialisation of units in the network), and studies concerning the coordination of the network (i.e., degree of centralisation, policies, incentives, controls, and knowledge sharing across units of the network).

For instance, Shi and Gregory (1998) develop a map of IMN configurations, split according to the degree of geographic dispersion of the network (domestic, regional, multinational, and worldwide dispersion) and the level of coordination between nodes in the network (multidomestic orientation versus global orientation). Accordingly, the authors suggest four key categories of capabilities required in IMN: strategic targets accessibility, thriftiness ability, manufacturing mobility, and learning ability. The latter, learning ability, is particularly relevant to this study, given

that it relates to knowledge sharing across the network, which becomes more difficult as the complexity of the network increases. Thus, a more complex dispersed network requires improved levels of coordination to enhance learning ability across the network.

Multiple authors pick up on the importance of knowledge flows across IMN (Noruzi et al., 2018; Szász et al., 2019; Vereecke et al., 2006). For instance, Szász et al. (2019) propose that manufacturing plants within an IMN tend to be positioned along a continuum of being net knowledge receivers or net knowledge senders. The authors find that knowledge sending is improved via three key elements: having an organisational culture across the network that fosters knowledge sharing, introducing incentive systems and structures that reward knowledge sharing, as well as the level of interaction between humans across the network (Szász et al., 2019). Similarly, Vereecke et al. (2006) develop a typology of plants in IMN, based on the innovation and people flow between them. Depending on whether a plant has high or low levels of innovation- and people in- and outflow, plants are categorised either as being isolated, receivers, hosting networks players, or active network players. The latter two types exhibit the highest levels of knowledge sharing.

2.2.2 Global Engineering Networks

Intra-organisational networks have further been studied on an engineering level, commonly labelled global engineering networks (GEN), particularly as companies increasingly disperse their engineering activities across the globe to improve efficiency and access to resources (Zhang et al., 2007). For instance, Zhang et al. (2008) develop a framework of GEN, based on the dimensions of network configuration and network performance (see Figure 2.1).

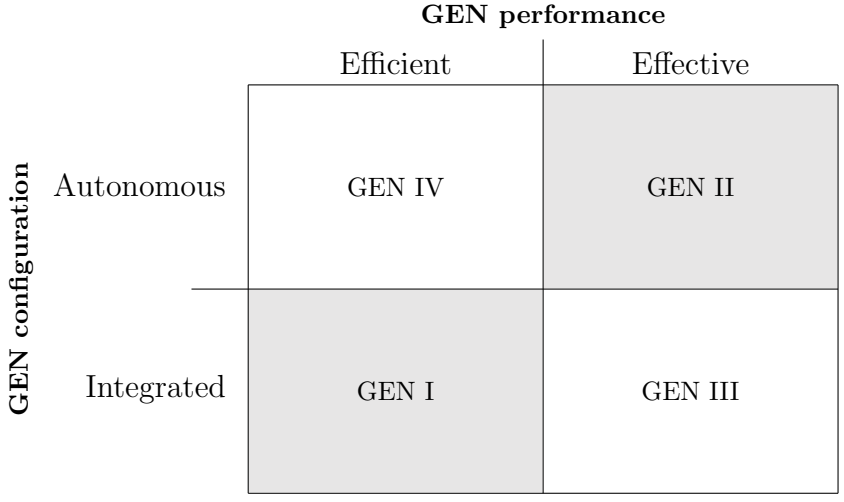


Figure 2.1: Framework of GEN, adapted from Zhang et al. (2008)

As shown, Zhang et al. (2008) suggest two main types of network configuration (integrated GEN versus autonomous GEN), that vary along four dimensions (network structure, coordination mechanism, governance system, and support system). Where integrated GEN exhibit concentrated engineering centres, formal collaborative mechanisms, operational governance, and standardised support systems, autonomous GEN are characterised by dispersed and independent engineering centres, informal competitive mechanisms, strategic governance, and customised support systems (Zhang et al., 2008). This complicates their management but also highlights their importance to innovation within the company. In terms of network performance, the authors propose the categories of effective versus efficient GEN, where effective GEN are quick, flexible, and focus on customer-driven innovation, while efficient GEN focus on economies of scale and scope, and reuse existing knowledge and solutions rather than innovate (Zhang et al., 2008).

Studies on GEN span all parts of the engineering value chain, from idea generation and selection, through design and development, production and delivery, service and support, to disposal and recycle (Zhang et al., 2007; Zhang and Gregory, 2011). However, given the focus of this thesis, the first two stages of the engineering value chain, idea generation and selection, and design and development, are particularly relevant. Indeed, in a recent review of the literature on the internationalisation of R&D and innovation by multinational enterprises, Papanastassiou et al. (2019) find that scholarly research in this area is increasingly focussing on the network-like characteristics of internationalised R&D activities. Thus, the following section will delve into further studies on international R&D networks.

2.2.3 International R&D Networks

Since MNCs have shifted from mainly using foreign subsidiaries to exploit knowledge and innovation developed in the home country, to using these subsidiaries as actual sources of competitive advantage, scholars have been focussing increasingly on cross-border knowledge creation resulting from the decentralisation and internationalisation of R&D activities (Frost, 2001; Hegde and Hicks, 2008; Lagerström et al., 2019; Vrontis and Christofi, 2019).

Many of these studies suggest that the product life cycle model by Vernon (1966), which maintains that coordinating international R&D is too costly across international borders and so foreign subsidiaries mainly exist to adapt and diffuse centrally developed innovation, is insufficient for explaining the extent and increase of foreign innovative activities of firms, especially given that a lot of foreign R&D centres are

not co-located with manufacturing sites. Instead, other factors have emerged for why innovative activity is located globally, rather than kept centralised. It should be noted that, though the literature stream on this topic has overarchingly used the term *internationalising R&D*, decentralising R&D by locating an R&D unit in an innovation cluster does not necessarily mean that this has to be done in a different country. For example, U.S. MNCs may choose to locate an innovation subsidiary in Silicon Valley, despite it not being in a foreign country, to access resources, knowledge, and skills in that region.

Definition and Typologies

Since the pioneering studies of Ronstadt (1978) and Behrman and Fischer (1980) on the internationalisation of corporate R&D, much has been written on different taxonomies of how MNCs carry out decentralised R&D. Though different authors have classified different types of international R&D networks in different ways, the taxonomies all seem to have parallels and are briefly outlined in Table 2.2.

Authors (year)	Typology of international R&D networks
Archibugi and Michie (1995)	Three categories of the globalisation of innovation: **global exploitation of technology** (cross-border commercialisation of national technology; may or may not involve setting up foreign R&D sites); **global technological collaboration** (development of knowledge and innovations with strategic partners, such universities, research centres, or other firms, in multiple countries); **global generation of technology** (R&D and innovative activities both in the home and the host countries; can include the concept of a listening post[2])
Behrman and Fischer (1980)	Three types of market orientation: **home market orientation** (MNC tends to invest abroad for the purposes of importing materials and components, rather than for R&D activities); **host market orientation** (MNC focusses on the markets in the places where units are located; R&D carried out abroad if the host country requires adaptation of the technology); **world market orientation** (MNC is interested in benefiting from skills and talent found in various locations across the globe)
Dunning and Narula (1995)	Four main types of foreign R&D facilities: **product, material, or process adaptations** (intended to improve and adapt products and/or processes to local markets); **basic materials or product search** (substantial product improvements for local markets, often because research inputs are immobile in the host country location); **rationalised R&D** (similar process to Type 2, though R&D aims to make use of economies of scale and scope and R&D outputs can be exploited globally); **strategic asset-seeking R&D** (obtaining a competitive advantage by accessing local technical and scientific skills and talent, and by benefiting from knowledge spillovers from other firms in the same location; can include the concept of a listening post)
Gassmann and von Zedtwitz (1999)	Five types of R&D organisation in MNCs: **ethnocentric centralised R&D** (R&D activities are concentrated in the home country, usually when the home country is technologically superior to the countries in which subsidiaries are located); **geocentric centralised R&D** (R&D is centralised in the home country, but R&D personnel takes on a more internationally-minded focus by collaborating with international manufacturing or sales sites); **polycentric decentralised R&D** (R&D is carried out in multiple different locations, with no distinct centre, to cater to different regional markets); **R&D hub model** (R&D activities are spread across different locations but are controlled and coordinated tightly from the central home base); **integrated R&D network** (R&D in the home base no longer controls and coordinates global R&D activities; multiple R&D centres are connected closely and collaborate tightly; no distinct centre)

[2]A listening post is an element of a company's decentralised R&D structure, which serves the strategic purpose of allowing the company to stay abreast of scientific and technological developments in the location of the listening post (Gassmann and Gaso, 2004, 2005)

Ronstadt (1978)	Four types of R&D investments abroad: **transfer technology units (TTUs)** (established to transfer technology from the parent company to the foreign market, to adapt the technology to the market and provide local customer service); **indigenous technology units (ITUs)** (established to develop products for the foreign market specifically); **global technology units (GTUs)** (established to develop products for the world market); **corporate technology units (CTUs)** (established for long-term, exploratory purposes, to provide new knowledge and technology; CTUs include the concept of listening posts)
von Zedtwitz and Gassmann (2002)	Four trends in the internationalisation of R&D activities, when separating the concept of research from that of development: **only research is internationalised** (a research unit is usually located in a centre of excellence for that field); **only development is internationalised** (usually occurs for the purpose of adapting products to local markets); **development follows research** (if a foreign research office performs well and enables new opportunities for development); **research follows development** (if foreign development offices require extra research capabilities). Four archetypes of R&D internationalisation, based on these trends; **national treasure R&D** (research and development are both based in the home country); **technology-driven R&D** (research is dispersed; development is domestic); **market-driven R&D** (research is based in the home country; development is dispersed); **global R&D** (research and development are both dispersed)

Table 2.2: Different taxonomies of the internationalisation of R&D networks

Collating the parallels between the various typologies, three main categories emerge in the internationalisation of R&D networks (note that innovation subsidiaries may evolve from one type to another over time (Ryan et al., 2018)):

Type 1: R&D follows manufacturing internationally to allow for product adaptation to foreign markets (homologation).

Type 2: Foreign R&D sites serve as listening posts to allow the company to be aware of new developments in foreign markets.

Type 3: Foreign R&D sites serve as actual sources of innovation, making use of skills and talent in foreign markets.

Multiple studies have confirmed the shift of Foreign Direct Investment (FDI)[3] in R&D from a market-based focus to a technology-based focus, i.e., from Type 1 to Types 2 and 3 (Cantwell and Mudambi, 2005; Hurtado-Torres et al., 2018; Singh, 2007; Wolfram et al., 2018).

Centres of Excellence (COEs)

The concept of a subsidiary that has a specific charter and fulfils a strategic purpose for an MNC has been discussed using varying nomenclature. While some authors use the idea of *decentralised R&D* for innovation-specific strategic subsidiaries, others use terminology like *strategic leader* (Bartlett and Ghoshal, 1986), *global innovator* (Gupta and Govindarajan, 1991), or *world mandate* (Birkinshaw and Morrison, 1995) (see Table 2.1). A further literature stream involves the concept of a Centre of Excellence (COE), defined as a *"small group of individuals recognised for their leading-edge, strategically-valuable knowledge, and mandated to leverage and make that knowledge available throughout the global firm"* (Moore and Birkinshaw, 1998, p.81). In their framework of GEN, Zhang et al. (2008) position COEs as belonging to an autonomous, effective network (see GEN II in Figure 2.1 above). While Moore and Birkinshaw (1998) discuss COEs in the context of professional service companies, the concept has since been developed further to include MNCs from different industries and COEs focussing on different activities, such as research, development, production, marketing and sales, logistics and distribution, and purchasing (Adenfelt and Lagerström, 2008; Baraldi and Ratajczak-Mrozek, 2019; Foss and Pedersen, 2002; Frost et al., 2002; Holm and Pedersen, 2000a,b; Richard et al., 2019). For this research, the concept of R&D COEs is relevant, as it is comparable to other terminology used for innovation-specific subsidiaries in the literature (see Table 2.3 for a summary):

[3]FDI is defined as the process by which MNCs *"acquire existing assets abroad or set up new wholly or majority owned activities in foreign markets"* (Narula and Zanfei, 2009, p.318).

Author(s)	Equivalent Terminology
Bartlett and Ghoshal (1986)	Strategic leader
Birkinshaw and Morrison (1995)	World mandate
Cantwell and Mudambi (2005)	Competence creating subsidiary
Frost et al. (2002); Holm and Pedersen (2000a,b); Moore and Birkinshaw (1998)	Centres of Excellence (specifically R&D COEs)
Gupta and Govindarajan (1991, 1994)	Global innovator
Jarillo and Martínez (1990)	Active subsidiary
Rabbiosi (2011)	Innovator subsidiary
Rugman et al. (2011)	Innovation-specific strategic leader
White and Poynter (1984)	Global mandate

Table 2.3: Equivalent terminology to *corporate innovation subsidiary*

Despite the various terminology used to describe the phenomenon, both in the literature and in practice, this thesis will maintain the label of *corporate innovation subsidiary* throughout.

2.2.4 Summary of Global Innovation Networks

As discussed in the above sections, the literature on global innovation networks of MNCs spans multiple levels: manufacturing, engineering, and R&D. Nonetheless, key concepts relating to these networks are translatable and relevant across the levels. In particular, the concepts of network configuration, coordination, and knowledge management emerge as key areas of focus. Indeed, given its relevance to this thesis, the remainder of the literature review will focus on knowledge management in multinational corporations more generally.

2.3 Knowledge in Multinational Corporations

With the emergence of the knowledge-based theory of the firm, the importance of knowledge creation and -transfer to the sustainable competitive advantage and innovation performance in MNCs has been brought to the fore (Grant, 1996a,b; Gupta and Govindarajan, 2000; Kogut and Zander, 1992, 1993, 1996). In particular, as mentioned in Sections 2.1.1 and 2.2, the idea that knowledge in an MNC can stem not only from the company's headquarters, but also from its international network of subsidiaries presents a key shift in the way that MNCs function and in the way their activities are discussed by the academic community (Cantwell and Mudambi, 2005). This warrants delving deeper into the concept of knowledge creation and -flows within MNCs, for which a definition of knowledge is first necessary.

2.3.1 What is Knowledge?

The question of the definition of knowledge quickly becomes philosophical. Rather than focussing on highly abstract notions of knowledge, this review will discuss how knowledge has been defined in the international business literature, i.e., organisational knowledge. The literature suggests that there are three key levels of distinction when defining organisational knowledge: the concept of information versus know-how, the concept of technology as a subset of knowledge, and the concept of tacit versus explicit knowledge.

Information Versus Know-How

Kogut and Zander (1992, 1993) define organisational knowledge by splitting it into the two categories of information and know-how. They define information as *"knowledge, which can be transmitted without loss of integrity once the syntactical rules required for deciphering it are known"* (Kogut and Zander, 1992, p.386), for example, facts, axiomatic propositions, and symbols. To define know-how, Kogut and Zander (1992) quote the work of von Hippel (1988): *"Know-how is the accumulated practical skill or expertise that allows one to do something smoothly and efficiently"* (von Hippel, 1988, p.76). Thus, the concepts of information and know-how can be differentiated by considering the former as knowing *what* something means and the latter as knowing *how* to do something (Kogut and Zander, 1992). It is important to note that other studies do not treat both information and know-how as a subset of knowledge, but instead treat information and knowledge as two separate concepts (e.g., Malik et al. (2019); Taschler and Chappelow (1997)). However, despite the difference in terminology, the definitions in these instances are still broadly the same, in that information is considered as being instantaneously transferable, and knowledge is considered as consisting of hands-on skills, personal know-how, and judgement, acquired through experience (Taschler and Chappelow, 1997). This study will henceforth use the term *knowledge*, rather than *know-how*, based on the provided definitions.

Technology as a Subset of Knowledge

The literature on organisational knowledge considers all functions of a corporation, such as R&D (i.e. technological knowledge), manufacturing, marketing, finance, and so on. Reviewing the literature on knowledge and technology transfer in MNCs reveals that some authors appear to use the concepts of knowledge and technology fairly interchangeably (e.g., Battistella et al. (2016)), whilst others treat technology as being distinct from knowledge, often as a clear subset of the latter (e.g., Ismail et al. (2018); Malik (2002); Zhang et al. (2015)). It has been suggested that trans-

ferring technology is a useful way of transferring explicit knowledge (see below for definition) because explicit knowledge is often embedded within technology (Argote and Ingram, 2000; Galbraith, 1990; Zander and Kogut, 1995). In the interest of clarity, it is crucial to be specific and define the scope of the type of knowledge one is studying. Given the focus of the present research on knowledge transfer from corporate innovation subsidiaries located in innovation clusters to the company's headquarters, knowledge in this work will refer to technological knowledge specifically, rather than focussing on other functions of the firm. However, the rest of the literature review will continue considering all types of knowledge in order to gain a broad understanding of the field.

Tacit Versus Explicit Knowledge

A further common discussion point in the literature on organisational knowledge is the idea of tacitness. The seminal definition of tacit knowledge by Polanyi (1966) suggests that *"we can know more than we can tell"* (p.4), i.e., tacit knowledge is difficult to transmit to another person because it is embedded in our experiences. Similarly, Kogut and Zander (1992) paraphrase Polanyi's definition in the context of organisational knowledge to suggest that *"organisations know more than what their contracts can say"* (p.383). In contrast, explicit knowledge is codifiable, i.e., it is possible to put into words, numbers, or symbols, and can thus more easily be transferred, for example, through technology (Galbraith, 1990; Kogut and Zander, 1993; Nonaka, 1994).

2.3.2 Transfer of Knowledge

One reason why firms exist is that they are better than markets at transferring knowledge (Kogut and Zander, 1992, 1993, 1996). As a result, much academic research has been devoted to studying the transfer of knowledge across and within organisations. At a high level, the literature on this topic can be split into the categories of range of transfer (inter-firm versus intra-firm) and, as a subset of intra-firm knowledge transfer, the direction of that transfer (forwards from headquarters to subsidiary, lateral from subsidiary to peer subsidiary, or reverse, from subsidiary to headquarters).

Range of Transfer

The reviewed literature on knowledge transfer focusses, in particular, on how knowledge is created and transferred *within* the organisation. Nonetheless, certain studies on knowledge transfer *between* organisations (i.e., inter-firm knowledge transfer) do exist (e.g. Albino et al. (1999); Battistella et al. (2016); Gagnon et al. (2019);

Galati and Bigliardi (2019); Milagres and Burcharth (2019)). These studies focus particularly on the factors that enable effective sharing of knowledge between organisations, such as their relationship. Thus, the studies on inter-organisational knowledge transfer relate closely to the literature on strategic alliances (Aggarwal and Kapoor, 2018; Dyer and Singh, 1998; Mowery et al., 1996) and open innovation (Bogers, 2011; Secundo et al., 2019; Xie et al., 2016).

Conversely, intra-firm knowledge transfer has been defined as *"the process through which one unit [of an organisation] (e.g., group, department, or division) is affected by the experience of another"* and, as a result, it *"manifests itself through changes in the knowledge or performance of the recipient units"* (Argote and Ingram, 2000, p.151). Given the relevance of intra-firm knowledge transfer to this study's research context, Sections 2.3.3 and 2.3.4 will delve into this topic in more detail.

Direction of Transfer

In keeping with early literature on MNCs placing emphasis on company headquarters as the focal point of investigation, much work on intra-firm knowledge transfer considers mainly *forwards* transfer from the organisation's headquarters to its subsidiaries (e.g., Colakoglu et al. (2014); Kogut and Zander (1992, 1993); Minbaeva (2007)). However, with the recognition that MNCs can learn at their periphery and benefit from knowledge sourced and created at subsidiaries, knowledge transfer literature has begun to incorporate *lateral* (from subsidiary to peer subsidiary) and *reverse* (from subsidiary to headquarters) knowledge transfer (e.g. Ambos et al. (2006); Björkman et al. (2004); Frost and Zhou (2005); McGuinness et al. (2013); Mudambi et al. (2014); Noorderhaven and Harzing (2009)).

2.3.3 Intra-Firm Knowledge Transfer as a Process

The remainder of this literature review will focus primarily on reverse intra-firm knowledge transfer (i.e., from subsidiary to headquarters), given its relevance to this study. In particular, this section discusses different existing models for intra-firm (usually reverse) knowledge transfer, taking a process-based view of the matter, and outlines their similarities and differences.

Existing studies on knowledge transfer predominantly refer to communications theory by representing knowledge transfer using a broadcasting model (Battistella et al., 2016; Minbaeva, 2007; Noorderhaven and Harzing, 2009; Szulanski, 2000). Studies using this broadcasting metaphor have basic elements in common: the source of the knowledge transfer, the recipient, the channel of transfer, the transfer content, and

the broader context. This basic broadcasting model of knowledge transfer is shown in Figure 2.2.

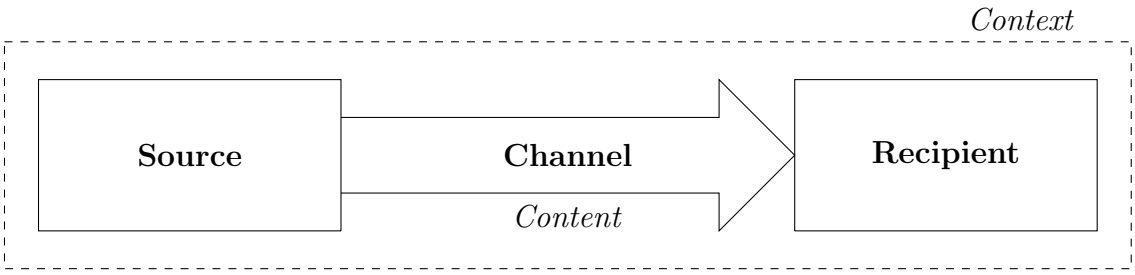


Figure 2.2: Simplistic representation of a broadcasting model of knowledge transfer

Despite this common scaffold, the literature diverges on the additions that each study makes to the basic model from Figure 2.2. For example, Noorderhaven and Harzing (2009) suggest a limitation in the broadcasting model as it does not sufficiently emphasise the importance of social interaction between the actors in the model. To compensate for this, the authors consult social learning theory, suggesting that more focus needs to be placed on how disparate units within an organisation communicate and collaborate.

Furthermore, Szulanski (2000) delves deeper into the actual steps of transfer connecting the source and the recipient in the broadcasting model. The author suggests four distinct stages and discusses the challenges, or *stickiness* (cf. Jensen and Szulanski (2004)), faced at each stage:

1. **Initiation:** This stage involves recognising, and acting on, opportunities to transfer knowledge, for instance by noticing a gap in knowledge in the organisation. *Stickiness*, i.e., difficulty of transfer and potential loss of knowledge, can occur if operations in the business are not understood sufficiently to recognise gaps in knowledge, and if there is uncertainty in knowing whom to ask to fill the gap.

2. **Implementation:** This is the actual exchange of information and resources between source and recipient. Stickiness at this stage can occur if communication between source and recipient is difficult. Facilitating this step might require solving incompatibilities in how the information has been codified, any obstacles in language or culture between source and recipient, as well as differences in technical understanding. A possible solution is the lending of personnel between units, which can be costly, but increases trust and reduces the loss of information (cf. Inkpen and Tsang (2005)).

3. **Ramp-up:** This occurs when the recipient begins using acquired knowledge. Stickiness can arise due to unexpected problems in how the recipient uses the knowledge, which can prevent the recipient from replicating the knowledge to the expected quality. Reasons for this may include insufficient training of personnel at the recipient unit, key personnel leaving the unit, or differences in culture between the source and recipient site, which may prevent the knowledge from being used in the anticipated way.

4. **Integration:** This step involves the new knowledge becoming progressively routinised in the recipient unit. Stickiness can occur if difficulties are encountered that cause the recipient to revert to the former status quo. To avoid this, the source and recipient must maintain regular interaction to ensure obstacles can be removed as they occur.

In further studies, Szulanski discusses *replication* as a basis for reducing stickiness and thus improving knowledge transfer, particularly through the use of *templates* (Jensen and Szulanski, 2007; Szulanski and Jensen, 2004). In other words, knowledge can more easily be transferred within organisations by creating *"working examples"* (Szulanski and Jensen, 2004, p.348) (i.e., templates) of the knowledge and transferring these templates, enabling more exact imitation of the knowledge at the recipient site. While Szulanski mainly discusses the use of templates in the context of transferring knowledge embedded in organisational routines, the concept of a template and replication as a basis for knowledge transfer can be translated to the technological knowledge embedded in innovation projects (the subject of this thesis), by suggesting that technological knowledge is more easily transferred through the use of a physical artefact, such as a working prototype (the template), rather than through the use of reports or presentations.

2.3.4 Factors Affecting Intra-Firm Knowledge Transfer

Addressing the factors that help and hinder successful knowledge transfer is a common focus in the literature on intra-firm knowledge transfer. These factors, in particular subsidiary embeddedness, external knowledge sourcing, characteristics of actors involved in the transfer and the relationship between them, as well as actual transfer content and mechanism, are discussed in the following sections.

Subsidiary Internal Embeddedness

Authors in the field have increasingly examined subsidiaries' relationships with their headquarters (i.e., their internal embeddedness), particularly as the literature on

subsidiary mandates has evolved towards acknowledging the strategic role that subsidiaries play in creating and absorbing new knowledge for MNCs (Asakawa et al., 2018; Cantwell and Mudambi, 2005; Ciabuschi et al., 2011; Gölgeci et al., 2019). While the literature seems to agree on the positive effect of internal embeddedness on reverse knowledge transfer (Ciabuschi et al., 2017; Ferraris et al., 2018; Gölgeci et al., 2019), an essential aspect of internal embeddedness, namely subsidiary autonomy, has been highlighted as a trade-off effect in this relationship.

The autonomy (both strategic and operational) of a multinational subsidiary can be considered as a function of its integration into the parent organisation. It has been defined as *"a decision-based process that evolves through bargaining between centre and periphery in an organisation"* (Taggart, 1997, p.55). While autonomy has been shown to be conducive to the subsidiary's innovative capabilities (Asakawa, 2001; Beugelsdijk and Jindra, 2018), a certain level of integration into the rest of the organisation is also necessary to enable a successful transfer of these innovative ideas and technologies. This balance has been labelled the *"innovation-integration dilemma"* by Mudambi (2011) (p.318) and is summarised effectively by Ghoshal and Bartlett (1995): *"In the absence of such an integration process, decentralised entrepreneurship may lead to some temporary performance improvement as existing slack is harnessed, but long-term development of new capabilities or businesses is seriously impeded"* (p.148).

Subsidiary External Embeddedness

External embeddedness, i.e., the intensity of interaction with one's local environment, has similarly gained interest in the international business literature recently (Meyer et al., 2011; Narula, 2014; Nell and Andersson, 2012; Santangelo et al., 2018; Valentino et al., 2018). In particular, focus is placed on how MNCs can strategically absorb new knowledge by means of their subsidiaries' external embeddedness (Cantwell and Mudambi, 2005). However, the impact of a subsidiary's external embeddedness on knowledge transfer to its company headquarters is complex and highly debated. While Ferraris et al. (2018) do not find a positive correlation between subsidiaries' external embeddedness and reverse knowledge transfer, Håkanson and Nobel (2001) find that a subsidiary's external embeddedness is positively related to its innovativeness, and that higher innovativeness increases the probability of knowledge transfer, suggesting an indirect link between external embeddedness and reverse knowledge transfer. Other authors reject the idea of any linear relationship between external embeddedness and MNC performance, by introducing the concept of *overembeddedness* (Nell and Andersson, 2012; Uzzi, 1996, 1997), i.e., external embeddedness positively affects MNC performance, but only up to a point.

Subsidiary Dual Embeddedness

Meyer et al. (2011) highlight the need for subsidiaries to be simultaneously deeply embedded in their parent company network, as well as in their external environment, resulting in the critical challenge for headquarters of *"shepherd[ing] its most valuable subsidiaries towards 'dual embeddedness'"* (p.245). The concept of dual embeddedness is recurringly discussed in the context of reverse intra-firm knowledge transfer (Achcaoucaou et al., 2014; Cenamor et al., 2019; Najafi-Tavani et al., 2015; Oehmichen and Puck, 2016), with the conclusion that multinational subsidiaries require both strong ties to their local environment, as well as close interaction and relationships with their parent organisation, to enable them to transfer knowledge effectively.

External Knowledge Sourcing

The concept of dual embeddedness is related to a subsidiary's function of sourcing external knowledge, as the subsidiary needs to both find external knowledge sources and engage with them (external embeddedness), as well as be able to integrate this knowledge into the organisation (internal embeddedness) (Monteiro, 2015; Monteiro and Birkinshaw, 2017; Phene and Almeida, 2008).

In particular, Monteiro and Birkinshaw (2017) study a telecom MNC's scouting unit in Silicon Valley (akin to the corporate innovation subsidiaries discussed in this study), to determine its approach to external knowledge sourcing. The authors find four key processes that support external knowledge sourcing: *channelling*, *translating*, *matchmaking*, and *transforming*. Where *channelling* refers to the subsidiary's initial activities of setting up and scouting the external environment, the remaining three processes focus on how the subsidiary transfers the externally sourced knowledge into the parent organisation: *translating* involves manipulating knowledge to make it understandable for people at headquarters; *matchmaking* involves finding a suitable match between a business unit within headquarters and an external partner in the subsidiary's local environment (e.g., a start-up); and *transforming* involves pushing back on headquarters' ideas and helping them redefine problems and seek new solutions. As demonstrated by Monteiro and Birkinshaw (2017), a corporate innovation subsidiary's role is thus heavily geared towards transferring newly found knowledge to the parent company.

The process of *matchmaking* as defined by Monteiro and Birkinshaw (2017) suggests delving deeper into the collaboration between large MNCs and small start-ups—a concept often referred to as managing *asymmetric partnerships* or *alliances* (Cimon,

2004; Hao and Feng, 2018; Pérez et al., 2012). The challenges faced by MNCs trying to collaborate with start-ups are discussed widely in the literature. Pérez et al. (2012) suggest that asymmetries between partners, for example, in size, age, or scope, can actually facilitate knowledge creation by *"clarifying the roles each partner plays in the relationship and reducing the cooperative-competitive tension"* (p.150). Other authors, however, highlight issues preventing successful collaboration between MNCs and start-ups. These include the following:

- A lack of trust between partners (Minshall et al., 2010; Niederkofler, 1991; Prashantham and Birkinshaw, 2019);
- A lack of start-ups' experience with sticking to stringent quality and safety requirements (Minshall et al., 2010; Niederkofler, 1991; Prashantham and Birkinshaw, 2008), especially in the automotive industry (Gassmann et al., 2010);
- A lack of speed on the side of the MNC, given rigid bureaucracies and slow decision-making (Minshall et al., 2010; Prashantham and Birkinshaw, 2008);
- And traditional, complex supplier contracts not being suitable for exploratory work with start-ups, given a clear difference in culture between entrepreneurial small firms and bureaucratic large firms (Gassmann et al., 2010; Minshall et al., 2010; Niederkofler, 1991).

Actor Characteristics

A particular focus of studies on knowledge transfer lies with the characteristics of the actors involved in the process, i.e., of the sender and recipient involved in knowledge transfer. For instance, it is found that top management experience and support for the sender (i.e., for the subsidiary) is a key factor in determining the success of knowledge transfer (Gaur et al., 2019; Nuruzzaman et al., 2019; Vlajčić et al., 2019a).

Furthermore, the recipient may struggle with internalising knowledge transferred by subsidiaries because of their *absorptive capacity*, i.e., their ability to recognise, assimilate, and apply that knowledge (Cohen and Levinthal, 1990; Gupta and Govindarajan, 2000). In the context of knowledge transfer, studies consider absorptive capacity as a potential barrier on the recipient unit's side, as a low absorptive capacity means that the recipient cannot successfully acquire and integrate knowledge from the source (Foss and Pedersen, 2002; Minbaeva et al., 2003; Spraggon and Bodolica, 2012).

An exemplary factor that hinders the recipient's absorptive capacity and is also discussed widely as an obstacle of asymmetric partnerships is the concept of bureaucracy. This concept was first formally defined by Weber (1922) to include aspects such as the size of space and population being administered within the company, the complexity of tasks being conducted, the scope of the finances being administered, and the need for more formal communication channels to efficiently manage the various aspects of increasing bureaucracy. In the context of knowledge management, bureaucracy has frequently been found to stifle innovation as well as the company's ability to absorb new knowledge (Damanpour, 1996; Gaur et al., 2019; Thompson, 1965), and thereby negatively impact knowledge transfer from a subsidiary to company headquarters.

A further actor characteristic impacting the knowledge transfer process is the innovativeness of the sender (i.e., the subsidiary). Håkanson and Nobel (2001) find a positive correlation between a subsidiary's innovativeness and its propensity to transfer knowledge to its parent organisation. Mudambi et al. (2014) find a similar result, but only up to a limit. The authors suggest an inverted U-shape for the positive effect of subsidiary innovativeness on reverse knowledge transfer, as after a certain point the subsidiary becomes too innovative and autonomous, and thus no longer has much to gain from transferring its knowledge to the parent organisation (Mudambi et al., 2014).

Actor Relationship

Leading on from individual actor characteristics is the concept of motivational disposition, openness, and flexibility of both source and recipient to share knowledge, which heavily impacts the relationship between actors (Gaur et al., 2019; Gupta and Govindarajan, 2000; Kim and Kim, 2019). Given that knowledge is *"intimately and inextricably bound with people's egos and occupations,"* it does not flow easily between units in an organisation (Davenport et al., 1998, p.53). Considering knowledge as power, more innovation can lead to the subsidiary hoarding its knowledge, rather than being motivated to share it with headquarters (Mudambi and Navarra, 2004; Mudambi et al., 2014). On the recipient side, psychological resistance, such as the Not-Invented-Here (NIH) syndrome, can prevent the recipient from incorporating knowledge that has been transferred by a subsidiary (Gupta and Govindarajan, 2000; Kim and Kim, 2019). Drivers for the NIH syndrome include an ego-defence mechanism (blocking knowledge that might suggest others are more competent than the recipient) and power struggles (internal competition) (Gupta and Govindarajan, 2000).

The relationship between source and recipient is further discussed along various dimensions. For example, the relationship between headquarters and subsidiary can be split into the geographical, cultural, and cognitive distance between them. Geographic distance is found to have a negative correlation with reverse knowledge transfer, suggesting that MNCs should dedicate resources to facilitate the knowledge transfer from far-away subsidiaries (Vlajčić et al., 2019b). Cultural distance between a subsidiary's host and home countries is found to moderate the positive relationship between the subsidiary's performance and reverse knowledge transfer, i.e., when the cultural distance is higher, the positive relationship between the subsidiary's performance and knowledge transfer to the parent organisation is lower (Qin et al., 2017). Finally, cognitive distance seems to be mainly discussed in the context of inter-firm relationships, rather than between units of the same MNC (Nooteboom, 2000; Wuyts et al., 2005). Yet, the findings may still hold for intra-firm relationships, as different units within an MNC may possess different knowledge and skills, resulting in a cognitive gap between them. Relevant studies suggest a trade-off after a point, i.e., an inverted U-shape, between cognitive distance and learning that can take place between organisations. This results from the issue that knowledge gained from other organisations is *"useless if it is not new, but it is also useless if it is so new that it cannot be understood"* (Nooteboom, 2000, p.72).

The literature suggests that inhibitors of intra-firm knowledge transfer can be mitigated somewhat by having high levels of trust, communication, and coordination, i.e., *corporate socialisation*, between actors (Björkman et al., 2004). One method of achieving this involves the transfer of people between the source and the recipient of the knowledge to be transferred, which Harzing et al. (2016), Inkpen and Tsang (2005), and Szulanski (2000) suggest increases trust, reduces loss of information, and thus facilitates the implementation of transferred knowledge. Similarly, Chiambaretto et al. (2019) discuss the benefits of a knowledge broker to knowledge sharing, as the broker's core role is to manage the tensions arising between collaborating units of an organisation. This relates to the discussed concept of internal embeddedness, as strong communication and trust suggest a higher level of integration of the subsidiary into the organisation.

Transfer Content

When knowledge is transferred, the ease of transfer depends on the actual content of the transfer. In particular, the attributes of knowledge that have been found to affect the ease of transfer include the causal ambiguity, tacitness, and value of that knowledge (Gaur et al., 2019; Gupta and Govindarajan, 2000; Nair et al., 2018; Szulanski, 2000). For example, Szulanski (2000) highlights causal ambiguity

of knowledge as one of the key predictors of *stickiness* in transfer. Similarly, tacit knowledge is found to be more difficult to transfer by definition, as it is harder to verbalise. Explicit knowledge, on the other hand, is inherently easier to transfer, given that it can be written down, codified, or embedded in technology (Zander and Kogut, 1995). When considering the importance of knowledge to the MNC, Gupta and Govindarajan (2000) find support for their hypothesis that the higher the value of the subsidiary's knowledge, the higher the outflows of knowledge from that subsidiary. However, this relationship has been found to display an inverted U-shape by other authors, as previously discussed (Mudambi et al., 2014; Nooteboom, 2000).

Transfer Mechanism

The mechanisms by which knowledge is transferred can be split into formal and informal, as well as virtual and face-to-face mechanisms (Ipe, 2003). Formal knowledge transfer mechanisms include structured work teams, training programmes, and technology-based systems (Ipe, 2003). In contrast, informal transfer mechanisms include social networks and personal relationships (Gupta and Govindarajan, 2000; Ipe, 2003). These formal and informal mechanisms can be broken down further into virtual versus face-to-face mechanisms. For instance, Spraggon and Bodolica (2012) categorise the following four mechanisms for knowledge transfer:

- **Static (formal) virtual processes:** e.g., patents, e-documents, reports
- **Dynamic (informal) virtual processes:** e.g., emails, telephone, blogs
- **Canonical (formal) face-to-face processes:** e.g., cross-functional teams, formal meetings, training, brainstorming
- **Non-canonical (informal) face-to-face processes:** e.g., informal network, informal encounters, communities of practice, informal mentoring

Different mechanisms are suggested to be relevant for different content of knowledge being shared. While face-to-face and informal mechanisms are relevant to transferring tacit knowledge, virtual and formal mechanisms apply to transferring explicit, codified knowledge and technology (Ipe, 2003; Spraggon and Bodolica, 2012).

2.4 Defining the Literature Gap

The previous sections have provided a detailed overview of the literature on multinational subsidiaries, R&D and engineering networks, and the transfer of knowledge. As demonstrated in Table 2.1, various typologies have been developed over the years

to categorise different types of subsidiaries. Despite these efforts, fewer studies have then focussed on taking one specific category of subsidiary and developing theory around it. Instead, most theory in this area has been developed with the multinational subsidiary generally in mind. Filling this gap by focussing specifically on innovation-related subsidiaries presents a research opportunity.

Furthermore, it has been suggested that reverse intra-firm knowledge transfer, and especially qualitative, case study-based research in this area, is still underrepresented in the literature (Ambos et al., 2006; Cunningham et al., 2017; Håkanson and Nobel, 2000; Michailova and Mustaffa, 2012). The lack of qualitative studies in the field of knowledge transfer *"seems to constrain the in-depth understanding of the studied phenomena"* (Michailova and Mustaffa, 2012, p.384). This call is answered in this thesis by conducting in-depth case study research on reverse intra-firm knowledge transfer from corporate innovation subsidiaries located in innovation clusters to their respective headquarters.

The above literature review integrated the factors affecting knowledge transfer identified by a variety of studies. The process of integrating this literature has revealed that studies in the field tend to consider factors of knowledge transfer individually, rather than holistically, thus neglecting the interactions between them. This gap in the existing literature is summarised by Spraggon and Bodolica (2012) (p.1273):

> *Current research concentrates on a single aspect rather than a fruitful combination of knowledge conversion mechanisms, barriers, and enablers, and media richness capacities of knowledge transfer processes for shedding light on intra-firm knowledge transfer experiences. Although several taxonomies exist for enhancing the efficacy of knowledge transfer (Daft and Huber, 1987; Dennis et al., 2008; Li et al., 2010; Nonaka et al., 2000), these taxonomies generally emphasise a standalone facet failing to consider the inner multidimensionality of knowledge transfer phenomena. No attempts are being made to gain a holistic understanding of knowledge transfer inefficiencies faced by organisations and assist managers in selecting optimal knowledge transfer processes through the development of an integrative taxonomy of processes that accounts for their multidimensional contingencies.*

While Spraggon and Bodolica (2012) merely call for an integrative taxonomy, i.e., a classification of factors, this study takes a further step towards gaining a holistic understanding of knowledge transfer by developing an integrative conceptual framework, i.e., an analytical structure illustrating the various factors affecting knowl-

edge transfer and their interactions (Christensen, 2006). The initial framework is developed in Section 2.4.1 below and is based on the above literature. This initial framework is subsequently used to approach the analysis of case study data and is modified according to the findings. Through two phases of case studies and consequent framework modification, this thesis addresses the identified research gap calling for a holistic understanding about intra-firm knowledge transfer.

2.4.1 Conceptual Framework Development

The initial integrative conceptual framework shown in Figure 2.3 below adopts the broadcasting model of knowledge transfer (shown in its most basic form in Figure 2.2 above), given its prominence in the literature. The conceptual framework builds on this basic broadcasting model and integrates the key identified factors that impact knowledge transfer discussed in Section 2.3.4:

- A knowledge source (in this case the corporate innovation subsidiary) plus its characteristics;
- A knowledge recipient (in this case the company headquarters) plus its characteristics;
- The internal and external embeddedness of the subsidiary;
- The subsidiary's external knowledge sourcing activities;
- The relationship between source and recipient;
- The mechanism of transfer as an arrow from source to recipient;
- The content of what is being transferred;
- The broader context (in this case an innovation cluster, such as Silicon Valley, Tel-Aviv, Beijing, Tokyo, or Berlin).

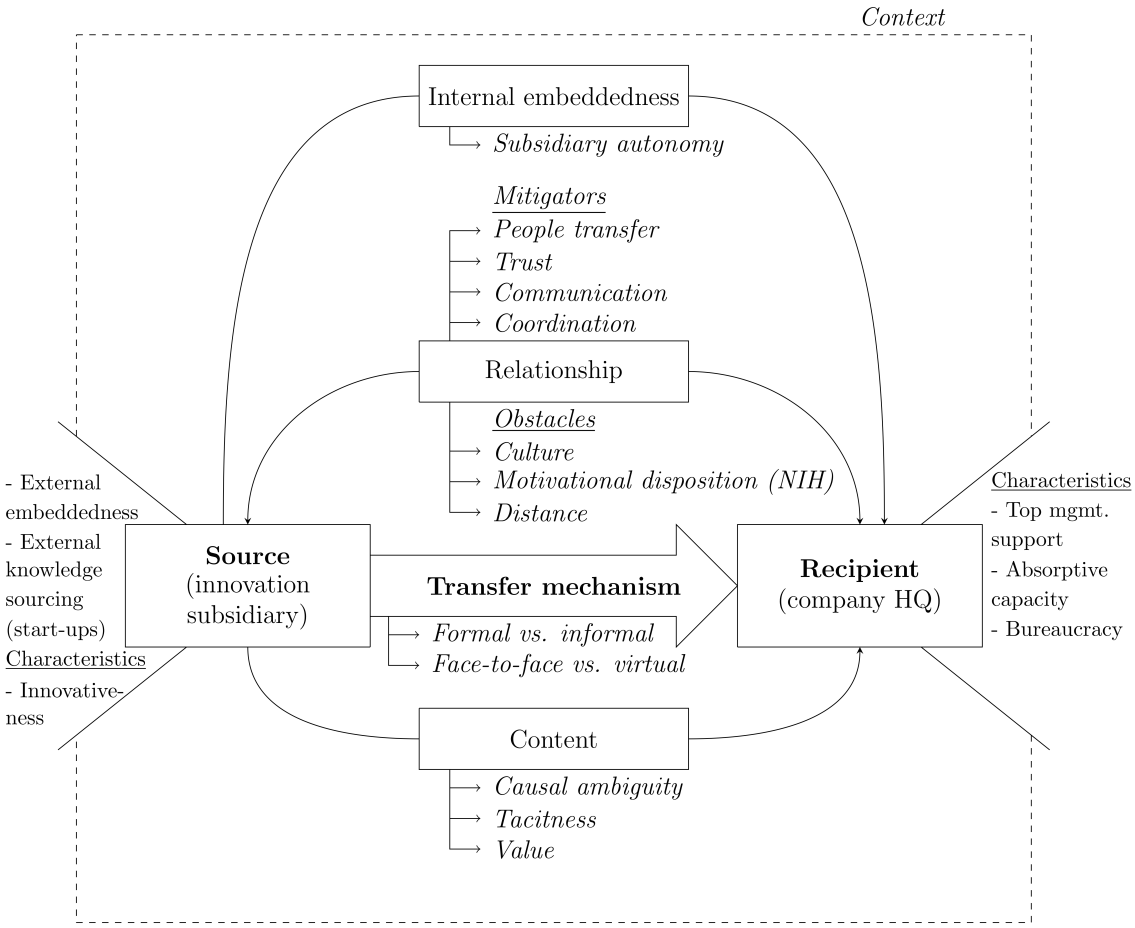


Figure 2.3: Initial integrative conceptual framework, based on the reviewed literature

This framework is used to approach the analysis of the automotive case study data in Chapter 4, constituting Phase 1 of the research. The findings from this phase are then used to modify the framework and produce an iterated version of it. This version, in turn, is used to approach the analysis of the case studies in Phase 2 (see Chapter 5). Again, subsequent findings are used to produce a further modified version of the framework.

Despite its context specificity, throughout the analysis, the aim of the framework is to provide a holistic view of the transfer process from corporate innovation subsidiaries to the parent organisation. Dimensions of transfer are not considered in isolation, but their interactions and implications are explored, thus addressing the identified literature gap and allowing the researcher to answer the research questions, which are reiterated in the following chapter.

Chapter 3

Research Approach

This chapter outlines the research approach taken in this study. This includes discussing research objectives, the philosophical stance taken, as well as the resulting methodology used to answer the research questions in a replicable way. This chapter closes with an evaluation of the quality of the research approach, with reference to the study's validity, reliability, and ethical considerations.

3.1 Research Objectives

The previous chapter reviewed relevant existing literature, reinforcing the research question and sub-questions introduced in Chapter 1:

How is knowledge transferred from a corporate innovation subsidiary located in an innovation cluster to its company headquarters?

1. What are the obstacles impeding the knowledge transfer from a corporate innovation subsidiary located in an innovation cluster to its headquarters?
2. How are these obstacles managed in practice?

To answer these questions, the following research objectives have to be achieved, thus contributing to the field of international business, particularly the topics of internationalisation, transfer of knowledge, and subsidiary-headquarters relations, from both a theoretical and a practical perspective:

1. Understanding what a corporate innovation subsidiary is and what it does;
2. Identifying critical obstacles to the knowledge transfer from a corporate innovation subsidiary to its headquarters, as well as the measures that have been put in place to facilitate the process;
3. Developing a framework that conceptualises the knowledge transfer process from a corporate innovation subsidiary to its headquarters.

3.2 Philosophical Stance

A crucial element of research involves determining the relationship between data and theory. This requires an understanding of the philosophy of science (Easterby-Smith et al., 2015). Key considerations in this area include the researcher's ontological and epistemological positions, as well as their impact on the study. Evaluating these concepts allows an appropriate methodology to be devised, as benefits and drawbacks of various methods, in particular in reference to bias caused by the researcher's reflexive role, can be weighed against each other. To this end, *ontological* and *epistemological* issues require defining (Burrell and Morgan, 1979; Easterby-Smith et al., 2015).

3.2.1 Ontological Assumptions

Ontology concerns the nature of social reality, i.e., of the phenomenon under study (Blaikie, 2007; Burrell and Morgan, 1979). It addresses the existence of certain entities in the physical world and the assumptions that one makes about them, such as the existence of truth and facts (Blaikie, 2007; Easterby-Smith et al., 2015).

Ontology in the social sciences has commonly been split into three opposing positions: realism, relativism, and nominalism (Easterby-Smith et al., 2015). Realism supports the idea that social concepts exist independently of their being researched, discovered, or labelled (Blaikie, 2007; Burrell and Morgan, 1979). Relativism suggests that social concepts are defined differently by different actors, and that truth is therefore not absolute, but *"can vary from place to place and from time to time"* (Collins, 1983, p.88). Nominalism distances itself further from realism, by suggesting that reality is made up only of artificial concepts, names, and labels given by mankind, and that therefore, there is no truth (Burrell and Morgan, 1979). The concepts of realism, relativism, and nominalism are summarised in Table 3.1, which has been adapted from Easterby-Smith et al. (2015).

Ontology	**Realism**	**Relativism**	**Nominalism**
Truth	Single truth	There are multiple 'truths'	There is no truth
Facts	Facts exist and can be revealed	Facts depend on the viewpoint of the observer	Facts are human creations

Table 3.1: Contrasting the concepts of realism, relativism, and nominalism, adapted from Easterby-Smith et al. (2015)

3.2.2 Epistemological Assumptions

Epistemology concerns how one inquires into the nature of the world and addresses the theory of knowledge (Blaikie, 2007; Burrell and Morgan, 1979; Easterby-Smith et al., 2015; Johnson and Duberley, 2000).

Epistemology has been split into two main contrasting views in the social sciences: positivism and interpretivism (also called social constructionism) (Easterby-Smith et al., 2015). Positivism makes the ontological assumption that *"reality is external and objective,"* as well as the epistemological assumption that knowledge is of significance only if it is the result of empirical verification (Easterby-Smith et al., 2015, p.51). Interpretivism suggests that positivism achieves limited success in the social sciences, as reality is socially constructed and interpreted by the researcher, rather than objectively observable (Easterby-Smith et al., 2015). Instead, interpretivism focusses on the meaning that people (individually and collectively) give to a situation (Blaikie and Priest, 2019). The differences between the two positions are summarised in Table 3.2 (adapted from Easterby-Smith et al. (2015)).

	Positivism	**Interpretivism**
The observer...	must be independent.	is part of what is being observed.
Human interests...	should be irrelevant.	are the main drivers of science.
Explanations...	must demonstrate causality.	aim to increase general understanding of the situation.
Research progresses through...	hypotheses and deductions.	gathering data, from which ideas are induced.
Concepts...	need to be defined so that they can be measured.	should incorporate stakeholder perspectives.
Units of analysis...	should be reduced to simplest terms.	may include the complexity of 'whole' situations.
Generalisation through...	statistical probability.	theoretical abstraction.
Sampling requires...	large numbers selected randomly.	small numbers of cases chosen for specific reasons.

Table 3.2: Contrasting the concepts of positivism and interpretivism, adapted from Easterby-Smith et al. (2015)

3.2.3 Integrating Ontology and Epistemology

When linking the spectra of ontology and epistemology, a strong realist ontological view aligns with a strong positivist epistemology. Nominalism, on the other hand, aligns with a strong interpretivist epistemology (Easterby-Smith et al., 2015). Relativism finds a middle ground between the spectra, incorporating aspects of both positivism and interpretivism (Easterby-Smith et al., 2015).

Based on the above considerations, the philosophical stance for this study encompasses elements of a relativist ontology, as the reality of what is being researched (corporate innovation subsidiaries of incumbent automotive manufacturers) exists independently of this research, yet the facts and truths of the somewhat subjective field of study may vary from place to place and from time to time. Furthermore, this study identifies with an interpretivist epistemology, as the subject of study involves a whole complex situation, rather than simple, individual variables. The aim of the study is to gain an understanding into this complex situation to induce ideas from it, rather than to find statistical causality based on precise hypotheses.

Thus, the philosophical stance for this study follows a *relativist ontological*, and an *interpretivist epistemological* viewpoint.

3.2.4 Resulting Research Strategy

Research strategies provide *"a procedure, a logic, for generating new knowledge"* (Blaikie, 2007, p.8) and thus answering a study's research questions. Blaikie (2007, 2009) defines four distinct research strategies, as outlined in Table 3.3:

	Inductive	**Deductive**	**Retroductive**	**Abductive**
Aim	To establish descriptions of characteristics and patterns	To test theories, to eliminate false ones and corroborate the survivor	To discover underlying mechanisms to explain observed regularities	To describe and understand social life in terms of social actors' meanings and motives
Start	(a) Collect data on characteristics and/or patterns	(a) Identify a regularity that needs to be explained	(a) Document and model a regularity and motives	(a) Discover everyday lay concepts, meanings
	(b) Produce descriptions	(b) Construct a theory and deduce hypotheses	(b) Describe the context and possible mechanisms	(b) Produce a technical account from lay accounts
Finish	Relate these to the research questions	Test hypotheses by matching them with data	Establish which mechanism(s) provide(s) the best explanation in that context	Develop a theory and elaborate it iteratively

Table 3.3: Outlining four research strategies, adapted from Blaikie (2009)

Given their focus on regularities (in contrast to the complex, uncertain research context of this thesis), neither a deductive, nor a retroductive research strategy are suitable for this study. Inductive reasoning is commonly known as making an *"inference from particular to general"* (Cohen, 2005, p.432), while abductive reasoning refers to accepting *"a conclusion on the grounds that it explains the available evidence"* (Hookway, 2005, p.1). Both approaches suitably address the research purposes of exploration, description, and evaluation, although the inductive research strategy is less suitable for *"why?"* and *"how?"* questions and understanding complex social phenomena (Blaikie, 2007, 2009). Abductive reasoning, first introduced by Peirce (1931), aims to build theory by using multiple suitable existing theories as inputs to empirical observation. The strategy involves following an iterative loop between theory and empirical data (*theory matching* or *systematic combining*), guiding researchers to their conclusions (Dubois and Gadde, 2002). Thereby, the abductive research approach allows a researcher to understand data and literature *"from the perspective of a new conceptual framework"* (Kovács and Spens, 2005, p.138) (see also Danermark et al. (2001) and Dubois and Gadde (2002)).

Given the relativist ontological and interpretivist epistemological stance, as well as the research context of this study (the complex social situation of global automotive

companies having corporate innovation subsidiaries located in innovation clusters), a preliminary conceptual framework and structure based on existing literature was necessary to bring an initial order to the problem. The resulting preconceptions of the researcher rule out the use of pure inductive grounded theory as laid out by Glaser and Strauss (1967), and point instead towards the iterative theory matching process of the abductive research strategy as a more suitable approach. Following the abductive research approach allows the researcher to modify the analytical framework derived from the literature throughout multiple phases of data collection and analysis.

3.3 Research Context

3.3.1 The Automotive Industry

The contemporary automotive industry has been characterised as mature and incumbent, with large barriers to entry and exit (Diehlmann and Häcker, 2013; Holweg and Oliver, 2016), and has thus been named the *"industry of industries"* (Drucker, 1946, p.149). Innovation and life-cycles are relatively slow, and the leading firms are highly embedded, which stems from the dominant design in the industry, established about a century ago (Holweg and Oliver, 2016). It is argued that the automotive industry is facing drastic changes, given contemporary issues of climate change, rapid technological advancement, and the market entrance of new, less conventional players, such as Tesla, Google, and Apple (Butler and Martin, 2016; Diehlmann and Häcker, 2013; Holweg and Oliver, 2016). Research suggests that incumbent automotive manufacturers need to react to this volatility and innovate more rapidly, making the study of innovation in this industry relevant, exciting, and important.

Automotive Supply Chain Structure

Figure 3.1 depicts an overview of a generic automotive supply chain. Historically, the manufacturers, known as OEMs (original equipment manufacturers) conducted most of the work along the supply chain, with Ford even going as far as controlling coal and iron ore mines, as well as rubber plantations and sheep farms in the 1920s (The Economist, 2009; World Bank, 2019). However, since the 1980s, the industry has been undergoing manufacturing and supply chain reforms, resulting in more manufacturing responsibility being given to first-tier suppliers, while OEMs focus on vehicle design, marketing, and assembly (Holweg and Oliver, 2016). Thus, today we have a structure as depicted in Figure 3.1, with a consolidated number of *"mega-suppliers"* (Tier 1) (Holweg and Oliver, 2016, p.30), such as Bosch, Denso, and Continental, providing most core systems of the vehicle, and smaller second-tier

suppliers providing first-tier suppliers with the parts needed for their integrated systems (Silver, 2016). This thesis focusses on the activities of OEMs, though references are made to other points in the supply chain where relevant.

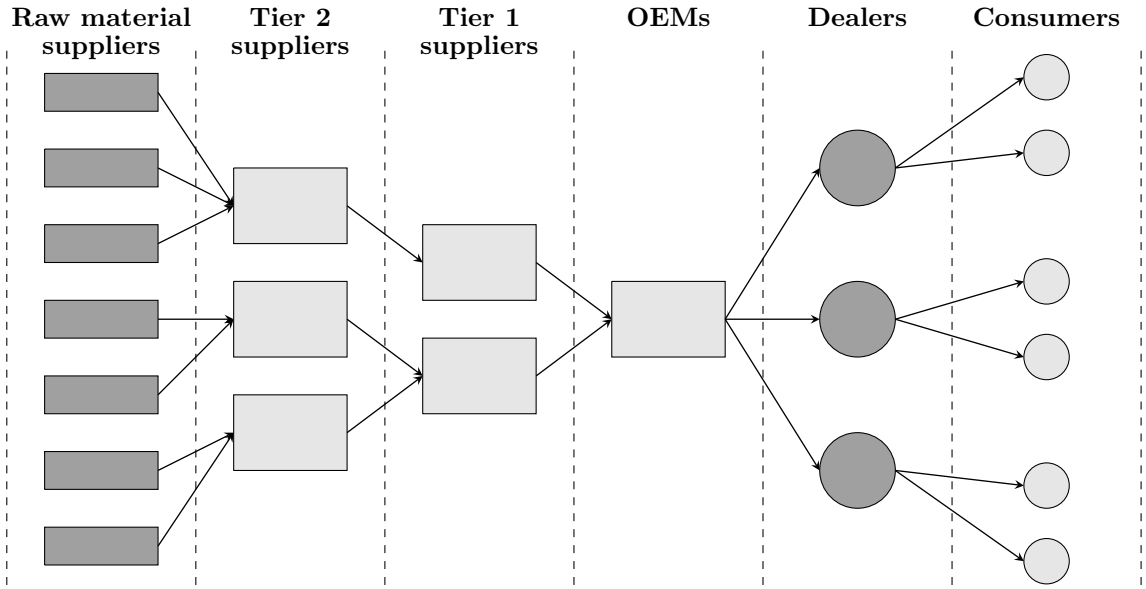


Figure 3.1: Automotive supply chain, adapted from Chandra and Kamrani (2003)

Automotive Research and Development Structure

While nomenclature varies between companies, most automotive OEMs split their research and development activities into three phases: (1) an initial phase (fundamental research); (2) a concept phase (pre-development); and (3) series development, after which the project is passed on to production (Weber, 2009). The entire vehicle development process usually takes about seven years and is depicted in Figure 3.2.

Figure 3.2: An outline of the automotive research and development process

Traditionally, an automotive OEM's innovative activity was largely conducted in-house (Ili et al., 2010). More recently, however, high costs of R&D and the entrance of new players into the industry have resulted in the boundaries of automotive OEMs becoming more permeable (Hering et al., 2011; Lazzarotti et al., 2013). One method of collaboration that these OEMs have been following involves setting up a *"technology scouting office"* (Lazzarotti et al., 2013, p.44) (falling under the umbrella term *corporate innovation subsidiary* adopted in this thesis) in innovation clusters such as Silicon Valley, Tel Aviv, Beijing, and others. These corporate innovation

subsidiaries take on many forms and sizes, but generally search for new technologies, develop prototypes, and feed these into the first two phases of the process depicted in Figure 3.2 (research and pre-development) at headquarters.

3.3.2 Prominent Innovation Clusters

Silicon Valley

While the first automotive innovation subsidiaries were established in Silicon Valley only in the mid- to late 1990s, Silicon Valley has been developing into a prominent innovation cluster since roughly the Californian gold rush of the mid-19th century. Since then, *"one industry has led to the next one in an apparently endless cascade of continuous reinvention"* (Scaruffi, 2016, p.6). The gold rush led to railways, shipping operations, and ports being built for transportation. The establishment of ports, in turn, had two side-effects: firstly, ports created coastal cities requiring electrical power, which could only be transmitted through high-voltage power transmission. This need established the San Francisco Bay Area as a leader in electrical engineering. Secondly, ports required radio communications, which drove the development of electronics, the semiconductor industry, microprocessors, personal computers, the software industry, and eventually the internet (Scaruffi, 2016). The high levels of innovation and wealth in the region have attracted companies and people from all over the world, including major players from the automotive industry.

Research has indicated that one of the factors that has made Silicon Valley so successful today is a focus on social and regional networks (Engel, 2015; Saxenian, 1994). The boundaries between firms are porous, and labour markets are open (Saxenian, 1994), making Silicon Valley a prime location for exchanging ideas and collaborating to drive innovation forwards; i.e., for practising open innovation (Chesbrough, 2003a,b). Researchers have highlighted the combination of competition and cooperation between entrepreneurs, which is used to attempt to displace incumbent companies (Engel, 2015). This emphasises the importance of incumbents being present in such a regional cluster, so they can be a part of, and drive, the innovation process, rather than be displaced by it.

The amalgamation of innovative actors, such as universities, MNCs, entrepreneurs, and investors, makes Silicon Valley a particularly successful, and therefore interesting, example of an innovation cluster (Engel and del Palacio, 2011; Engel, 2015), warranting further exploration of the region.

Other Prominent Innovation Clusters

While Silicon Valley is considered the largest and most talked-about innovation cluster globally, it is certainly not the only one. Engel and del Palacio (2011) discuss Israel as another key *"Super Cluster of Innovation"* (p.27) as it, too, constitutes *"an environment that favours the creation and development of high potential entrepreneurial ventures and is characterised by heightened mobility of resources, including people, capital, and information"* (Engel and del Palacio, 2011, p.27). Similarly, prominent authors such as von Zedtwitz (e.g., see von Zedtwitz et al. (2007, 2018); von Zedtwitz (2004); Sun et al. (2007)) conduct research into multinationals' foreign R&D units in China and South Korea, given the countries' transformation into highly innovative economies over the last two decades (Jang et al., 2017; Prud'homme and von Zedtwitz, 2018). Indeed, several of the automotive OEMs that are present in Silicon Valley have established similar corporate innovation subsidiaries in Tel Aviv, Shanghai, Beijing, Seoul, Tokyo, Paris, and Berlin.

3.4 Selection of Research Methodology

"A research design is the logic that links the data to be collected (and the conclusions to be drawn) to the initial questions of study" (Yin, 2003, p.19). Thus, careful consideration of the research methodology is vital for successful research. Researchers have many options when designing methodology and must choose whether to conduct experiments, surveys, histories, archival analysis, or case studies. As illustrated in Table 3.4, Yin (2003) considers the suitability of each approach:

Strategy	**Form of research question**	**Requires control of behavioural events?**	**Focuses on contemporary events?**
Experiment	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes
Archival analysis	Who, what, where, how many, how much?	No	Yes/no
History	How, why?	No	No
Case study	How, why?	No	Yes

Table 3.4: Suitability of different research approaches, adapted from Yin (2003)

3.4.1 Case Study Approach

The case study approach has been chosen as the most appropriate research method for this study, given the recommendations of Yin (2003) above, the author's discussed relativist, interpretivist philosophical stance, the research context, as well as the study's research questions. Yin (2003) defines a case study as an empirical inquiry that *"investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident"* (p.13). Case studies are used in situations in which there are more variables of interest than data points, and must thus employ a variety of data collection and analysis methods to encompass the complexity (Yin, 2003).

A qualitative, exploratory case study approach is particularly relevant for this study, as *"how?"* questions are being asked about a contemporary set of events, over which the researcher has little or no control (Baxter and Jack, 2008; Yin, 2003). Case studies allow for a combination of planned and opportunistic data gathering, which can be useful in a complex social situation which cannot be fully understood a priori, and must therefore be open to emergent requirements for further data gathering (Cassell and Symon, 2004). This study encompasses multiple cases, rather than being a single case study, given that the phenomenon under investigation (automotive OEMs having corporate innovation subsidiaries located in innovation clusters) is not a critical, unique, typical, revelatory, or longitudinal case (Yin, 2003, p.40-1).

The case study approach has historically been criticised for its lack of precision, quantification, objectivity, and rigour (Yin, 2003). However, this stereotype can be challenged by understanding the strengths and weaknesses of the case study approach (Gable, 1994). The purpose of a case study is not to generalise statistical results from a sample to a population (Gioia et al., 2010; Thorngate, 1976). Instead, the purpose is to gain an in-depth, yet encompassing understanding of a complex phenomenon and then induce from a case result to a framework, typology, model, or theory (Gioia et al., 2010; Niederkofler, 1991; Thorngate, 1976).

3.4.2 Flowchart of Research Methodology

The research method for this study is outlined in Figure 3.3 which has been adapted from a diagram by Yin (2003) (p.50). Note that, while Yin (2003) incorporates a feedback loop in the flowchart to signify important discoveries during the study resulting in a reconsideration of the literature and the analytical framework, as well as further phases of data gathering, Figure 3.3 has these feedback loops drawn out in full in the interest of clearly conveying all steps of the abductive research method.

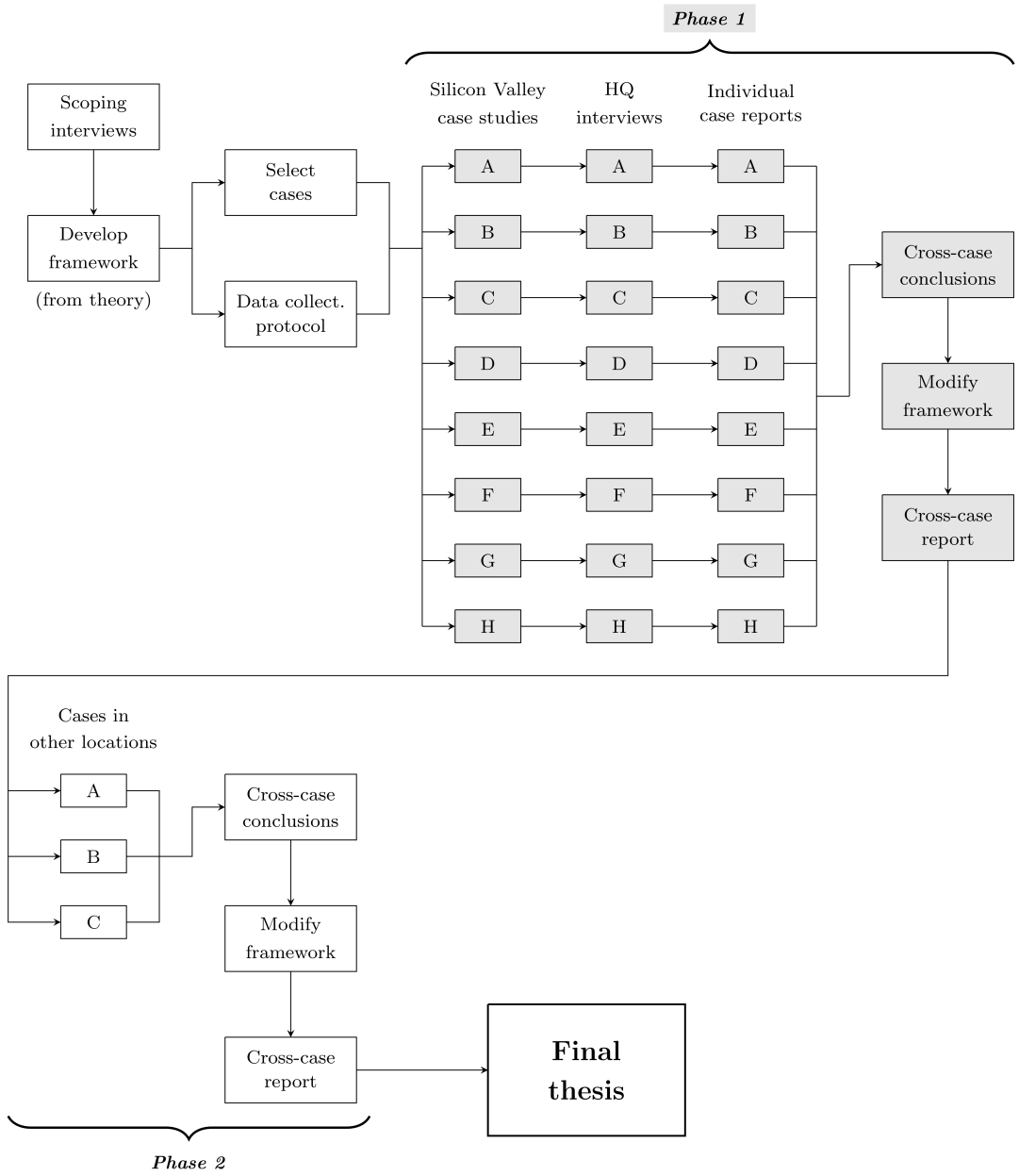


Figure 3.3: Overview of the research method, based on Yin (2003)

As illustrated, this study encompasses two phases of data gathering and analysis. Following the summary of these phases below, details of the case study design and analysis are discussed in Section 3.5.

Phase 1

The first round of qualitative case interviews was conducted at Silicon Valley automotive corporate innovation subsidiaries, based on the initial conceptual framework developed from the literature. To gain a more complete picture of the cases, each subsidiary's headquarters was interviewed. After writing individual case reports and cross-checking these with interviewees to avoid misunderstandings and misrep-

resentations, cross-case solutions were inferred from open coding analysis. These cross-case conclusions were then used to modify the initial conceptual framework.

Phase 2

The output of Phase 1 prompted the researcher to attempt validation of these findings at automotive corporate innovation subsidiaries of three of the case companies in other locations (including Berlin, Tel Aviv, Paris, Shanghai, Beijing, Seoul, and Tokyo). Based on further rounds of open coding, the framework was again modified.

3.5 Case Studies: Design and Analysis

This section discusses the details of the case study design, including sampling and case selection, the unit of analysis, as well as data collection and analysis procedures.

3.5.1 Case Selection

Given the automotive industry as a contemporary example of an industry undergoing radical changes, as well as Silicon Valley as a prominent cluster in which many such changes are occurring (see Section 3.3), relevant cases for this research needed to fulfil the following criteria:

1. The parent company must be an incumbent global automotive OEM;
2. The parent company must have a corporate innovation subsidiary located in Silicon Valley and possibly another in a further innovation cluster;
3. Subsidiaries must *not* conduct only corporate venture capital (CVC) activities, as knowledge transfer to headquarters in these cases is limited.

Based on extensive internet research, a list of 11 automotive OEMs with an R&D presence in Silicon Valley was created. Of these, one is a young manufacturer of electric vehicles (founded in 2003 in Silicon Valley) and thus does not fulfil the criteria of being an *incumbent* automotive OEM. Furthermore, one of the identified Silicon Valley subsidiaries conducts solely CVC activities and therefore does not qualify. This leaves nine viable cases to choose from, one of which the researcher was unable to gain access to. Thus, this study has selected eight of the nine incumbent automotive OEMs that have a relevant corporate innovation subsidiary located in Silicon Valley (note that Company F has two subsidiaries in Silicon Valley, referred to in this thesis as Subsidiaries F1 and F2):

Case	Silicon Valley subsidiary size (# employees)	Silicon Valley subsidiary age (# years)	HQ location	Overall company size (# employees)
A	50	21	Germany	∼130,000
B	300	24	Germany	∼280,000
C	70	8	France	∼470,000
D	200	21	Germany	∼650,000
E	3	12	USA	∼180,000
F	F1: 40; F2: 250	F1: 18; F2: 3	Japan	∼370,000
G	200	7	USA	∼200,000
H	30	19	Japan	∼220,000

Table 3.5: Overview of case companies' Silicon Valley subsidiaries (as of Aug. 2019)

To test the validity of the findings from the Silicon Valley based subsidiaries, the global network of corporate innovation subsidiaries of each of the eight companies was considered for further interviews (Phase 2 of this study). Of the eight companies, five do not have other corporate innovation subsidiaries with similar characteristics to the Silicon Valley offices (for example, some interviewees or websites mention the company's R&D headquarters Asia, or a single technology scouting contractor working in Israel, when prompted about their global network of innovation subsidiaries). These cases were thus rejected for Phase 2 of this study, while the remaining three companies (Companies A, B, and C) were chosen for a further round of interviews.

3.5.2 Unit of Analysis

The unit of analysis is related to the study's research questions (Yin, 2003). Given the focus of this work's research questions on the knowledge transfer from subsidiary to company headquarters, the chosen unit of analysis constitutes the *unit level* of an organisation. In this study, *unit level* refers to the subsidiary itself, as well as the knowledge-receiving unit at headquarters (usually the R&D unit). This unit of analysis allows for comparisons between sender and receiver of knowledge, as well as between subsidiaries in different locations—a trait that is highly relevant to answering the research questions and achieving the research objectives.

3.5.3 Data Collection

Yin (2003) defines six distinct sources of data in case study research: documentation, archival records, interviews, direct observations, participant observation, and physical artefacts. Of these, documentation, archival records, and physical artefacts are *secondary* data sources because their collection *"is not the responsibility of the analyst"* (Stewart and Kamins, 1993, p.3). Interviews, direct observations,

and participant observations are *primary* data sources, as the researcher collects the data him– or herself. In addition to categorising data sources into *primary* and *secondary* sources, they can further be divided into those that provide data *internal* to the main unit of analysis (the subsidiaries and the respective company headquarters), as well as those providing data *external* to these units. A summary of the data sources used in this study is shown in Figure 3.4:

	Primary	Secondary
Internal	Interviews with employees of subsidiaries and HQ	Company documents (e.g., presentations websites, minutes); existing case studies
External	Interviews with third parties (e.g., automotive Tier 1 suppliers & other industry experts)	Academic publications; other publications (e.g., newspaper articles)

Figure 3.4: Summary of data sources used in this study

While interviews with employees (mainly managers) of the subsidiaries and the respective company headquarters (i.e., primary, internal data) comprise the main data source, data from the remaining three quadrants of Figure 3.4 are triangulated with this interview data, resulting in the creation of *"converging lines of inquiry"* (Yin, 2003, p.98), thereby improving the study's construct validity (see Section 3.6 below).

Qualitative interviews with employees of the case subsidiaries and their headquarters were designed in a semi-structured format. Guiding questions were established beforehand and captured in a case study protocol (see Appendix A), but interviews were kept open and flexible, allowing the researcher to opportunistically pursue certain topics with certain interviewees (Rubin and Rubin, 2005; Yin, 2003).

For Phase 1 of this study (see Figure 3.3), the researcher commenced by conducting initial phone interviews with Silicon Valley based automotive corporate innovation subsidiaries, in order to establish contact and ask about potential in-person visits. She subsequently spent three months in California as a visiting student at the Haas School of Business, UC Berkeley, in order to conduct fieldwork locally. Interviews were conducted at all eight cases in Silicon Valley. Upon her return to the UK, the researcher conducted follow-up phone interviews with the Silicon Valley based subsidiaries, as well as with managers at the eight companies' headquarters. Interviewing headquarters provided a valuable and necessary perspective to knowledge

transfer, as it was important to gain insights from both the knowledge source (subsidiary) and the knowledge recipient (headquarters). Individual case reports were sent to interview partners in Silicon Valley for comments and approval, to avoid misinterpretation or misrepresentation of the data.

To explore similar issues at automotive corporate innovation subsidiaries in other locations (Phase 2), the researcher conducted initial phone interviews with further subsidiaries of case Companies A, B, and C, located in other innovation clusters, in order to establish contact and ask about potential in-person visits. This enabled her to travel to Shanghai, Beijing, Seoul, and Tokyo for one month of fieldwork, consisting of interviews at the Asian corporate innovation subsidiaries of Cases A, B, and C. Subsidiaries in other locations to which the researcher was not able to travel in person (e.g., Berlin, Paris, and Tel Aviv) were interviewed on the phone. Given that most interview partners in Phase 2 were interviewed more than once and the researcher already had a deep understanding of the research context, individual case study reports were not written for this phase. Instead, the researcher was able to triangulate the data with her previous understanding and analysis from Phase 1.

Throughout this study, all in-person interviews (and most phone interviews) were recorded and transcribed. For phone interviews in which consent to record was not given, or in which the audio quality was not sufficiently high to record, the researcher took rigorous notes during the interview and wrote up summaries immediately following the call. In sum, a total of 79 interviews were conducted, seven of which did not involve any of the eight case companies, but provided valuable external input. This study comprises a total of 421 pages of interview transcripts and notes, as well as 247 pages of secondary internal documents.

Table 3.6 provides an overview of how many interviews were conducted per case company. As can be seen, the number of interviews conducted varies case by case. Companies A and B exhibit significantly higher numbers of interviews, as both cases were used for a second round of case studies (Phase 2), and because both cases were used for initial scoping interviews. Generally, the principle of saturation was followed in deciding how many interviews to conduct per case company: further interviews were conducted until no novel, additional data was found (Glaser and Strauss, 1967).

A more detailed summary of all interviews (including interviewee role, interview medium, and duration) is provided in Appendix B. Note that all interviewees were promised anonymity in order to encourage a more open dialogue. Thus, company and individual names are anonymised throughout this study.

Case	A	B	C	D	E	F	G	H	Other
# Interviews	17	18	6	9	4	8	4	6	7

Table 3.6: Overview of interviews per case company

3.5.4 Data Analysis

As discussed in Section 3.2.4, this study aims to build theory through abduction and therefore iteratively consults the literature for a conceptual framework on knowledge transfer and modifies this framework based on different phases of data collection and analysis. To this end, the *Gioia method* (Gioia et al., 2010, 2013) of analysing qualitative data was adopted. While the Gioia method builds on the concept of grounded theory as defined by Glaser and Strauss (1967) and Strauss and Corbin (1998), Gioia agrees that one should not be *"completely uninformed about prior work,"* but instead focus on not letting *"existing knowledge get in the way"* of the data analysis (Gehman et al., 2018, p.291). Whilst this study consults prior literature for the development of an initial conceptual framework, this serves mainly to narrow down the field of study to the knowledge transfer from the subsidiaries to the respective headquarters and helps formulate some guiding open-ended questions for the semi-structured interviews. In keeping with the abductive approach, this conceptual framework is modified after each phase of case study data collection and analysis (see Figure 3.3).

The Gioia method consists of multiple rounds of *coding*, i.e., reading through all interview transcripts and notes and highlighting relevant first-order *codes* (akin to Strauss and Corbin (1998)) for the purposes of providing some overview and structure to the data (Gioia et al., 2010, 2013). The first order analysis does not yet aim to reduce data, as it attempts to remain close to the interviewees' terminology. The large resulting number of codes are subsequently compared for similarities and differences, and condensed to bring order to a cluttered, sometimes tautological list of codes, thus resulting in a re-combination to second-order *categories* (akin to *axial coding* defined by Strauss and Corbin (1998)). Two examples of the coding procedure conducted for each interview transcript is shown in Appendix C.

Data analysis following the Gioia method resulted in a code tree, outlining the relation between the list of first-order codes and second-order categories. An example of this code tree, developed from the analysis of the case study data in Phase 1 of this study, is shown in Appendix D. Following the abductive approach, the second-order categories in this code tree are compared with the conceptual framework derived

from the existing literature and are thus used to modify the framework. Note that, for simplicity and clarity, the code tree shown in Appendix D only exhibits those codes that were not found in the existing literature and were thus used to modify the framework. The same analysis procedure was used in the Phase 2 case studies.

The qualitative data analysis software, *MAXQDA*, was used for coding, allowing the researcher to maintain a structured and organised overview of all interview data and all first- and second-order codes. This measure follows the recommendation of Yin (2003) to maintain a case study database including all notes and transcripts for improved oversight and reliability (see Section 3.6).

3.6 Evaluation of Research Approach

To judge research design quality, Yin (2003) suggests four criteria against which to measure. Table 3.7 defines these criteria and how they are fulfilled in this study.

Criterion	Definition	Fulfilment in this study
1. Construct validity	Consideration of the extent to which correct operational measures are being used for the concepts being studied.	Multiple sources of evidence have been used: interviewing a wide range of employees from case companies and other companies; triangulating these with other sources of secondary data; presenting findings back to key contacts to confirm interpretations.
2. Internal validity	This applies mainly to explanatory or causal studies, rather than to exploratory ones. Internal validity involves ensuring that correct cause-effect relationships are derived.	Given the exploratory nature of this case study research, which does not aim to answer propositions by making causal claims, internal validity is of less concern. Nonetheless, comparative analysis was performed on interview data by identifying similarities and differences between information provided by interviewees.
3. External validity	Consideration of the study's generalisability to other domains.	Replication logic was used across cases; findings from Phase 1 were cross-checked for validation in Phase 2.

4. Reliability	Consideration of the study's repeatability.	A strict case study protocol was followed; interviews were recorded and transcribed (where interviews could not be recorded, rigorous notes were taken); interview transcriptions and notes were coded and stored in a case study database.

Table 3.7: Fulfilling the criteria for good research design by Yin (2003)

3.6.1 Ethical Considerations

To evaluate a research approach, not just methodological considerations, but also ethical aspects must be examined. Based on the recommendations of Easterby-Smith et al. (2015), the following measures have been taken to improve the ethical considerations of this work:

- Ensuring a rigorous research design to improve quality and validity of findings;
- Honesty and transparency about research intentions when approaching potential case companies, to avoid deceit, build trust with interviewees, and therefore improve research findings;
- Gaining consent that interviews will be recorded;
- Careful consideration of confidentiality issues as and when they arise, such as promising anonymity of case companies and individuals to encourage a more open dialogue;
- Reviewing interpretations of data with relevant employees to ensure validity of findings;
- Ongoing self-assessment on the part of the author about the ethics of research.

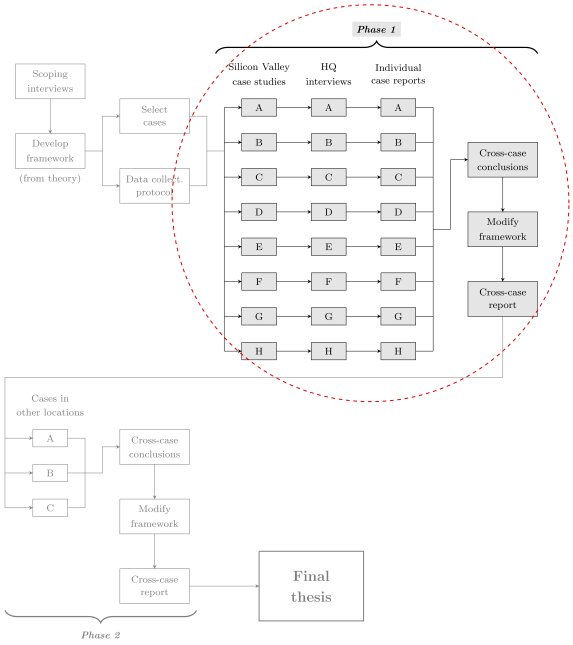
3.7 Chapter Conclusion

Based on the above considerations of the research approach, including the research objectives, the philosophical stance taken, the methodology used to answer the research questions, and an evaluation of the quality of the research approach, the following chapters present an analysis of the data collected in Phases 1 and 2 of this study. Finally, Chapter 6 provides a discussion of the research implications and this study's contribution to theory and practice.

Chapter 4

Phase 1: Case Studies from Silicon Valley

This chapter provides an analysis of the data gathered in Phase 1 of this study, i.e., eight case studies of automotive corporate innovation subsidiaries located in Silicon Valley (see right). Each case is discussed using key factors affecting knowledge transfer uncovered from the literature and incorporated into the initial conceptual framework (see Figure 4.1 below). Note that, in the interest of brevity and clarity of presentation, certain factors affecting knowledge transfer will be combined into one heading when discussing the case study data (e.g., external embeddedness and external knowledge sourcing, and transfer content and mechanism). Furthermore, observations from each case that deviate from the existing literature are discussed, resulting in a refinement of the framework at the end of this chapter.



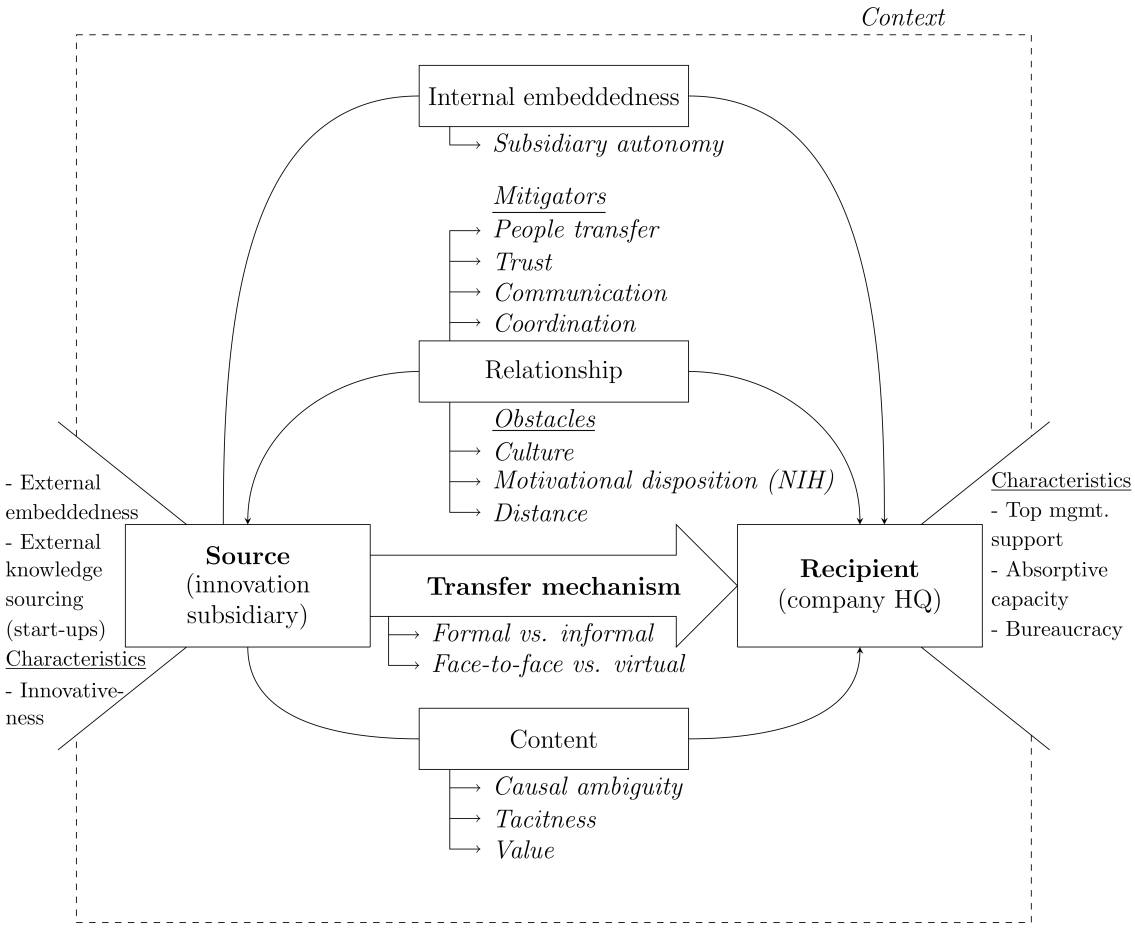


Figure 4.1: Initial conceptual framework derived from the literature

4.1 Case A

4.1.1 Subsidiary A Background

Established in 1998, Subsidiary A was among the first automotive corporate innovation subsidiaries in Silicon Valley. When founded, the subsidiary had six employees—a mix of local hires and expatriates (*expats*) from Company A headquarters (located in Germany). The original task of the subsidiary was exploratory in nature, with the aim of finding new technology trends in Silicon Valley, and sending them to headquarters for further evaluation and development.

Realising the strategic importance of the Silicon Valley region, the subsidiary grew to about 10 employees by 2000, 20 employees by 2005, 30 employees by 2010, and around 50 employees by 2019. With the increase in hiring, in particular engineers, the subsidiary shifted from technology scouting to conducting research projects with universities, as well as collaborative prototyping with start-up companies and automotive Tier 1 suppliers' innovation subsidiaries in Silicon Valley.

4.1.2 Internal Embeddedness

Employees at the subsidiary require an excellent network (internal embeddedness) in the parent organisation to be able to find a home for projects. This network is facilitated through expats, i.e., employees from headquarters who are sent to the subsidiary on a temporary basis (usually three to five years), as well as through a designated team at headquarters that acts as a bridge-builder between the subsidiary and headquarters business units. The importance of expats is the following: *"Expats are the real connection to [headquarters], because [headquarters] is huge. And so it is hard to wade through everybody to get to the actual key person responsible"* (A-7)[1]. Furthermore, expats facilitate raising awareness about the subsidiary at headquarters, because: *"I guarantee you, there are people in [my headquarters business unit] that do not even know that an office exists here [...], so [expats] are here to help open people's eyes and raise the awareness through their network"* (A-5). Furthermore, even when the correct contact person is known, physical and time differences complicate communication: *"One challenge is being so far away, but trying to get the attention of someone that you need information from. [...] You can't just go to their desk and ask them a question"* (A-7).

The autonomy of a multinational subsidiary has been considered as a function of its integration, i.e., embeddedness, into the parent organisation. Subsidiary autonomy in terms of both strategic aspects (e.g., decision-making for which projects to launch), as well as operational aspects (e.g., budget), constitutes a trade-off: too little autonomy and the subsidiary merely replicates what could easily be done at headquarters; too much autonomy and knowledge created at the subsidiary is unlikely to reach headquarters due to a lack of integration.

Operationally, Subsidiary A employs a dual-budget mechanism, where some budget for research projects is autonomous and funding for projects that are closer to series development has to be raised on a project-by-project basis. Strategically, however, this subsidiary is less autonomous than the budget suggests. Whilst projects should be able to be launched without first obtaining support from headquarters, the interviewees rarely follow this option. Instead, they highlight the importance of securing interest from a headquarters business unit before starting a project, in order to be *"better safe than sorry"* (A-5). This can limit the innovativeness of the subsidiary, as suggested by the literature (e.g., Beugelsdijk and Jindra (2018); Birkinshaw and Hood (2001); Ghoshal and Bartlett (1995); Gupta and Govindarajan (1991)).

[1]See Appendix B for an overview of interviewees and their IDs.

4.1.3 External Embeddedness and Knowledge Sourcing

Whilst part of the subsidiary's purpose is to find relevant start-ups in Silicon Valley and develop prototypes with them, interviewees suggest that these collaborations often cannot proceed further than the prototyping stage because of asymmetries between the partners. For example, *"start-ups have much faster processes"* (A-5), IP contracts *"take months to be drawn up by the different legal departments"* (A-5) and start-ups are *"seldom able to scale and industrialise"* (A-9). To mitigate these challenges, the subsidiary usually facilitates the connection of the start-up to an established Tier 1 supplier in the industry, who ensures that the technology is *"feasible and reproducible at high quantity and quality"* (A-9).

4.1.4 Actor Characteristics

Problems in the knowledge transfer process from subsidiary to headquarters are attributable in part to bureaucracy. Given the size of the entire organisation, finding the right department at headquarters to work with poses a major challenge for subsidiary employees: *"The company is so large, finding someone to answer your question or that has the authority to give the information or support something is a challenge"* (A-7). Furthermore, even if subsidiary employees find an appropriate department, employees at headquarters are, by definition, busy with their day-to-day work:

> *Say I find something new and approach series development [at headquarters] with it. They are currently in over their heads with a project that might not even be going fully according to plan. So they are already under a lot of pressure. And then I tell them that I have something new for them. Their enthusiasm for this is usually limited. (A-8)*

As this is similar across business units, subsidiary employees may have to *"pitch the project five or even ten times"* (A-6) in order to find a department at headquarters that is the right strategic fit for that project and that has the time to adopt it. Similarly, in the words of an interviewee at headquarters:

> *Yes, we are all [Company A] employees. Nonetheless, we all have our own goals, we all have our own work. And if somebody calls and says: 'Can you look at this for 1.5 hours?', then that is a lot of time. And if it is somebody that I don't personally know and only know that they are from Silicon Valley, then of course it is difficult to take the time to look at their proposal. I have to admit that. You really need a personal network for this, as well as top management support, who say that this [subsidiary] is important. (A-8)*

Depending on the project, it is not just time of headquarters employees that the subsidiary needs top management support to obtain: *"For some of the projects, I do require hardware which I get shipped over [from headquarters]. So if you just ask blankly to [headquarters], the answer is always: 'No'"* (A-7). Support for the subsidiary has to come from the very highest level to make sure that headquarters business units have the pressure to supply time and resources to the subsidiary.

Certain measures are taken to improve top management awareness and support. For example, regular visits to Silicon Valley are carried out: *"[Management] will make a point to visit our office and we usually give them an overview of all the projects we are working on"* (A-7). Furthermore, there is a training course for top executives from the organisation that is run in Silicon Valley, through which the subsidiary *"has gained awareness within the organisation"* and which has enabled them to *"earn a high standing, all the way up to the board"* (A-6).

4.1.5 Actor Relationship

The discussed challenge of headquarters employees not having the time to listen to ideas from the subsidiary is an issue that can be traced back to what has been labelled as the Not-Invented-Here (NIH) syndrome in the literature. The following statement suggests a certain envy and mistrust of the subsidiary, which can be categorised as an ego-defence mechanism in the NIH syndrome (Gupta and Govindarajan, 2000): *"Being in a highly attractive location, of course we are often told: 'You work where other people go on holiday'"* (A-5). Another interviewee at the subsidiary discusses that *"there are still many [at headquarters] who think in more traditional ways, who say: 'Hmm... where does this come from?'"* (A-6)—a definite sign of the NIH syndrome.

Differences in organisational and national culture constitute a key obstacle to knowledge transfer. For instance, challenges such as a large MNC not knowing how to work with start-ups, budgeting, communication, trust, and headquarters bureaucracy all encompass issues of opposing culture. In essence, the subsidiary behaves more like an entrepreneurial start-up, while headquarters behaves like the large MNC that it is, weighed and slowed down by heavy processes. According to the current head of the subsidiary, the subsidiary tries to be *"as little like [headquarters] as possible"* (A-3), because they want to *"think like a Silicon Valley company"* (A-3).

This bureaucracy also results in the relationship between subsidiary and headquarters being fairly one-sided. In the words of an interviewee at the subsidiary: *"We do*

not have direct influence over whether the technologies we find end up in the car. [...] The decision is not in our hands" (A-5). Nonetheless, the subsidiary makes sure to *"provide as much knowledge and insight about our projects for the higher-level decision-makers as possible, to support their decision, no matter in what direction it might go"* (A-5). This level of loyalty appears to be unrequited by headquarters.

The main strategy for mitigating these relationship issues seems to be the presence of expats in the subsidiary. While expats are expensive, they foster a *"natural collaboration"* (A-6) with headquarters. Of the roughly 50 employees at the subsidiary, eight are expats who are spread across various topical areas (A-6). Similarly, a designated unit at headquarters helps by being a *"bridgehead"* (A-8) between Silicon Valley and headquarters.

4.1.6 Transfer Content and Mechanism

To catch headquarters' attention, the subsidiary must demonstrate the value of their idea. This can be done by *"making ideas come alive"* (A-8) because:

> *Simply presenting a PowerPoint about the start-up or technology they [the subsidiary] have found doesn't work. They need to build a POC [proof of concept] that is close to an automotive use-case and approach the relevant business unit [at headquarters] with it. (A-8)*

The idea of demonstrating value by delivering a tangible POC rather than a slide presentation has been labelled "Death by PowerPoint" by multiple interviewees in this study and can determine whether a project will be transferred successfully.

A further obstacle to knowledge transfer involves timing. New vehicle development cycles last an average of five to seven years and there are only *"certain points [in the cycle] at which you can feed in"* (A-8). Hardware can only be added between certain development stages, whilst software is usually easier to integrate during development, though only if the system architecture allows (A-6, A-8). This presents a challenge as innovations from faster moving industries, such as consumer electronics, will often be outdated by the time they are integrated into the vehicle if the correct point in the development cycle is missed. Thus, technology roadmaps have to be proactively considered when conducting projects at the subsidiary.

The discussed obstacles to knowledge transfer are mitigated using various formal and informal mechanisms. For one, expats help establish a network within the organisation so that the subsidiary knows whom to talk to. Secondly, regular business trips are carried out both by subsidiary employees to headquarters and vice versa

because *"there is nothing more important than the face-to-face interaction to help with working together"* (A-7). In addition to face-to-face meetings, the subsidiary is in phone or video contact with headquarters at least four to five times per week and has a regular newsletter in which it updates headquarters on projects and new technology trends in the industry (A-5, A-8). Finally, Company A headquarters conducts an annual innovation fair day, attended by the board and managers from series development business units, at which innovative projects from the company's global network of innovation units are showcased. This raises awareness about the innovation subsidiaries throughout the organisation and can facilitate the match-making between a subsidiary's project and a relevant headquarters business unit.

4.1.7 Further Considerations

When the subsidiary was first established, its task was very exploratory in nature: *"In the early days, [the subsidiary] had the task of just seeing what new trends there are"* (A-6). Starting in 2010, the organisational structure of Subsidiary A shifted, so that, while all employees at the subsidiary are now organisationally part of the Company A R&D department, the employees' specific focus areas mirror the business unit organisation of headquarters. This means that each team at the subsidiary has a specific business unit in the headquarters series development department[2], with whom they communicate and collaborate most closely (for example, IT, electronics, powertrain, driver assistance, etc.). In other words, the subsidiary has shifted from being mainly exploratory to being organisationally tied into headquarters series development and carrying out more series development-orientated work. Now, projects have to be taken to higher levels of maturity before transferring them directly into series development, rather than carrying out greenfield projects and transferring them into research at headquarters. This organisational restructuring is described by one of the interviewees in the subsidiary:

> *We are in the R&D department code which used to be kind of farther out research and it used to be way more independent and so things would be taken up and then done for several years and then killed off because it would either be very long-term focussed, so nothing that they could put in series, or two, it would be too expensive, or three, the promise never found itself out. But we have had more of a re-organisation, where we are supposed to be very similar to [headquarters]. We are supposed to be more R&D for series and it is supposed to be more like D&P, development and production, than R&D. (A-7)*

[2]The typical automotive R&D process can be split into three phases: (1) an initial phase (fundamental research); (2) a concept phase (pre-development); and (3) series development, after which the project is passed on to production (see Figure 3.2).

A possible explanation for this shift lies with the rapid developments in the automotive industry which are putting pressure on integrating technologies that used to be on a farther out horizon (e.g., driver assistance systems, cloud-connected vehicles, and electric vehicles) into the actual vehicle. Thus, the subsidiary is shifting from being an innovation subsidiary working on greenfield, radical innovations, to being an extended, outsourced arm of headquarters' series development department.

Whilst the interviewees at the subsidiary merely stated that they are moving closer to series development without providing judgement on this shift, an interviewee at headquarters is more blatant in the evaluation:

> *It is beneficial to get rid of the pre-development phase and instead tie the [subsidiaries] into the series development department straight away. They should be doing fewer POCs, fewer pilot projects. Either do the project, or leave it, but don't waste time on pre-development projects that are too expensive, too far removed from the customer, or too unscalable and so don't get taken on by any business units. Series development has to be involved from the very start to ensure that there is buy-in. It has to be clear from the start who will be the internal customer: who will adopt the project and take it further? (A-11)*

The subsidiary's organisational shift closer to series development is symptomised by the subsidiary approaching a series development business unit in headquarters before even launching a project to make sure the unit provides buy-in to the project, either financially or in other ways, such as resources, people, or agreeing to adopt the project at hand-over. Securing early buy-in from headquarters reduces the risk of carrying out projects in Silicon Valley as it provides a target customer at headquarters. If buy-in is not secured early on, the subsidiary might find itself having finished a project, proposing it to headquarters and then: *"They may say that we never talked about doing this project and that it is not valuable to them. So it is important to have that communication and to discuss that project, to make sure we are all aligned with the overall company objectives"* (A-7).

This organisational shift has further resulted in the expectations for the subsidiary changing accordingly. Instead of carrying out greenfield projects, they are now expected to be more aligned with what headquarters series development is working on already. While employees at the subsidiary meet this expectation by, for example, securing buy-in from a headquarters business unit before launching a project, they nonetheless feel part of Silicon Valley and want to partake in novel ideas that may lie outside the scope of the company's series development department. However, the

subsidiary is often not utilised to carry out projects *"that make sense in that location"* (A-6), but are instead used as a *"free resource"* (A-6). This goes against the idea of making use of the *"location's unique advantage"* (A-6) and instead resembles (very expensive) outsourcing of development work.

A further issue relating to the expectation about the subsidiary's role is the idea of *innovation theatre*, i.e., large companies establishing a presence in an innovation cluster not for the purpose of actually gaining technological value from the region, but to instead appear innovative, new, and prepared for the future. This usually is not a conscious decision, but instead manifests itself in how top management treats the subsidiary, how seriously headquarters takes projects coming from the subsidiary, and how well projects are actually integrated into the company. For example, Subsidiary A is often *"misused by management to take a tour of Silicon Valley and experience digitisation up close"* (A-11), which is *"not the point"* (A-11). Furthermore, visits by top management have been described as a *"dog and pony show*[3]*"* (A-7). Management viewing the subsidiary as a public relations campaign suggests a conflict in the expectations by headquarters and subsidiary about the latter's role.

[3]A *dog and pony show* is defined as *"an often elaborate public relations or sales presentation; also: an elaborate or overblown affair or event"* (Merriam-Webster, 2019).

4.2 Case B

4.2.1 Subsidiary B Background

Subsidiary B was the first automotive corporate innovation subsidiary to be established in Silicon Valley. It was founded in 1995, with the original task of being a technology trend scouting facility with just five employees. It grew over time as different technologies became relevant in the area. For example, the topic of the dot-com boom was a contemporary trend that drove the subsidiary to hire more employees in the early 2000s, followed by consumer electronics, electric vehicles, connectivity, and autonomous driving. The subsidiary grew to 40 employees by 2000, 100 employees by 2010, and over 300 employees by 2019. With new technological trends, it became strategically beneficial to be present and engaged in Silicon Valley, resulting in the subsidiary shifting from conducting pure research and early-stage prototyping, to also carrying out more mature development work.

Furthermore, Company B headquarters (located in Germany) established a unit focussing on business innovation and new business models in 2007, incorporating this unit into the Silicon Valley subsidiary in 2012. In August 2017 this unit was reconfigured to become an internal incubator for the company (from here on called *Lab-B*), allowing all employees of Company B to submit business ideas and potentially receive funding and support to take this idea to market. Ideas from Lab-B can either be implemented within Company B, or spun-off as separate start-ups. In 2018, Lab-B was set up as a separate legal entity, to enable it to move faster and autonomously of headquarters.

4.2.2 Internal Embeddedness

To facilitate the process of knowledge transfer, Company B has introduced designated knowledge transfer personnel, both at the subsidiary and at headquarters, that foster the subsidiary's embeddedness into the organisation. On the subsidiary side, the knowledge transfer personnel consist mainly of expats who have strong connections to various headquarters business units and can bridge the gap between the two sides. They understand both the Silicon Valley and headquarters perspective and are therefore in charge of ensuring *"a smooth, transparent exchange of information"* (B-6), as well as *"that the innovations being scouted and developed in Silicon Valley actually fit into the company's technology roadmap and eventually end up in front of the customer"* (B-6). Projects taken to headquarters by expats *"have a higher chance of success because they have a champion"* (B-10). On the headquarters side, Company B established a designated unit to *"facilitate the collaboration model with*

[the subsidiary]" (B-6) and to ensure that the two parties *"are interlocked"* (B-6). Subsidiary B is part of Company B's headquarters R&D department and mainly conducts projects that have been specifically requested by business units in this department (B-9). The autonomy of the subsidiary is thus limited, which is similarly reflected by its budget mechanism. The budget is secured on a project-by-project basis from business units at headquarters which *"has benefits because you have dedicated funding to work on certain things, but it also has risks because it doesn't provide much opportunity to do much on your own"* (B-3). This budget mechanism results in the following *Catch-22* cycle: to pitch for funding for a project, the subsidiary needs a POC or a prototype to demonstrate its value, but this is difficult to achieve before having secured funding for that project.

Lab-B, the internal incubator at this subsidiary, does not *"fit into any divisional unit of the organisation"* (B-3), and so does not *"want to put any unnecessary risk into any group"* (B-3). To avoid having a single unit within the company shouldering the liability of incubating uncertain business ideas, Lab-B was split off as a separate legal entity in 2018 (B-4). This allows for more autonomy and faster decision-making, which reduces some of the obstacles that can stifle innovation (e.g., being slowed down by headquarters' bureaucratic processes). However, *"being a separate legal entity has its risks because you have to be a sustainable business on your own. Our funding mechanism is not 100% subsidised, so our projects that we garner, or gain will have to support the business"* (B-4).

4.2.3 External Embeddedness and Knowledge Sourcing

Subsidiary B was founded in Silicon Valley because *"we access the ecosystem through the office located there. That is why [the subsidiary] was founded [...]. I don't think doing this sort of thing from [headquarters] works. You need to really be part of the ecosystem and you need to be located in the region"* (B-6). This interview excerpt clearly demonstrates the importance of the subsidiary being well-embedded in its external environment. This allows the subsidiary to collaborate with start-ups and other players in the cluster, which is particularly important when headquarters *"don't have the competence in-house, such as for software projects"* (B-7).

Nonetheless, the subsidiary is aware that *"start-ups will not be our Tier 1 suppliers"* (B-6) because *"they cannot produce on that scale"* (B-6). Having start-ups collaborate directly with Tier 1 suppliers from an early stage *"enables [the start-ups] to ramp up and to have the expertise of someone that is able to convert something into being automotive-grade"* (B-4). To further mitigate the asymmetries between start-

ups and a global OEM, Company B does not enforce exclusivity for a project when working with a start-up. In other words, once Company B has taken a project to market, the start-up is free to also offer this technology to a competitor. The reasoning behind this is demonstrated by the following interview excerpt: *"The worst thing you can have, as [Company B], is putting an investment in a start-up and keeping them all for yourself because, at the end of the day, we are a small supplier of vehicles to the world"* (B-6). Instead, *"the success of a start-up is providing to all the world's vehicles and us benefitting from doing it first"* (B-6).

4.2.4 Actor Characteristics

Despite Subsidiary B being the first of the automotive corporate innovation subsidiaries in Silicon Valley (established in 1995), the first Company B executive did not visit Silicon Valley until 2015 (B-3). *"This was really an 'oh-shit' moment, in which everything changed"* (B-3). Indeed, *"this executive saw the digitisation that would be affecting the automotive industry first-hand"* (B-3), prompting a Company B executive meeting in Silicon Valley to raise awareness about Subsidiary B throughout the company. Now, *"[top management] are here [at the subsidiary] on a regular basis. We have board members here three times a year. [...] We are just having coffee with them, [...] it is very intimate"* (B-4). This is vital for knowledge transfer, given that *"if top management does not fully support [the subsidiary], then it is difficult to actually implement anything [at headquarters]"* (B-6).

4.2.5 Actor Relationship

"When people from Silicon Valley and [headquarters] series development encounter each other, expect a clash of cultures" (B-10). Throughout the cases in this thesis, the clash of cultures between the bureaucratic company headquarters and the small, agile corporate innovation subsidiary is strongly supported by various evidence. For instance, the following interview excerpts elucidate the basis of this clash of cultures at Company B:

> *Although we are all one organisation, it's not that they [headquarters] don't trust us [the subsidiary] as individuals, it's that the methodology, the approach that we have, is not something that they are used to. So that takes time to understand and accept and also to see what we are able to deliver. (B-4)*

Furthermore:

> *There is rejection of the people working at [the subsidiary] by the people working in [headquarters] series development. The series development*

> *people think: 'What have you guys ever actually brought into the car? Let us show you how to develop a car.', while the people in [the subsidiary] think: 'How slow are you? You will be disrupted tomorrow.' (B-10)*

This clash of cultures and consequent NIH syndrome result in low acceptance of subsidiary projects by business units at headquarters (B-4, B-6, B-9), and so the subsidiary *"really has to put effort into bringing their innovations to the right person in the company"* (B-9). Finding the right person in the company to take on projects is facilitated by having an expat leading the subsidiary and by having expats manage projects, to then *"champion"* (B-10) their project when they move back to headquarters.

4.2.6 Transfer Content and Mechanism

As similarly discussed for Subsidiary A above, interviewees at Company B support the view that software projects are easier to transfer than hardware projects, given that software projects have a *"shorter innovation cycle"* (B-6) and can therefore be integrated more easily into headquarters' roadmaps (B-3). Nonetheless, challenges of knowledge transfer persist.

Indeed, an interviewee at Company B headquarters suggested that, while the subsidiary *"does new stuff, like software and autonomous driving and infotainment, there is not enough of a connection with series development to ever do anything with it"* (B-7), resulting in the subsidiary *"designing PowerPoints"* (B-7), without implementing their technology at headquarters. This challenge of *Death by PowerPoint* is being addressed by moving the subsidiary ever closer to headquarters' series development department (see Section 4.2.7 below).

Other knowledge transfer mechanisms include regular communication between the subsidiary and headquarters, in order to *"foster this relationship and information exchange"* (B-6). Furthermore, the subsidiary gets exposure at headquarters through writing a regular newsletter, in which they avoid focussing exclusively on automotive and *"insinuating"* (B-3) any specific solutions. Instead, the newsletter aims to *"enable the others"* (B-3) because *"the big success of innovation is allowing someone to have the initial idea and supporting them to run with it"* (B-3). This spirit suggests a certain selflessness by the subsidiary in putting the innovation capabilities of the company ahead of their own desire for recognition.

As discussed, projects are often managed by an expat, who then has responsibility of bringing the project to headquarters and championing its implementation. However,

for projects not led by an expat, transfer is a lot harder: *"In this case, the project is presented at an innovation fair at headquarters, but usually nothing further happens"* (B-10), because series development does not take sufficient interest.

4.2.7 Further Considerations

Projects at corporate innovation subsidiaries are commonly split into the categories of *pull projects* and *push projects,* where pull projects are specifically demanded, i.e., *pulled,* by a headquarters business unit, and push projects are those in which the subsidiary has an interesting idea and pitches it to headquarters to *push* it into the organisation.

At Subsidiary B, the balance between pull and push projects is about 80/20 (B-7). The balance has been shifting ever more in favour of pull projects and has resulted in the subsidiary only being able to work on *"blue sky projects that are 25 years away [if they] have spare time next to pull projects"* (B-7). Generally, projects driven by the subsidiary (push) are handed over to the pre-development department at headquarters because these projects tend to be less mature and more exploratory (B-9). Pull projects, on the other hand, are usually demanded specifically by a series development business unit, given that they *"know exactly what they want and when they want it developed by"* (B-7). This results in the knowledge transfer between the subsidiary and headquarters being less linear and not a *"one-way street"* (B-6). Instead, projects are developed collaboratively, with knowledge generation and transfer taking place iteratively between the two parties (B-6).

Projects pulled from series development usually involve *"traditional R&D"* (B-4), such as improving existing vehicle mechanisms, while push projects involve *"new innovation concepts"* (B-4). The rise of pull projects suggests that the subsidiary is evolving to be closer to headquarters' series development department and is thus moving towards conducting incremental, rather than radical innovation. This development suggests a dichotomy in expectation between headquarters and the subsidiary about Subsidiary B's role. While a senior manager at headquarters believes that the subsidiary needs *"more structure"* (B-10) rather than being *"new and cool [...] without clear tasks and goals"* (B-10), a manager at the subsidiary supports the following view about the subsidiary's role:

> *You know you're doing a job right when you eliminate your entire job. And I think that's the most important thing here too. [...] Our success is when the entire organisation is doing it [innovation] naturally, and there is no need for us. And that is our objective. (B-3)*

While the subsidiary manager aims for the subsidiary to have a deep impact on the innovation capabilities of the overall organisation, the headquarters senior manager views the subsidiary as an extended workbench for series development—two contrasting expectations.

4.3 Case C

4.3.1 Subsidiary C Background

Subsidiary C was established in Silicon Valley in 2011 as a scouting facility consisting of three employees. The subsidiary had the original aim of finding new ideas and technology trends in Silicon Valley and sending them to headquarters in France for further evaluation and development. Today, the subsidiary consists of about 70 people, of which 50 are in charge of conducting research, while 20 are in charge of conducting open innovation activities.

Since its establishment in 2011, this subsidiary has evolved from mainly conducting scouting activities to also carrying out POC and prototyping work. This is done in collaboration with external companies, such as start-ups, as the subsidiary's key aim of being located in Silicon Valley is to source knowledge from other industries.

4.3.2 Internal Embeddedness

Subsidiary C consists of about 50% local hires and 50% expats who stay for two to three years before returning to headquarters (C-1, C-5). Part of the purpose of having expats at the subsidiary is to *"avoid differences in expectations between the mothership and the Silicon Valley office"* (C-3), which can arise given the cultural differences between an entrepreneurial, risk-friendly, fast-moving innovation subsidiary, and bureaucratic, risk-averse, slow-moving headquarters. The benefits of the expat rotation programme are further described by an interviewee:

> *We [the subsidiary] are so far from headquarters you can talk every day, but still you are not there. Right now, we have a new guy from headquarters and he has all this information, so we are jumping on him. Like 'Who is thinking about this? Who is thinking about that?' Just because the team [in Silicon Valley] knows he still knows all this. [...] At the same time, you are so disconnected from the headquarters that you need some people who are well-integrated there to make it work. (C-1)*

Knowledge transfer is inhibited by the subsidiary often lacking a network in headquarters and thus not knowing whom to talk to: *"On [the subsidiary's] side it is more or less clear who [the counterpart for knowledge transfer] is. But from headquarters' side it is less clear. You cannot just talk to anybody"* (C-1). By providing this vital network in headquarters, expats facilitate knowledge transfer.

This subsidiary changed leadership in March 2018. The new head of the subsidiary has placed more emphasis on the challenges of knowledge transfer and has therefore introduced two new personnel roles to help ease this process: the role of Chief Technology Director (CTD) and the role of Innovation and Operations Director (IOD). The CTD is in charge of *"upstream activities"* (C-3) such as *"finding and understanding cutting-edge technology"* (C-3) from external actors like start-ups and universities, and making key decisions such as: *"This part should be done in-house, and this should be sourced from the outside"* (C-4).

The IOD's role, on the other hand, is to *"bridge the gap between Silicon Valley and [headquarters]"* (C-3). The IOD is in charge of bringing project outputs from the subsidiary to business units at headquarters to make sure *"something gets done with it"* (C-3). The role of the IOD is *"very important for the outcome of this lab because if projects are not transferred to the mothership, then nothing happens"* (C-4).

Subsidiary C has a fairly autonomous budget, with which it can freely conduct prototype and POC development. The details, benefits, and drawbacks of this system are described by an interviewee:

> *What [the founder of the subsidiary] did very well, but what causes a lot of problems at the same time, is negotiating autonomy for the lab. We can decide on our own what project we want to start, and we do not need an approval of a business unit [at headquarters] to start a project. We have our own budget, so the decision is taken just by [the head of the subsidiary]. It is easier when you come [to the business unit] and you can show something. It can look ugly, it can have tonnes of wires around it, but it is a working prototype. It is easier to have something tangible to show. At the same time, it causes a different kind of dilemma, when you come out of nowhere to a business unit saying: 'Hey, we have this cool stuff.' In many cases, they say that that's not how they want it. So, it turned out that it is a very good thing in comparison to many other [innovation subsidiaries], because you can move faster, but sometimes you are too fast. And so now we try to work more with business units from early stages of the process to get their buy-in earlier. (C-1)*

While the autonomous budget mechanism allows the subsidiary to move fast, its internal embeddedness is compromised as a result. To improve internal embeddedness while maintaining its autonomy, the subsidiary is thus trying to involve headquarters in projects from an earlier stage, to enable business units to take more ownership over the projects, thereby increasing the chances of successful transfer (C-1).

4.3.3 External Embeddedness and Knowledge Sourcing

As mentioned, this subsidiary consists of 50% local hires and 50% expats from headquarters (C-1, C-5). While local hires do not outweigh expat hires, according to an interviewee at this subsidiary, the *"reason for being here is really to hire local talent"* (C-1). This is because:

> *Silicon Valley has a very specific mindset and style and you need to know the ecosystem. And [expats from headquarters] come here and they have no idea how Silicon Valley works. [...] In my opinion, there is no point in having only expats here just because, if you do that, what is the reason for being here? (C-1)*

Company C's motivation for setting up a corporate innovation subsidiary in Silicon Valley involves the benefit of learning from external actors, especially from a range of industries. This drive is discussed by an interviewee at the subsidiary:

> *Automotive is an interesting space to be and there are lots of convergences with entertainment, with energy right now in terms of electric vehicles, with IoT [internet of things] [...]. Automotives are historically super bad at this. I mean, it is not their core business, they have no idea how to do these things. So, in order to do these things, you need to kind of outsource those capabilities from other companies. And that is the main driving force behind being here [in Silicon Valley]. (C-1)*

The main type of company the subsidiary outsources these innovative capabilities to is start-ups. Working with start-ups can be challenging as the start-up's technology needs to fit into a larger system, usually supplied by a traditional automotive Tier 1 supplier. To ease this process, the subsidiary can engage a Tier 1 supplier in the collaboration with the start-up because *"it is more effective to let a Tier 1 buy it from the start-up"* (C-5). Indeed:

> *We realised that some of the projects are impossible without suppliers. Or they are possible, but it makes it hard if we need to change something [...]. So, we have partnerships with the few Tier 1 suppliers that have innovation offices here [in Silicon Valley]. (C-1)*

This collaboration model holds multiple benefits for the subsidiary: firstly, it attracts more start-ups to the subsidiary because it offers a clear growth path to the start-up. Secondly, it reduces the risk of wasting resources by working with the start-up because the Tier 1 supplier can more easily plan on integrating the technology into its existing systems from an early stage.

4.3.4 Actor Characteristics

Having support from Company C executives is *"very conducive"* (C-4) to the relationship and the knowledge transfer between the subsidiary and headquarters. In the interest of improving transparency and trust between the two sides, the Company C CEO visited the Silicon Valley subsidiary in July 2018:

> *It is very rare for the CEO to visit an R&D location. We were very proud and the people here [at the subsidiary] were excited. It motivated them. He listened to our issues and will bring this experience back to the mothership. Hopefully he will be supporting us in future as well. (C-4)*

Other higher-level managers at headquarters' series development department visit the Silicon Valley subsidiary more often, about *"once a quarter"* (C-5), and sometimes *"every month"* (C-5), when a project requires it.

4.3.5 Actor Relationship

Subsidiary C has, as of 2019, *"not yet delivered any outcomes"* (C-4) that have ended up on the market, resulting in headquarters not having *"much trust in us [the subsidiary]"* (C-4). This issue, paired with the notion that *"naturally, the mothership wants to do everything"* (C-3), has resulted in a strong NIH syndrome of headquarters towards the subsidiary.

Other fundamental cultural differences are adversely affecting the relationship, and thus the knowledge transfer, between subsidiary and headquarters. For instance, there is a *"difference of speeds. [...] On [headquarters'] side, you have to go through bureaucratic processes, so [headquarters] are much slower compared to the Silicon Valley team"* (C-5). On the other hand, *"the Silicon Valley team is similar to a start-up. They can implement their products the next day"* (C-5). This difference of speeds results in frustrations on the subsidiary side, as headquarters lags behind in implementing ideas offered by the subsidiary. Frustrations on the headquarters side result from a different cultural issue:

> *The Silicon Valley culture is that the people are getting in and out of jobs quickly. So there are some projects that, while in the transfer phase, we [at headquarters] might have some questions for the people in Silicon Valley, but the key contact person is already gone, so we just have to stop that project. (C-5)*

The demonstrated obstacles to a functioning relationship between the two sides result in a *"gap of mindset"* (C-5), as well as a *"gap of goals"* (C-5). As discussed,

as of March 2018 the new head of the subsidiary has introduced the position of an Innovation and Operations Director (IOD) to facilitate the relationship between headquarters and the subsidiary. However, the effects had not yet been felt by early 2019, when follow-up interviews were conducted.

4.3.6 Transfer Content and Mechanism

Subsidiary C highlights the benefit to knowledge transfer of demonstrating tangible value by developing a working prototype with *"tonnes of wires around it"* (C-1) rather than preparing a slide presentation. Furthermore, a key issue relating to transfer content and mechanism highlighted by interviewees involves timing of said transfer. Indeed, *"the problem is the lead-time because you need to feed into this [development] cycle. You can finish a POC, but the cycle is already in the middle, so they [headquarters] are not able to take it into the cycle"* (C-1). While projects relating to software, sales, or after-sales are easier to accommodate at various points in the development cycle (C-1, C-2, C-5), when projects from the subsidiary *"feed into the roadmap, [...] you really need to ensure a two-way street. They [headquarters] need to tell you [the subsidiary] what they are working on and you say what you can feed in, and when"* (C-1).

Company C implements various formal and informal mechanisms to facilitate the transfer process, such as regular visits between headquarters and subsidiary employees. While *"there is not one recipe"* (C-1) for managing the knowledge transfer, a key ingredient is discussed by an interviewee:

> *It is really constant, constant communication and that is what I keep telling to the team. You need to communicate. You cannot just show up once every half a year infront of a business unit [at headquarters] and say: 'Hey, we have this great project.' You really need to talk to them week, by week, by week, so you have these good relations and an understanding of what is happening on both sides. Because we do not have any control over the [development] cycle. (C-1)*

4.3.7 Further Considerations

To gain support from headquarters top management, the Silicon Valley subsidiary demonstrates projects and their value to executives. However, according to interviewees at Company C headquarters' series development department, the subsidiary *"often demonstrates one aspect of the [project] scenario and not the entire scenario"* (C-5). This means that *"the executives understand only what has been done, but*

they do not see that almost everything has not yet been done" (C-5), resulting in top management having unrealistic expectations about the ability of headquarters series development to integrate the project into a vehicle. The executives are left believing that *"everything can be done"* (C-5), when in reality *"it's not that easy and not true"* (C-5).

This gap between what the subsidiary promises Company C executives and to what extent these projects can actually be implemented by headquarters series development results in friction between series development and the subsidiary. *"Both teams have to show their presence"* (C-5) which is difficult when the subsidiary has *"an interesting idea and they gather good feedback from executives, but actually it is not easy to do, or not possible, not realistic"* (C-5), making it look as though the project's failure is caused by the series development department's inability to integrate it.

The above issue can result in unrealistic expectations of Company C executives about the role of the subsidiary. While the subsidiary is *"upstream"* (C-5), focussing on early-stage research, executives are given false impressions about the maturity of the projects being conducted. Thus, top management sees the subsidiary as being more closely related to headquarters series development, when in reality the subsidiary *"often only tests their ideas on a simulator, not on an actual vehicle, and not in an actual environment, so [...] they don't understand the real problems we [headquarters] encounter in the real world, with real people"* (C-5).

A further misunderstanding between the subsidiary and headquarters results from a key performance indicator (KPI) used by the subsidiary: a failure KPI for *"how many ideas we have to kill"* (C-1). This concept aligns with the entrepreneurial culture of Silicon Valley: failure is acceptable and encouraged, as long as lessons are learned. However, this failure KPI is *"super hard for headquarters to understand. Like: 'What? Failure KPI?' But it's very important to us [at the subsidiary]"* (C-1).

4.4 Case D

4.4.1 Subsidiary D Background

Subsidiary D was first established in 1998, making it one of the first automotive corporate innovation subsidiaries in Silicon Valley. The subsidiary started out as a listening post with just three employees, in charge of being the *"ears on the ground and eyes on the ground"* (D-2), reporting technology trends to Company D headquarters. In particular, at the time the company was interested in learning more about silicon chips and the internet, and how these technologies might be relevant for the automotive industry. In order to expand the scope of their activities in Silicon Valley, the subsidiary grew to around 50 employees by 2005, with the added task of developing prototypes, rather than just focussing on trend scouting.

Since then, the subsidiary has grown to almost 200 employees, making it the company's biggest research facility outside its home country (Germany). The subsidiary is made up of a large variety of engineers, designers, scientists, psychologists and more, and is now carrying out research, pre-development, series development, and, in the case of digital and software projects, even full production. In particular, the subsidiary focusses on collaborating with local partners, particularly start-ups and universities.

4.4.2 Internal Embeddedness

In the last five years, Subsidiary D has consciously been trying to reduce its number of expats because, while on the one hand, *"expats are the network to the mothership and that should not be underestimated"* (D-8), they are also *"extremely expensive because they have very good contracts"* (D-8). Furthermore, *"if you have 20% expats you also have 20% knowledge loss after a while. This is tough because you have a high mobility of the workforce in Silicon Valley anyways, so you have a lot of knowledge loss anyways, as people rotate"* (D-8). Having too many expats exacerbates the knowledge loss. Thus, the subsidiary has reduced its percentage of expats from 100% when founded in 1998, to 25% in 2005, and to just 5% in 2019 (D-8).

Company D is made up of multiple brands, as is common across many automotive OEMs. The subsidiary caters to multiple of the company's brands, but often conducts projects for specific brands separately, without sharing results across the whole organisation. In 2013, one of these brands established a unique organisational feature at its headquarters to aid the collaboration with the subsidiary: an *Innovation Circle*, consisting of representatives from different departments across the

organisation who can help assess a project from the subsidiary and decide whom at headquarters to transfer it to (D-5). Among others, the Innovation Circle includes representatives from product management, marketing, the subsidiary itself, purchasing, and heads of various series development business units, who may become the future owner of a project.

Before establishing this Innovation Circle, transferring projects from the subsidiary was *"random, unstructured, and based on networks"* (D-5). Now, while some projects are still transferred using subsidiary employees' personal network at headquarters, the Innovation Circle presents a structured way of *"catching"* (D-5) projects from the subsidiary and making it easier for the subsidiary to *"penetrate the organisational boundary"* (D-5). Other brands at Company D still follow the *"entirely network-based"* (D-5) approach to knowledge transfer, which can result in the subsidiary not feeling like a core part of the organisation if they lack a personal network in a specific topic area.

To fund its projects, Subsidiary D employs a dual-budget system:

> *We have one component, which is roughly 40%, that is our base funding. That is the base amount that we get every single year, that we can use for research projects that we are proposing. And then roughly 60% of our funding is what we call 'bilateral project funding', where [headquarters] specifically request us to work on a specific topic on their behalf and they have to pay for that. That does not come out of our yearly base funding, that is straight-forward project funding. (D-2)*

According to the head of the subsidiary, finding funding from a business unit at headquarters is a deliberate strategy for knowledge transfer (D-3). While speed is the most important factor in the early stage of a project (thereby warranting the use of the autonomous base budget), finding *"co-investors"* (D-3) from a headquarters business unit becomes vital as the project matures, as this secures an internal customer and eventual recipient of that project. Having a dual-budget system is a *"systematic way of improving the success chances of a transfer"* (D-3).

4.4.3 External Embeddedness and Knowledge Sourcing

A key aim of Subsidiary D is to hire locally (D-1, D-8). The motivation behind this is the talent from a range of industries available in Silicon Valley:

> *Almost 80% of the people that work for us [the subsidiary] are not from the car industry. They are coming from other places and other industries. Being able to use their expertise and their outside perspective and*

> *translating it into our industry really creates a lot of respect for the team that we have created here. And with that we get a lot of open ears [from headquarters]. (D-2)*

As can be discerned, hiring local talent not only improves the subsidiary's embeddedness into its local environment, but also fosters its credibility and standing within headquarters.

Furthermore, the subsidiary's purpose is to gain *"access to the ecosystem"* (D-1), where ecosystem refers to the *"start-ups, [...] the mindset, [...] the meet-up events"* (D-1). Engaging with the ecosystem is vital, given that *"if you only go to Silicon Valley once or twice a year, you won't take the spirit back"* (D-1), the spirit being less *"fail-safe"* (D-1) than the traditional automotive culture. Instead, the subsidiary aims to embrace the idea that *"when you fail, it is nothing bad as long as you learn from it"* (D-1).

Being embedded in its external environment enables the subsidiary to collaborate with, and source knowledge from, local companies which is highly desirable, given that *"it is actually more beneficial to work with an outside firm than trying to reinvent the wheel inside the company itself"* (D-2). A key way of looking outside is to work with start-ups in Silicon Valley because this enables *"faster and cheaper innovation"* (D-6). However, as Company D headquarters is *"not that good at working with start-ups yet"* (D-6), the subsidiary tries to ease the process by first considering which Tier 1 supplier will eventually integrate the start-up's technology into a scalable system and further facilitating the relationship between the start-up and that Tier 1 supplier (D-5).

4.4.4 Actor Characteristics

The subsidiary requires employees with varying characteristics. On the one hand, employees with a technical background are necessary for *"developing productive analytical solutions"* (D-1). However, these people are not usually *"in direct contact with the business"* (D-1) because they often lack the skills to be *"communicative, open, and willing to explain technical stuff in detail to someone who is new to it"* (D-1). For this purpose, the subsidiary also employs project managers, who *"have skills in negotiating and talking to [headquarters]"* (D-1), thereby closing *"the gap between both sides"* (D-1).

On the headquarters side, it is particularly important that the top levels of management support the subsidiary, because, according to an interviewee at the subsidiary,

"if anybody ever tells you that you can get buy-in [from headquarters business units] without the C-level [CEO, CTO, etc.], I have not seen that in my 11 years in Silicon Valley" (D-2). Without buy-in from the headquarters business units, knowledge transfer is impeded, as projects from the subsidiary do not have a committed recipient. To improve the C-level's awareness of, and support for, the subsidiary, executives conduct visits during which *"[the subsidiary] has [the executives] fully captive"* (D-2), and the subsidiary can thus pitch projects without the headquarters' representatives being distracted by *"their day-to-day work"* (D-2).

4.4.5 Actor Relationship

A key issue affecting the transfer of knowledge from Subsidiary D to headquarters is the *"human factor"* (D-3), in particular the NIH syndrome. In the words of the head of Subsidiary D:

> *Nobody will look you in the eye and say: 'I am not taking over this project because it was not invented by me.' Instead, they will find a lot of other reasons for why the project cannot be taken over. Until you actually find out that the real reason is NIH, this takes a long time. [...] The pride of developers at headquarters is too strong. This is a problem that is impossible to eliminate because, at the end of the day, you are working with people. (D-3)*

When projects from the subsidiary are not taken on by headquarters business units, this prevents the subsidiary from demonstrating its credibility. In turn, *"business units won't directly finance a project without knowing the credibility of the [subsidiary]"* (D-8). Thus, the NIH syndrome is not only preventing projects from the subsidiary from being transferred to headquarters, but is preventing the financing of new potential projects. Instead, headquarters still maintains the mindset that: *"It is good to have the [subsidiary] and I like them and I get inspired by them, but regardless, the decisions are made at headquarters. [...] Why should those guys in Silicon Valley tell me what to do?"* (D-1).

The relationship between the subsidiary and headquarters appears to be characterised by envy, competition, threat, and resentment. The IT department of the subsidiary was founded as an alternative IT to that at headquarters. As discussed by an interviewee in this department:

> *It was an initiative from our CIO. He said we need a sort of 'second IT', but there is no way to really give it a good name. You can't really say the 'slow' IT [at headquarters] and the 'fast' IT [at the subsidiary],*

> *[...] because the others [at headquarters] get offended. So instead, we just have two ITs. (D-1)*

Furthermore, the following interview excerpt points to the envy felt by headquarters towards the subsidiary employees:

> *You can imagine, coming from a small town [at headquarters], how people think when your colleague leaves to San Francisco and is doing cool stuff. What would you think? 'Ah this guy, such a nice life. He is doing cool [stuff]. So much freedom.' And then six months later, you call him and say: 'Hey, I have a perfect idea, and actually, your boss liked it, so now please take it back and do it.' How do you give the feeling to the people at home who are doing a great job every day, and it is just not as sexy as our job, how do you give them the feeling that they are not the team from the bench when it comes to IT innovation? (D-1)*

The relationship, and the knowledge transfer, between subsidiary and headquarters is further strained by the inherent cultural differences between the two parties. Headquarters has *"lots of requirements when it comes to security"* (D-1), leaving *"lower space for exploring new things"* (D-1). Given the nature of their jobs, headquarters' employees follow the mindset of *"don't make a mistake. Make sure this car is running, because, ultimately, we don't want to have our customers get hurt"* (D-1). While this is vital for the safety and success of the vehicles produced, the subsidiary follows the mindset that they *"just want to show that it works"* (D-1). As a result, it is headquarters' job *"to get on [the subsidiary's] nerves"* (D-1).

At many companies discussed in this study, expats serve as a bridge between headquarters and subsidiary and can help mitigate relationship issues. However, as mentioned, Subsidiary D is focussing on reducing the proportion of expats, given their expensive contracts and the knowledge loss occurring when they rotate back to headquarters (D-2, D-8). In the context of knowledge transfer specifically, expats are considered *"a soft factor"* (D-3). They *"can be helpful, but they do not guarantee a successful transfer"* (D-3). Given this uncertainty, it is considered too risky to rely on expats for knowledge transfer, resulting in the subsidiary having organised its knowledge transfer *"independently of expats"* (D-3).

Given the reluctance of relying on people to fix people issues, it was suggested that *"having structured processes in place, and understanding how decisions at headquarters are made, can help mitigate the human challenges of transfer"* (D-3). However, structured processes further complicate the bureaucracy and resulting lack of speed in decision-making at headquarters.

4.4.6 Transfer Content and Mechanism

At Subsidiary D, early stage POCs are usually conducted using the autonomous base budget and are then presented to a business unit at headquarters to pitch for further funding. Firstly, conducting the POCs with their base budget *"saves time in the early steps of a project"* (D-5). Secondly, having something tangible to present to headquarters allows the subsidiary to demonstrate the value of their projects better and thereby avoid *"Death by PowerPoint"* (D-2), a problem that can occur when ideas are presented using a slide presentation rather than a POC because *"you cannot bring back technology with a slide deck"* (D-1). The predilection for developing POCs has gone so far that *"there is this goal, that no one does PowerPoint at [the subsidiary]"* (D-1). While this idea *"doesn't work out"* (D-1) in practice, it demonstrates the importance of presenting tangible value to headquarters' business units for successful knowledge transfer.

A further consideration during knowledge transfer involves how the project *"fits into the typical timeline of new vehicle development"* (D-2). Getting the timing of transfer to match with a gap in the development cycle involves tight collaboration and communication, i.e., a two-way street, between the subsidiary and headquarters:

> *Sometimes it is us [the subsidiary] asking: 'Hey, we are ready to hand over because we have done our part and now you need to take it for the rest of the way.' Or sometimes they [headquarters] say: 'Hey, we are ready now to include it in our production process.' (D-2)*

Mechanisms in place to facilitate this collaboration and communication between the subsidiary and headquarters include *"travelling to [headquarters] frequently to work with teams on the ground"* (D-2), having representatives from headquarters visit the subsidiary (D-2), daily calls with headquarters (D-1), and a *"trade show"* (D-2) within headquarters, where all the company's R&D teams show off their projects to the C-level suite (D-2). However, while these trade shows provide an excellent opportunity to raise awareness about the subsidiary's work, an interviewee raised the following concern about them: *"Series development managers are then meant to choose projects at the trade show that they want to take on, but this doesn't realistically happen"* (D-7). This reluctance can be ascribed to a lack of interest in new, external ideas by the headquarters business units (D-7).

4.4.7 Further Considerations

Being part of headquarters' R&D department, this subsidiary splits its projects into two main categories: those considered *research* (i.e., earlier stage, later time horizon)

and those considered *development* (i.e., higher maturity, closer time horizon) (D-2, D-8). The subsidiary currently has a 50/50 split between research and development projects. The fairly high proportion of development projects *"goes against the original purpose of the [subsidiary]"* (D-8); its original purpose being more exploratory and early-stage.

The development projects tend to be *"direct requests from headquarters"* (D-2). Indeed, *"ideally, the results from the [subsidiary] will be transferred into series development"* (D-6) at headquarters because this improves the chances of the subsidiary's results eventually ending up in a vehicle. However, to be able to transfer projects directly to series development business units at headquarters, the subsidiary needs to ensure that their projects are developed to a certain level of maturity, thus explaining the subsidiary's shift to incorporating more and more development projects over time. This shift is further justified by the following interview excerpt: *"If it takes too long for an idea to be implemented into a vehicle, it hurts your reputation and it demoralises your workforce. They want to see their stuff in the vehicle"* (D-2).

An interviewee at Company D headquarters supports the subsidiary shifting closer to series development, away from early-stage research:

> *The subsidiary used to work without clear tasks and goals and without clear OKRs [Objective Key Results]. When they were new and cool they could do this. Now there needs to be more structure [...] because there needs to be more responsibility for doing series development work at the [subsidiary], so that integration into headquarters is easier. (D-7)*

Thus, despite it being *"too expensive to do mainly development in Silicon Valley"* (D-8), this subsidiary, like many of the others discussed in this study, has been moving in the direction of series development, rather than sticking with its original exploratory purpose.

4.5 Case E

4.5.1 Subsidiary E Background

Subsidiary E was established in Silicon Valley in 2007 with two employees, to improve the company's proximity to experts in the field of consumer electronics, thereby facilitating the integration of consumer electronics into Company E vehicles. While Company E has its headquarters in the USA, the company nonetheless sought to establish a technology scouting office in Silicon Valley, given the region's growth in expertise not just for consumer electronics, but mobility generally. The scope of the subsidiary has since been to enable the company as a whole to learn how to work with early-stage start-ups, to find technologies that may be interesting to the company in future, and to scout potential talent for the company to hire. The subsidiary serves as the *"eyes and ears on the ground in Silicon Valley"* (E-2).

Since 2007, the subsidiary has never employed more than seven people at one time. While size and purpose of the subsidiary have not changed much, its methods for scouting for relevant start-up companies has developed. As of late 2016, Subsidiary E has been partnering with a Silicon Valley start-up accelerator, i.e., an organisation that offers fixed-term programmes in which it provides a range of seed investments, mentoring, and commercial connections for start-ups (E-1). Company E is partnering with this accelerator in order to find interesting start-ups to work with and mentor. The accelerator has introduced a separate *mobility* track for start-ups to apply to, with Subsidiary E being involved in the selection process for this track.

4.5.2 Internal Embeddedness

As with other cases in this study, this subsidiary's embeddedness into the organisation is key for knowledge transfer:

> *You have to make sure that the people out here [at the subsidiary] understand how the mothership operates. It doesn't do you any good to have a bunch of people out here coming up with great ideas, who then can't communicate back to the mothership. So it is really important for all my people to not only be well-networked in Silicon Valley, but also to have good connections back to other groups at [headquarters]. (E-3)*

While other subsidiaries manage this internal network through expats from various headquarters departments that continuously rotate through the subsidiary, this is not possible at Subsidiary E, given that it currently only has three employees, none of whom are expats on rotation (E-3). As *"good internal connections [...] take*

forever to build up" (E-3), the employees at this subsidiary spend a lot of time engaging with various departments at headquarters by making phone calls, visiting in-person, and writing a weekly newsletter (E-4).

4.5.3 External Embeddedness and Knowledge Sourcing

The allure of Silicon Valley, and the resulting reason for Company E choosing this location for an innovation subsidiary, are described by an interviewee:

> *It's not just that Silicon Valley has start-ups. The reason there are start-ups is because there is a strong venture capital community, a strong community of corporations that have people who either want to do start-ups or who want to pull start-ups in, and a strong university community where you have a lot of innovative people. (E-3)*

Company E wanted to be close to this agglomeration of innovative actors, to *"not just react to trends, but to drive them"* (E-3). Being located in Silicon Valley thus allows the subsidiary to source knowledge from local actors more easily than if it attempted to access the ecosystem from the outside.

As mentioned, one strategy for engaging with its external environment has been to form a partnership with a Silicon Valley accelerator, the reason being that the subsidiary's three employees are spread thinly in their scouting efforts across Silicon Valley. The accelerator provides a concentrated selection of mobility-relevant start-ups for Company E to potentially work with:

> *We [the subsidiary] figured out that we wanted to get into working with earlier stage companies. We realised that this was a gap. We would frequently find early-stage companies and have people [at headquarters] say that: 'The technology sounds exciting, have them come back to me in two years when they're 'automotive-ready'.' And I think that's the wrong answer. So, it was like: 'How do we work better with early-stage companies, knowing that early-stage companies are very different than later stage companies?' We said: 'Well, one of the things about early-stage companies is that it's a lottery, so we need to work with someone who is familiar with early-stage, who knows how to pick potential winners.' And so, we went around looking for different accelerator partners. (E-3)*

While partnering with this accelerator is helping the subsidiary find more start-ups, these start-ups are unlikely to become Tier 1 suppliers for Company E:

> *One of the reasons that we try to get past or get around some of these process barriers [at headquarters] is because the processes are all set up*

> *for stuff that is going straight into production. It's about sourcing a million axles. And what we're doing is, we're talking to start-ups about: 'Let's try a new thing.' We don't know if this is ever going to go into production. But we need a way to work together quickly, right now, [...] and understand that this might go nowhere. (E-3)*

Instead of directly sourcing *"a million axles"* (E-3) from the start-ups it works with, Subsidiary E determines how best to proceed with a start-up on a case-by-case basis (E-4). If the technology requires further R&D help, the subsidiary connects the start-up to a relevant contact at headquarters' research team, as the subsidiary itself does not have the facilities or the capabilities to take this step itself (E-4). If the start-up requires further funding, Company E has a corporate venture capital (CVC) unit at headquarters, which the subsidiary can connect the start-up to (E-4). If the start-up has a fairly mature technology, the subsidiary will introduce the start-up to an existing Tier 1 supplier who can then provide more details on specific automotive requirements and potentially help integrate the start-up's technology into a wider system (E-4). Introducing the start-up to an existing Tier 1 supplier helps Company E *"get to market faster than just working with a start-up"* (E-4) because the whole supply chain can be considered, and the start-up's technology can be integrated into a larger system, from an early stage.

4.5.4 Actor Characteristics

Subsidiary E has experienced a similar reaction by headquarters' employees to visiting Silicon Valley and seeing the subsidiary first-hand as other cases discussed in this chapter: *"We had a workshop where we brought people out here to understand Silicon Valley. [...] People have come out here now, and been exposed to what we have been talking about for years and are like: 'Wow!' It's a very different experience"* (E-3). Having headquarters understand Silicon Valley and the subsidiary's work first-hand is key for gaining *"really strong buy-in from the mothership"* (E-3). This buy-in, in turn, heavily affects the success of knowledge transfer from the subsidiary to headquarters because one needs *"people back home who are like: 'Yes, this is important, we are going to have somebody whose job it is to pay attention to make sure [the subsidiary] produces something useful.'"* (E-3). If there are no champions for the subsidiary at home, headquarters might *"just send people out [to Silicon Valley] and say: 'Let us know if you find something', but aren't really saying: 'We're here to catch.'"* (E-3).

In addition to buy-in and support from headquarters, a key actor characteristic affecting the knowledge transfer is headquarters' bureaucracy—a prominent obstacle

when the subsidiary is trying to mediate a potential collaboration with a start-up: *"As a large company, we have some large, heavy-weight processes, which doesn't always work well for a small company that we're trying not to kill"* (E-3).

Indeed, these heavy-weight processes result in slow decision-making which carries with it the added challenge of *"keeping people engaged over the length of time that it takes to get something to happen"* (E-3). While headquarters is working through the decision-making process of whether and how to engage with a start-up, the start-up needs to have *"something else to do, like another customer who is actually paying them, so that they are not just waiting for us. Because otherwise they go out of business"* (E-3). Similarly, if the start-up is not yet *"automotive-ready [...], headquarters has to be kept engaged"* (E-3) until the start-up is *"prime-time"* (E-3).

4.5.5 Actor Relationship

At Company E the NIH syndrome constitutes a challenge to knowledge transfer:

> *When you're a researcher you have to keep your head down and do your work. [...] But I think that the longer you have been in business, it is just more and more obvious that not all of the good ideas come internally from your own company. And you have got to have a good way of working with outside people, keeping track of what ideas are out there and helping them grow. (E-3)*

Being an automotive OEM, this is particularly difficult because *"we're not used to doing this"* (E-3).

To improve the relationship with headquarters and thus help counteract the NIH syndrome, the subsidiary assigns mentors from Company E headquarters to start-ups that it wants to collaborate with (E-2, E-3). Mentors from headquarters are often *"technical experts"* (E-3), but can also take on a more general role of helping the start-up navigate the complexities of a large automotive company. This is not only beneficial for the start-up, but also helps Company E *"to understand about outside innovation, understand about establishing those kinds of relationships, being helpful, working with outside companies"* (E-3), and generally how to work with early-stage start-ups.

While working with start-ups presents a valuable opportunity for Subsidiary E, it also poses a challenge given the *"differences in culture"* (E-3, E-4) between start-ups and an automotive OEM. Part of the subsidiary's role is to balance these cultures and to manage the expectations of both headquarters and the start-up. An example

of the type of culture clash the subsidiary needs to deal with is described by the following interview excerpt:

> *We [the subsidiary] have got start-up companies that would like to work with our [...] data. But we've got to get approval, which is fine, and I totally agree with that, but we tell them [at headquarters]: 'Look, the kind of approvals that you put in... These guys [at the start-up] just want a small, anonymised data set to do some testing. It's different from asking for a full data set of real-time data.' And the approval process should reflect that. If we want to learn what we can do with our data and we think that outside people are going to come up with clever ideas, maybe we should come up with a lighter-weight process, so more people can do it. (E-3)*

This example shows what start-ups and automotive OEMs can potentially gain from each other. Where an OEM has a wealth of experience and data, it does not necessarily know what new opportunities lie hidden in the data. Yet, Company E is hesitant to allow external companies to use its data, *"mainly because as an automotive company, we have never had data to share. Mostly it's been physical assets"* (E-3). Thus, part of the subsidiary's purpose is to provide the bridge between headquarters' resources and start-ups' innovative capabilities to use those resources, i.e., balancing the start-up and corporate culture.

Not only is there a culture clash between headquarters and start-ups, but between the subsidiary and headquarters, as the subsidiary functions more like a start-up than the multinational company it is a part of. The following interview excerpt exemplifies this fundamental culture clash which can inhibit headquarters from taking ideas from the subsidiary seriously:

> *You talk to people who come from [headquarters] and one of the guys [at the subsidiary] likes to ask them: 'Have you ever used Uber or Lyft*[4]*?' A lot of the older guys say: 'No.' Their issues are different. [...] Their response is like: 'What are you talking about? Sharing a ride? Calling some random person to take me? Why would I want to do that?' And then I'm like: 'You guys live places where there is good parking all the time and it is not hard to get around. You all have cars. You don't understand what it is like. People want this service.' (E-3)*

[4] *Uber* and *Lyft* are two widely-used ride-sharing service companies.

4.5.6 Transfer Content and Mechanism

The subsidiary's *"biggest pet peeve"* (E-3) is that transfer of projects can only be successful if the lead times of the vehicle development process are carefully observed. If the subsidiary has a project that they want to transfer, the subsidiary needs to go through the following process:

> *We need to be thinking right now about what programme we want to put [the project] into because we have to have X number of months lead time to get something into a programme. And if we know they [headquarters] are going to take, let's say, 18 months to get their product out, then what [programme] could we put [our project] into that is 18 months away from happening? (E-3)*

Roadmapping at Company E is *"first in, first out"* (E-3), resulting in current technologies being added to the bottom of the priority list at headquarters. This is a problem because, for example, *"if you have a USB port on your computer, you don't want to have to wait five years for it to show up on your car"* (E-3). Planning ahead to make sure that technologies are integrated into the vehicle not too long after they reach other markets is thus an important factor impacting the transfer of projects from the subsidiary to headquarters.

As with other cases in this study, the key mechanism for facilitating knowledge transfer is communication. Subsidiary E sends a weekly newsletter to its network at headquarters, updating the network about new start-ups that have been scouted (E-4). Additionally, the subsidiary conducts frequent, regular phone conversations and in-person visits with headquarters to maintain the relationship (E-2, E-3, E-4).

4.5.7 Further Considerations

Company E headquarters employs a *"talent circulation"* (E-4) programme, in which employees at the management level of the research department are rotated to the series development team for a few months and vice versa. This aims to teach fundamental researchers more about *"user experience, the mindset of engineering, doing research with a market focus in mind"* (E-4). Conversely, it aims to teach series development engineers more about *"fundamental science and how to work with a longer time horizon in mind"* (E-4).

This talent circulation is beneficial for Subsidiary E. As projects are usually transferred from the subsidiary to the research team which eventually transfers them to series development, it helps for all teams along the chain to understand the others'

priorities and aims. Without the understanding of the long-term view of research and the security and reliability requirements of series development, securing *"buy-in from the mothership"* (E-3) is difficult. For one, the employees in series development, who will eventually take over the project, may not understand that early-stage research projects do not yet have all problems figured out and may only be a POC. Similarly, employees in the research team may lack an appreciation of the pressure on series development to develop secure, reliable technologies that can feasibly be mass-produced. Thus, each party understanding the others increases the chances for successful knowledge transfer from the subsidiary to headquarters' research department, and from research to series development.

4.6 Case F

4.6.1 Subsidiary F Background

Company F, headquartered in Japan, has two subsidiaries in Silicon Valley. The first (Subsidiary F1) was established in 2001 and currently has around 40 employees, focussing specifically on research and technology in the field of connected vehicles. In addition, with the advance of autonomous vehicles, Company F decided to set up a further subsidiary in Silicon Valley in 2016 (Subsidiary F2), focussing specifically on artificial intelligence for the purposes of autonomous mobility. Subsidiary F2 is set up as a separate legal entity and has three branches across the USA: Silicon Valley, close to Stanford University; Ann Arbor, close to the University of Michigan; and Cambridge, close to the Massachusetts Institute for Technology (MIT). These three universities are world-class in terms of their research on artificial intelligence, which is why the company wanted to be physically close to said locations (F-4).

After investing equity in three start-ups with their initial autonomous budget, Subsidiary F2 decided to establish a dedicated CVC company (also a separate legal entity with its own budget) in Silicon Valley in 2017. Subsidiary F2 has grown quickly, from just 45 employees in 2016, to about 250 employees across all three locations in 2019 (the CVC company employs five people) (F-4, F-6). The following sections discuss both Subsidiaries F1 and F2, including references to the CVC unit where relevant.

4.6.2 Internal Embeddedness

Until about five years ago, Subsidiary F1 transferred knowledge to headquarters by writing reports. However, *"not much reaction happened with that"* (F-1). Instead, the subsidiary now has a small number of expats from headquarters (about 10% of the subsidiary employees), who come to the subsidiary to work on specific projects for one to three years and then rotate back to headquarters (F-1). These expats *"are kind of our idea of transferring ideas directly to headquarters"* (F-1) as *"exchanging people is more efficient"* than writing reports (F-1). Subsidiary F2 similarly has expats from headquarters (about 20% of the subsidiary employees), who spend two years in Silicon Valley, *"working with us, side-by-side on projects"* (F-4). Subsequently, *"the way that the project is transitioned to [headquarters] is to travel with the people that worked on it"* (F-4). Expats thus present a valuable means of sharing knowledge by providing a link between both of the Silicon Valley subsidiaries and Company F headquarters.

Despite expats providing a bridge to headquarters, Subsidiary F2 *"realised that we need to be more autonomous compared to the way most of [other innovation subsidiaries] go"* (F-4), in order to enable faster decision-making and to avoid being stifled by headquarters' bureaucracy. Subsidiary F2 is thus set up as a separate legal entity. The CVC unit is *"considered a subsidiary of [Subsidiary F2]"* (F-6), but is also a separate legal entity of its own because:

> *We [the CVC unit] wanted to make sure that we were able to be both really nimble and agile and that we could provide start-ups with a bit of certainty so that they wouldn't be subject to the whims of [Company F headquarters], which can change from time to time. (F-6)*

The autonomous governance system should allow the subsidiary to achieve the freedom of fast decision-making, thus enabling it to work with, and source knowledge from, start-ups more effectively.

Subsidiary F1 has to apply for funding on a project-by-project basis, via a *"job request mechanism"* (F-1). Having to follow multiple steps of applying for budget from various headquarters administrative departments slows the subsidiary down considerably and results in frustrations (F-8): *"We [the subsidiary] are watching what they [start-ups in Silicon Valley] are doing, but we cannot decide anything. We can provide small funding for a very small project, but it is very small. Nobody can be satisfied with that kind of project"* (F-7).

On the other hand, Subsidiary F2 and the CVC unit have *"more independence"* (F-7) and a completely autonomous budget. This enables them *"to be quick"* (F-6) and *"to get stuff done"* (F-4). This is important for the following reason: *"We want to be quick because we don't want to waste our opportunities, but also because we understand that start-ups often have a limited amount of runway which they need to survive, or they die"* (F-6).

4.6.3 External Embeddedness and Knowledge Sourcing

While Subsidiary F1 and F2 have expats from headquarters, the hiring at both subsidiaries is *"mostly local"* (F-1), thus embedding the subsidiaries into their external environment. Hiring locally is preferred because *"it is not efficient to hire somebody from [headquarters]"* (F-1), given the added costs of an expat contract and relocation. Furthermore, employing local talent is not only an issue of efficiency, but also targets skills and capabilities from the Silicon Valley job market: *"It is about access to talent. That is really the driving factor"* (F-5).

A further means of engaging with the external environment involves collaborating with local actors, such as start-ups. Besides Subsidiary F2 investing equity in start-ups through the CVC unit, Company F does not have much experience in collaborating with start-ups, because doing so is *"unnatural for the automotive industry"* (F-7). This is described further in the following excerpt:

> *[Working with start-ups] is a big problem. Basically, the automotive industry has a long history. It is already more than 80 years old and we have been focussing just on manufacturing. All of our technologies were coming from in-house. [...] This expertise made us very strong for this period. But now this is a kind of game changer. We have to utilise start-ups properly to speed up our development process and the development period. But we are still searching for how to do that. (F-1)*

4.6.4 Actor Characteristics

To gain top management support, Subsidiary F2 reports directly to a board of directors including the president and top executives of Company F headquarters (F-6). While assignments and budget still come from headquarters' R&D department, having a direct link to Company F executives helps Subsidiary F2 achieve a higher standing. Furthermore, as of 2017, the head of Subsidiary F2 has taken on a dual role as head of subsidiary, as well as *"the number two person in the R&D division in [headquarters]"* (F-4), thus strengthening the subsidiary's influence and helping to *"bridge the gap between there and here"* (F-4).

Subsidiary F1 has a less authoritative position at Company F headquarters. Instead, the subsidiary attempts to gain support from headquarters through having representatives visit Silicon Valley. However, these visits are not necessarily conducive towards enhancing the knowledge transfer process because *"there is this tendency of a lot of these [innovation subsidiaries] to end up becoming sort of like tourist destinations for executives"* (F-4). This results in frustrations, as employees coming from headquarters are *"just visitors. They don't make any decisions"* (F-1). Indeed, the subsidiary has to *"work very hard for [the visitors] not to be tourists. [...] They would come here, then we would go to Napa, you know, to see the wine country, and that has nothing to do with any of this innovation in any of these places at all"* (F-4).

A further characteristic affecting the knowledge transfer from both subsidiaries is the bureaucracy and resulting slow decision-making at headquarters. Naturally, *"it is really hard to steer the ship. It is really hard to change things. And the tendency is to make really slow decisions because everyone is afraid of making the*

wrong decision" (F-4). This results in delays in implementing projects from the subsidiaries. For instance, a computer vision project at Subsidiary F2 *"was finished a couple of years ago and [headquarters] is still testing it now"* (F-1). Delays in seeing projects implemented at headquarters (if implemented at all), result in the subsidiary maintaining that *"[headquarters] is not very highly motivated to think of very new things. I think they could afford to spend some money for just research"* (F-1). Frustrations about the knowledge transfer and headquarters' priorities are discernible.

4.6.5 Actor Relationship

Given that Company F headquarters is located on a different continent to the subsidiaries in Silicon Valley, there are certain practical issues that impede the relationship between the two sides:

> *It all goes back to the fact that the Pacific Ocean is wide. It is wide in terms of the time zone shift, which is really tough. You can see I have two clocks on my wall. And I know [headquarters] is waking up right now, but it is Saturday there. So everything is wrong. There is no one to talk to when I pick up the phone. So that is really tough. The language barrier is an issue. The cultural barrier has traditionally been an issue, but we are getting used to it. (F-4)*

At Subsidiary F1, interviewees allude to frustrations from the subsidiary towards headquarters, especially in the context of the subsidiary trying to collaborate with start-ups. For instance, when Subsidiary F1 receives requests from start-ups for a meeting to discuss a potential project, *"we are happy to hear them and we are interested in these new technologies, but the next step might be to just introduce them to headquarters [because] we cannot decide. Even if we are really excited, we cannot decide"* (F-1). When the subsidiary does introduce the start-up to headquarters, *"even if headquarters people are happy, they have to get some supplier involved in the discussion. So then we will be out of the discussion"* (F-1). This process is slow and excludes the subsidiary, which is in closer physical and cultural proximity to the start-up, from the collaboration. As a result, the subsidiary has *"never seen a successful collaboration with a start-up"* (F-7) since its foundation in 2001.

4.6.6 Transfer Content and Mechanism

When transferring projects to headquarters, the subsidiaries need to consider the differences between hardware- and software-focussed projects (F-7). Given the development cycle and roadmap for a new vehicle, timing for knowledge transfer is

crucial: *"A new vehicle needs five years to develop so it's very slow, very conservative, and so it is hard to take the new technology hardware into the business"* (F-1). However, for software-focussed projects, *"[headquarters] can immediately use the new IT service and so the uptake is quicker"* (F-1).

Furthermore, projects that are not aimed at reaching the market, but are instead targeted at building internal capabilities, can more easily be transferred than projects that will end up being bought by the end consumer (F-1, F-2). For instance: *"Sometimes we make software that is used to help the engineers, not in the product. If the [Company F] engineers like it, they can immediately start to use it"* (F-1). Building software tools for headquarters engineers, for instance related to *"checking for bugs"* (F-1), does not require the same levels of safety standards as software that ends up on the market (F-2, F-7).

To facilitate the transfer of knowledge, various mechanisms are employed by both subsidiaries. For instance, frequent phone calls help to confirm the *"direction and progress"* (F-8) of the subsidiary: *"Every two weeks, I [at headquarters] have a meeting for about one and a half hours in which I and [Subsidiary F1] researchers discuss the progress of the business, the direction, the output image, the schedule, and so on"* (F-8). Furthermore, knowledge is transferred via reports (F-8), as well as through expats on rotation at the subsidiaries (F-1, F-2). Finally, Subsidiary F2 has *"a big demonstration that happens at the end of each year. That helps to explain how well we are doing [to the rest of the organisation]"* (F-4).

4.6.7 Further Considerations

At Subsidiary F1, *"about 90% of all projects"* (F-8) are pull projects which are specifically demanded by a headquarters business unit in series development or production, rather than push projects in which the subsidiary pitches an own idea to headquarters. The level of maturity to which the subsidiary needs to take projects depends on which department at headquarters assigns the project (F-8). If the production department requests a project, Subsidiary F1 must complete the project past the *"advanced development"* (F-8) stage and then hand over to production. If headquarters' series development department assigns a project, Subsidiary F1 prepares a POC to be handed over to series development (F-8). Conversely, an interviewee at Subsidiary F1 maintains that the subsidiary conducts *"very fundamental research"* (F-1). Similarly, Subsidiary F2 *"are doing fundamental research, but their responsibility is that they need to build certain cars"* (F-1). There thus appears to be a mismatch in expectation about what level of maturity the subsidiary

conducts projects to, as the departments at headquarters requesting projects are production and series development, while both subsidiaries see their core task as being fundamental research. As a result, *"a very limited number of transfers [from subsidiary to headquarters] were successful. There is a huge gap"* (F-1).

4.7 Case G

4.7.1 Subsidiary G Background

Company G, headquartered in the USA, established a subsidiary in Silicon Valley in 2012, with a small team of four people, focussing on technology scouting in the area of big data. In 2015, Subsidiary G moved to new facilities, with a shift in scope of activities from scouting to research and prototyping, and an increase in size from four to 125 employees (G-2). The subsidiary has since grown to a mixed team of 200 engineers, industrial designers, ethnographers, and marketing and sales specialists. The team is focussed on a range of topics, including connectivity, mobility, autonomous vehicles, customer experience, and big data, and carries out a variety of activities in these areas, such as partnering with accelerator programmes in Silicon Valley, and collaborating with universities and start-ups.

4.7.2 Internal Embeddedness

Subsidiary G employs a mix of both expats (20%), who stay at the subsidiary for about three years before going back to headquarters, and local hires (80%) (G-2). An important aspect of expats is that *"they absorb some of the culture [from Silicon Valley] and bring it [to headquarters]"* (G-2). This helps diffuse the culture of innovation and risk-taking that is so common across Silicon Valley throughout Company G (G-4). Furthermore, expats carry the benefit of understanding both Silicon Valley and the traditional automotive industry, and are therefore better able to translate between the two, easing the process of knowledge transfer from the subsidiary to headquarters:

> *There are a few of us [at the subsidiary] that have spent time in both industries [automotive and software] that understand them, and we can make those translations. Because honestly, a lot of the frustrations that I have [...] are cultural differences between Silicon Valley and a traditional car company. It has nothing to do with language, nothing to do with country culture, as much as industry culture. (G-2)*

Expats thus present a valuable means of sharing knowledge by providing a link between Silicon Valley and the core of the organisation.

Not only do the subsidiaries in this study employ expats from headquarters on a team level, but the heads of the subsidiaries are often themselves expats following the three- to five-year rotation programme. Expat leadership is a key aspect of the knowledge transfer process because it ensures that the subsidiary has a network

within headquarters, making it easier to know whom to pitch ideas to. Subsidiary G employs a unique, noteworthy leadership model: a co-leadership approach involving one head of subsidiary from headquarters and one from Silicon Valley locally: *"We are trying to set up a bit more stability by having [the local head of the subsidiary] always be there and then having a partner that rotates every three years that comes in from [headquarters]"* (G-2).

The co-leadership governance approach allows the subsidiary to reap the benefits of two distinct leadership models: while the head from headquarters provides a bridge into the rest of the organisation, the local head provides stability and an understanding of the Silicon Valley cluster. The expat head thus enhances internal embeddedness further than merely employing expats on a team level, while the local head enhances external embeddedness further than the expat head could on his or her own.

Subsidiary G employs a dual-budget system (G-3). Initial POCs are conducted with the autonomous base budget, while more complicated prototypes are carried out with the financial support of a person or unit at headquarters (G-3). The initial POCs are usually presented to a business unit to pitch for further funding. Having something tangible to present to headquarters allows the subsidiary to demonstrate the value of their projects better, thereby increasing the chances that further funding will be supplied.

4.7.3 External Embeddedness and Knowledge Sourcing

Subsidiary G was originally established in Silicon Valley because it is *"impossible to pull innovations from Silicon Valley from afar"* (G-4). Instead, *"it is about being in the place, making connections, being close to the technology"* (G-4). The company wanted to *"keep a finger on the pulse"* (G-3) which is much more difficult to do without being embedded in the region through a permanent presence.

As mentioned, 80% of Subsidiary G's employees are local hires (G-2). The team is interdisciplinary, made up of engineers, industrial designers, ethnographers, and marketing and sales specialists. The purpose of hiring a *"balanced portfolio"* (G-2) of both locals and expats from a range of backgrounds is the following:

> *If you have only people who are local, we are going to end up designing a phone, because you have no concept of what is required for a car. If you move everyone from [headquarters] here, they will end up doing the same thing they were doing before, but at three times the cost. You need to have*

> *that mix, where most of the ideas are new, most of the ideas come from areas that are not traditionally the expertise of [Company G], but you also need to mould them into what it means for a car. So, when you do software, for example, it is similar to doing software for a phone, but not the same, and that difference, that is important, because there are safety requirements and regulatory issues there, which a software developer in the Valley wouldn't know about. That's where that mix happens. (G-2)*

To further embed itself in the local environment, Subsidiary G has become a commercial partner of some of the local universities' accelerator programmes which help commercialise discoveries made by members of the university through setting up start-ups. The accelerators focus on early stage start-ups and provide advisers and commercial partners. Subsidiary G has become one of these commercial partners in order to *"make sure we [the subsidiary] are not missing any important trends of any important companies that might come along"* (G-2). Furthermore, the benefit of partnering with an early-stage accelerator is demonstrated by the following excerpt:

> *This is where we can provide the biggest value. Because if we are plugged in to all those start-ups, you get to see the trends and the signals very early on. If you wait for a later stage, like even Series B or C*[5]*, by then pretty much everyone knows about [the start-up]. So, either they get snatched, or the valuations are too high, or you don't have a chance to mould them towards your interests. (G-2)*

Despite its strong motivation to collaborate with start-ups, the subsidiary is aware that start-ups will probably not end up being Tier 1 suppliers for Company G, as *"once you get to production, you need to rely on [the start-up] to actually provide you with enough [parts]"* (G-2). To ease the process of working with start-ups, the subsidiary has thus started acting as a platform to connect start-ups to existing Tier 1 suppliers, creating a three-way collaboration model:

> *[At the point of production] it makes sense that, if we can't rely on a ten-person start-up, we will have to pair them up with a Tier 1 supplier. But at least the Tier 1 supplier knows that [Company G] is interested. So, they don't take any risk. The start-up has a buyer, and we get the supply from someone we trust. It's a win-win-win. (G-2)*

4.7.4 Actor Characteristics

"To have an environment that promotes innovation, you need leadership support" (G-3). While a positive prerequisite for having top management support at Subsidiary

[5] *"Series B or C"* refers to later stage funding rounds for start-ups.

G is that the subsidiary reports directly to Company G's CTO (G-2), the subsidiary nonetheless faces challenges in trying to transfer projects to headquarters business units. For instance, when discussing a project proposed by the subsidiary, an interviewee reported that *"there was nobody in [headquarters] who saw that [project] within their job scope and said: 'This is something we should look into.'"* (G-4). Indeed, projects proposed by the subsidiary often lie outside the scope of headquarters employees' core responsibilities and thus do not easily find ownership within headquarters, making it difficult to transfer knowledge across (G-4). As a result, *"we [the subsidiary] are never the priority of somebody's day"* (G-4).

4.7.5 Actor Relationship

Despite the research and series development departments at headquarters having *"the official responsibility to help the company innovate more [...], the NIH syndrome is still a resistance point"* (G-3), preventing knowledge from the subsidiary being successfully transferred to, and implemented by, headquarters. Indeed, when the subsidiary tries to transfer projects, *"this is where things can break down because people [at headquarters] are too busy to consider alternatives to what they are currently doing"* (G-3). Furthermore, transferring knowledge to headquarters is *"almost an art"* (G-2) because it needs to occur at the optimal level of maturity:

> *If you bring [the project] too early, people [at headquarters] can shut it down. The antibodies shut it down because it doesn't look like something they know. If you grow it too much, they don't take ownership. Then they complain that you just impose it on them. So you want to have it somewhere in the middle level, where it is old enough and mature enough to survive on its own, but not so mature that people back there [at headquarters] cannot take ownership. (G-2)*

To improve the chances of knowledge from the subsidiary being implemented at headquarters, the subsidiary requires a champion for their project: *"We [the subsidiary] really need to find somebody in [headquarters] who will own this project and so the project will only be as successful as that person. And that person can't be [the CEO] every time"* (G-4). Instead, to find a champion, the subsidiary employees require a broad network at headquarters:

> *There is no dedicated team or unit or person [at headquarters], whose job it is to facilitate the transfer of projects. Instead, the team [in Silicon Valley] has to know the right people in [headquarters] to pitch ideas to and make the connection with the person who is responsible for this technology. This person in [headquarters] will end up owning the project so it has to be the correct person. (G-3)*

In addition to the NIH syndrome, the relationship between the subsidiary and headquarters is further characterised by feelings of dismissal from headquarters towards the subsidiary: *"We [the subsidiary] are very easily dismissed. People in [Company G] just think of us as this strange group in California doing their own thing. That makes us very easily ignored"* (G-4). As a result, *"it is very difficult for us to have an impact from afar"* (G-4). Furthermore:

> *Everybody [at headquarters] sees you [at the subsidiary] as a bunch of surfers in the California sun. [...] A lot of times you get seen as just adding more work for them, because all these new ideas need to be incorporated. Obviously, the ideas are disruptive and they need to be built in somehow, so you are adding work. And again, we are coming from a different point of view, so you are forcing them to think differently and that is always uncomfortable. (G-2)*

The somewhat adverse relationship between the subsidiary and headquarters may partly be ascribed to *"the cultural differences [being] so big"* (G-2). Where the subsidiary thinks and acts like a Silicon Valley start-up, headquarters is a slow, bureaucratic multinational corporation focussing on reliably mass-producing safe vehicles. As a result, the subsidiary ends up being *"a bridge between the Valley and [headquarters]. Almost cultural translators. Technical translators. We bridge that gap between how you work with a start-up versus how you work with a Tier 1 supplier that they are used to"* (G-2). Mediating the relationship between headquarters and start-ups presents challenges of its own:

> *At that point [of production], I start to understand [headquarters]. So, up to that point, I am a defender of the start-ups. I beat on big, bureaucratic [Company G], I narrow them down from an 80-page contract to a four-page contract. I see [Company G] as the bad guys. But once you move to production, and you need to make sure that you can bump six million cars a year, then I start defending [Company G]. (G-2)*

4.7.6 Transfer Content and Mechanism

As similarly illustrated in previous cases, Subsidiary G needs to check whether ideas for new projects are *"really strong or if [they are] just a PowerPoint"* (G-3). In other words, the subsidiary needs to demonstrate true value, as well as feasibility of an idea to get it to a stage *"where you have crossed most of the t's and dotted the i's"* (G-2), before transferring it to headquarters. Furthermore, as discussed in previous cases, software projects *"move a lot faster"* (G-2) than hardware projects, making knowledge transfer easier in these cases.

To facilitate this transfer the subsidiary employs a variety of mechanisms. For instance, Company G holds board of directors meetings in Silicon Valley and sends senior managers from across the company to workshops at the subsidiary, thus improving the subsidiary–headquarters linkages (G-3). Frequent communication through phone calls and in-person visits to headquarters by subsidiary employees further aid knowledge transfer (G-3). Finally, as discussed, the subsidiary employs a co-leadership approach with one head of the subsidiary being a permanent local hire and the second head of the subsidiary being an expat on rotation from headquarters (G-2). This approach provides a link to headquarters on a managerial level.

4.7.7 Further Considerations

The subsidiary conducts *"about 80% pull projects, 20% push projects"* (G-4). In other words, the majority of projects conducted at the subsidiary are specifically demanded by a headquarters business unit. Push projects are difficult to transfer to headquarters because the subsidiary needs to find *"continuous engagement with somebody in the business"* (G-4). In these cases, *"you really need an executive sponsor who really wants it, because everyone along the way is going to fight you"* (G-2). As a result, *"most projects are requested by, and done in conjunction with, [headquarters]"* (G-3).

Collaborating on projects with headquarters helps the subsidiary close the *"huge gap between the [subsidiary] and production"* (G-2) which can prevent ideas from the subsidiary being implemented at headquarters. Indeed, to close this gap and thus facilitate the transfer of knowledge from the subsidiary to headquarters, the subsidiary is *"trying to get a lot closer to production"* (G-2) by developing projects to higher levels of maturity. This statement contradicts the subsidiary's original exploratory nature, as similarly seen in previous cases.

4.8 Case H

4.8.1 Subsidiary H Background

Subsidiary H was first established in Silicon Valley in 2000, with the purpose of carrying out computer science research with local universities (H-2) and reporting on this research to its headquarters in Japan. However, the subsidiary quickly *"realised that [Silicon Valley] is the 'Mecca' of start-ups"* (H-2) and that there was thus more to be harvested than just research with universities. The agglomeration of start-up companies, investors, early adopter customers, and government policy favouring the development of new technologies drove Company H to establish a CVC arm in Silicon Valley in 2005 (H-2). Starting out with only four employees in 2000, the office grew to about six employees by 2005, 10 employees by 2010, and about 30 employees by 2019.

Conducting CVC investments in Silicon Valley exposed Subsidiary H to a variety of start-ups, as well as interesting larger companies (H-2). The subsidiary discovered a range of potential partners in which it did not want to invest equity, but with whom it nonetheless wanted the option of collaborating (H-2). Thus, in 2011 the subsidiary was transformed from a CVC lab into an open innovation lab, with the aim of co-conducting research, as well as POC and prototype development with external partners. This model enabled the subsidiary to collaborate with both young, small companies, as well as larger, established companies, around relevant technologies for the automotive industry.

However, problems arose when collaborating with start-ups, as the subsidiary was forced to implement standardised contracts used for automotive supplier relationships, which were too intricate for exploratory work with start-ups (H-2). In order to enable the subsidiary to move more quickly and independently from the rest of the organisation, Subsidiary H became a separate legal entity in 2017.

4.8.2 Internal Embeddedness

Subsidiary H employs a mix of local hires (70%) and expats from the parent organisation (30%) (H-2). Furthermore, the subsidiary is split into two teams: the open innovation team (mainly local hires in charge of external-facing activities, such as working with, and advocating for, start-ups), and the synergy team (mainly expats from Company H headquarters who have strong connections to various business units and can thus bridge the gap between the subsidiary and headquarters). As the synergy team understands both the Silicon Valley and the headquarters perspective,

they are in charge of *"translating the requirements of both sides and finding the right people within [Company H]"* (H-5). The synergy team knows *"who the most relevant people [at headquarters] are"* (H-5) and can therefore ease the process of transferring knowledge from the subsidiary to the most appropriate people at headquarters.

Until 2017, Subsidiary H was forced to use headquarters' standardised contract for external collaborations when working with start-ups in Silicon Valley (H-2). However, this contract was tailored to established relationships between OEMs and Tier 1 suppliers, including product liability insurance and other complicated agreements, rather than to exploratory projects with start-ups (H-2). In addition, the subsidiary experienced a gap between the month-long development cycles of many start-ups in Silicon Valley, versus the traditional automotive seven-year vehicle development cycle. In the words of an interviewee: *"Speed, we really needed speed [...]. We needed to move much faster than our mothership, so that is the main reason why we separated"* (H-2), to become a separate legal entity. Changing the governance structure of the subsidiary by setting it up as a separate legal entity allows for more autonomy around supplier contracts and faster decision-making independently of headquarters, which addresses some of the obstacles that can hinder external knowledge sourcing (such as being slowed down by bureaucratic processes at headquarters).

While Subsidiary H is now a separate legal entity, it does not have a fully autonomous budget, but instead employs a dual-budget system. In other words, the subsidiary has an autonomous base budget with which it can freely conduct projects, but has to apply for funding from headquarters business units on a project-basis if it wants to take projects to higher maturity (H-5). Furthermore, if a business unit at headquarters specifically asks the subsidiary to carry out a certain project, funding for this project will come from the headquarters business unit because, *"if [headquarters] want us [the subsidiary] to do it, they should pay for it. If we want to do it, we should pay for it"* (H-5). The dual-budget system allows the subsidiary to achieve a balance of both external embeddedness (through a certain level of autonomy and speed) and internal embeddedness (through securing buy-in and a home for the project inside the organisation).

4.8.3 External Embeddedness and Knowledge Sourcing

Since being established in 2000, Subsidiary H has become progressively more embedded in its local environment. As discussed, the subsidiary evolved from conducting computer science research with universities, to investing equity in start-ups, to developing POCs and prototypes with start-ups and other local players, to becoming a

separate legal entity in 2017 (H-2). Today, being an open innovation lab, Subsidiary H provides four key resources for external innovation partners (such as start-ups): funding for prototyping, test vehicles, a collaborative workspace, and mentors from Company H headquarters. While mentors are discussed in detail in Section 4.8.5 below, the following interview excerpt gives insight into the collaborative workspace, akin to an internal accelerator, offered by Subsidiary H: *"We host start-ups here. [...] We have a shop in the back to work together with the start-ups to modify the test vehicle and install their sensors, or displays, or other technologies"* (H-2).

The collaborative workspace eases the subsidiary's ability to source knowledge from start-ups, as it enables the start-ups to test their technologies in an automotive context. When working with start-ups, the subsidiary does not demand exclusivity, nor a time window in which Company H is the preferred customer. This collaboration agreement is described in detail by an interviewee:

> *We treat outside innovators as a fair, equal partner. So, whatever you have before the collaboration, it is yours, of course. And whatever we had, is ours. And whatever we put on the table and create new together, that is going to be shared. You have the freedom to do anything with this. We also have the freedom to do anything with this. You even have the freedom to go to [a competitor] and propose this to [a competitor]. Fine, no problem, we don't tie your hands at all. (H-2)*

The subsidiary and Company H want to give start-ups the opportunity to scale by also providing to other manufacturers. This constitutes a strong incentive for start-ups to partner with Subsidiary H first, instead of potentially approaching competing companies.

4.8.4 Actor Characteristics

The *"main challenge"* (H-5) to knowledge transfer is *"the slow response time by headquarters"* (H-5) which can be ascribed to the following:

> *[Headquarters] are busy, by definition. [...] And what we find is totally outside their scope. Of course, that is what we are looking for, disruptive innovation, so the better job we do, the farther outside the scope it is for people in [headquarters]. So there is a fundamental mismatch, a gap. We wasted a number of great opportunities because [headquarters] couldn't move at all. (H-2)*

To counteract these issues, support from Company H top management can be conducive because executives *"can drive projects top-down"* (H-6). Indeed:

> *Strong top leadership support is really the key for this type of problem, for innovation. Because this problem potentially creates some friction. [...] And friction is a good thing, but you need to have a certain mechanism to accommodate the friction. Otherwise it is a simple rejection by people at [headquarters] and nothing will really materialise from that. (H-2)*

A further factor impeding knowledge transfer is the difficulty of finding somebody at headquarters to *"drive the project"* (H-6) once it has been transferred. This issue may be ascribed to the following characteristic of many headquarters engineers: *"The project leader [at headquarters] needs to know the technical details and also has to have a personality to do such a risky project. Most of the people in headquarters who have the technical skill usually have many other things to do"* (H-6).

4.8.5 Actor Relationship

As discussed, when collaborating with local start-ups, Subsidiary H offers mentors from Company H headquarters, who provide *"rich experience in certain domains"* (H-2) from the automotive industry, which is particularly relevant for start-ups from other industries. Furthermore, they provide a bridge between the subsidiary and headquarters which can help foster the relationship between the two sides and thus ease the knowledge transfer process (H-2).

However, despite certain measures, such as having mentors from headquarters and a synergy team at the subsidiary in charge of fostering the link between the subsidiary and headquarters, the relationship between the two parties is characterised by a feeling of threat, given that certain projects from the subsidiary can be *"competitive to what [headquarters] are doing"* (H-2), and because:

> *Everyone here [in Silicon Valley] is comfortable with buzz words like AI [artificial intelligence], connectivity, cloud, robotics, VR [virtual reality] and so on. In [headquarters], people are more worried about these buzz words being a threat to their existence. They are afraid it will take away their significance. (H-4)*

The following example of successful knowledge transfer from the subsidiary to headquarters, which ended up causing trouble with the recipient department, further illustrates the subsidiary–headquarters relationship:

> *We built this [new infotainment unit] and showed this to our infotainment development team [at headquarters]. The head of that team [...] was so mad at us. It is a total threat to that department. It's a matter of*

> *job security, so he was really upset, and he said to me that: 'I don't think this is your job. Your job is to find or create a new idea, something that smartphones cannot do, and only cars can do.' I was kind of scratching my head and said: 'Well, I think, actually, that's your job. My job is to show how other technologies from outside are going to disrupt and change the way we do business.' (H-2)*

The feeling of being threatened by the subsidiary, coupled with the narrow focus of headquarters engineers (*"They are tasked with building next year's model so new ideas are not their priority."* (H-5)) results in the NIH syndrome preventing knowledge from being successfully transferred from the subsidiary to headquarters.

4.8.6 Transfer Content and Mechanism

A further obstacle to knowledge transfer is that headquarters waits *"for the next planning cycle to take projects"* (H-5). Given the seven-year length of the average new vehicle development cycle, introducing a project to headquarters at the correct time to fit into this cycle is crucial to facilitate the project's transfer. While this is a little easier for software than for hardware projects, given the faster development cycles, timing is nonetheless a key challenge (H-2). Moreover, given that headquarters business units are far removed from Silicon Valley *"physically and technologically"* (H-4), the subsidiary needs to tangibly demonstrate a project's value so that headquarters can *"see it, touch it, feel it"* (H-4). Thus, developing POCs is crucial, as *"sending [headquarters] a report or a slide deck is not going to demonstrate and explain the technology well"* (H-4).

To facilitate knowledge transfer, Subsidiary H employs a variety of mechanisms. For instance: *"We [the subsidiary] invite [Company H] executives here two to three times a year to showcase all the outputs in a real prototype demo. This way, the decision-makers can really see the value, see what customers really experience"* (H-2). In addition to executives, engineers from headquarters are invited to the subsidiary for multiple months at a time to collaborate on specific projects (H-5, H-6). Upon returning to headquarters, these visiting engineers subsequently serve as champions for their projects (H-5, H-6). Finally, the subsidiary conducts frequent calls with headquarters and sends a regular newsletter because *"frequent communication is really what it comes down to"* (H-4).

4.8.7 Further Considerations

By evolving into a legally separate open innovation lab, Subsidiary H has been able to provide more specialised resources to start-ups, thus enabling them to de-

velop projects to higher levels of maturity (H-2). This is beneficial to knowledge transfer, given that Company H has a *"long history of being engineering-driven and engineering-centric"* (H-5). As a result:

> *[Company H], for better or for worse, believes in its internal capability and doesn't look much to the outside. This makes them very practical, which is also a reason why we [the subsidiary] target series development rather than research [when transferring projects to headquarters]. (H-5)*

By taking projects to higher levels of maturity locally, the subsidiary is better able to target these projects to headquarters series development, thus improving chances of successful knowledge transfer. This notion reflects the trend seen in previous cases, of subsidiaries moving away from their initial exploratory purpose, towards series development.

Nonetheless, transferring projects to headquarters *"takes time. It is not over night like tossing something over the fence and they catch it"* (H-2). To improve knowledge transfer, an employee at headquarters, who had been to Silicon Valley to work on a project for six months, suggests that headquarters needs to train its engineers to have *"experience in working with start-ups and know the new technologies. [...] The best way to do this is to send more people [to the subsidiary]. Not long-term, but short-term"* (H-6). This is particularly important given the following analogy: *"There are many pitchers in Silicon Valley. [...] It is not difficult to train a pitcher, but it is difficult to train a catcher"* (H-6).

4.9 Cross-Case Analysis

This chapter presented findings from Phase 1 of this study, i.e., from eight automotive corporate innovation subsidiaries in Silicon Valley, along dimensions derived from the conceptual framework (see Figure 4.1): internal embeddedness; external embeddedness and knowledge sourcing; actor characteristics; actor relationship; and transfer content and mechanism (as well as further considerations outside of the initial framework). The following sections present a cross-case analysis of each dimension, culminating in a refinement of the conceptual framework. A summary table of the data is provided in Appendix E.

4.9.1 Internal Embeddedness

As demonstrated, the main means by which subsidiaries achieve internal embeddedness into their respective parent organisation involves expats, who spend between one and five years at the subsidiary before returning to headquarters. Furthermore, Subsidiaries A, B, C, D, and H employ designated knowledge transfer personnel, either at the subsidiary, at headquarters, or both, to further help foster the connection between the two sides. However, while expats provide important linkages to headquarters business units and can help champion the subsidiary at home, thus facilitating knowledge transfer, having too many expats can result in instability and knowledge loss when the expats leave. This suggests a risk of over-reliance on expats for knowledge transfer.

Subsidiary autonomy constitutes a further aspect of internal embeddedness, particularly with regards to the subsidiaries' budget and decision-making freedom. The studied cases tend to employ a dual-budget mechanism. In other words, the subsidiary has a base budget with which it can freely conduct certain POC development projects, but requires the involvement of headquarters business units for further funding to take projects to higher levels of maturity and thus transfer them to these aforementioned business units. This system results in limited subsidiary autonomy, as support from a headquarters business unit needs to be secured before a project can be conducted on a larger scale. To enable faster decision-making abilities, Subsidiaries F2 and H have been set up as separate legal entities. Nonetheless, while this does allow them to begin projects without headquarters' permission, continuing and transferring these projects requires involvement from the target recipient team from headquarters, to improve their sense of ownership over the project.

4.9.2 External Embeddedness and Knowledge Sourcing

Where expats provide the connection to headquarters, local hires help embed the subsidiaries in their external environment—a key aim of the subsidiaries, given that access to the region was commonly stated as a reason for establishing a permanent presence in Silicon Valley.

In addition to hiring local talent, the subsidiaries embed themselves in Silicon Valley by collaborating with local actors, particularly start-ups. Given the cultural differences between automotive OEMs and Silicon Valley start-ups, the subsidiaries reported difficulties in bridging the gap between the two worlds. This, coupled with the inabilities of start-ups to provide technologies according to automotive quantity and quality needs, has resulted in the subsidiaries introducing a three-way collaboration model between their headquarters, the start-ups, and a traditional automotive Tier 1 supplier, who can eventually integrate the start-up's technology into a larger system. Further means of facilitating the collaboration with start-ups include partnering with a local accelerator programme to increase exposure to start-ups, not demanding exclusivity (thus allowing the start-ups to grow faster), providing a collaborative workspace within the subsidiary, and investing equity through CVC units.

Generally, a balance of external and internal embeddedness, i.e. dual embeddedness, appears to be vital for knowledge transfer, as external embeddedness allows the knowledge to be sourced and acquired locally, while internal embeddedness allows this knowledge to be transferred and implemented in the wider organisation.

4.9.3 Actor Characteristics

While there are many characteristics of both the subsidiaries and headquarters that can be derived from the data, most of these are implicitly covered in other dimensions, such as the actor relationship. Instead, this section focussed mainly on the level of support for the subsidiary by headquarters' top management. A common theme appears to be that top management support has recently been improving, following visits by executives to Silicon Valley. A potential explanation for this is the surge in automotive-relevant technologies appearing in Silicon Valley in recent years, including autonomous driving, cloud connectivity, and big data. These potentially disruptive technologies may have driven the need for automotive executives to visit Silicon Valley, witnessing the pace of innovation first-hand and thus lending more support to their subsidiaries. However, despite improving support from top management, the subsidiaries' standing with lower level employees within headquarters is still lacking, resulting in knowledge transfer difficulties.

4.9.4 Actor Relationship

Across all eight cases, the relationship between subsidiary and headquarters is characterised by varying levels of adversity, manifested mainly in the NIH syndrome. In particular, interviews supported feelings of envy from headquarters employees towards subsidiary employees working in a more desirable location and conducting more ground-breaking projects, as well as a sense of threat that these ground-breaking projects might render headquarters employees obsolete. Furthermore, a lack of successful transfer has resulted in few projects from the subsidiaries actually entering the market. This, in turn, inhibits the subsidiary from building credibility, thus preventing headquarters from establishing trust for the subsidiary.

Adversity in the relationship between the subsidiaries and their respective headquarters may be ascribed to a vast difference in culture between the two sides. Where the subsidiaries see themselves as, and act like, start-ups, by wanting to be agile, entrepreneurial, and disruptive, headquarters is slowed down by bureaucratic processes, inertia, and regulations. Naturally, the two do not align well, thus presenting an obstacle to the knowledge transfer process.

4.9.5 Transfer Content and Mechanism

While the above dimensions have focussed on the softer issues surrounding knowledge transfer, such as people and the relationships between them, the dimension of transfer content and mechanism addresses more practical factors. For instance, a clear emphasis on developing tangible POCs to demonstrate value, rather than presenting slide presentations to headquarters, emerges from the data. This concept has been referred to as *Death by PowerPoint* and can result in the following *Catch-22* cycle: to pitch for funding for a project, the subsidiary requires a tangible POC to demonstrate its value, but this is difficult to achieve before having been allocated any funding for that project. The challenge of Death by PowerPoint highlights the importance of autonomy for the subsidiary to conduct POC development.

A second practicality to consider is timing. Interviewees at the subsidiaries highlight the challenge of fitting ideas into the rigid vehicle development cycle at headquarters and the resulting delays in introducing new projects to the market, if at all. In the case of software projects this issue is easier to overcome than for hardware projects, given the faster development times.

Mechanisms to facilitate knowledge transfer are fairly consistent across cases: expats, frequent phone- or video calls, newsletters, bilateral business trips, and in-

novation fair days at which to showcase projects all foster the communication and collaboration between subsidiaries and headquarters. However, despite these structural mechanisms, interviewees report ongoing struggles with knowledge transfer.

4.9.6 Further Considerations

While the data discussed in this chapter revealed interesting new insights along the above dimensions, these dimensions emanate from the initial conceptual framework, i.e., from the existing literature. However, each case further exposed certain considerations that are not discernible from the knowledge transfer literature and were thus not included in the initial framework.

Firstly, the subsidiaries appear to be shifting ever closer to their headquarters' series development department, despite their original purpose being highly exploratory in nature. As shown in the automotive research and development process in Figure 3.2, series development relates to a much higher level of maturity and proximity to the market than an exploratory innovation subsidiary might imply. A potential explanation for this evolution lies with the common focus on market success of a multinational corporation. Exploratory projects that have a long time horizon are too far-removed from the market and from the core scope of the organisation and can thus only be transferred to headquarters with great difficulty. Not being able to transfer immature projects, in turn, has driven the subsidiaries to develop projects to higher levels of maturity, thereby moving closer and closer to their headquarters' series development department and losing sight of their original exploratory purpose along the way.

This shift towards series development appears to be related to a dichotomy in expectation between headquarters and the subsidiaries about the latter's role. Where the subsidiaries tend to still consider themselves as focussing mainly on earlier stage research and technology scouting, headquarters often uses the subsidiaries as an extended workbench for their series development work. This manifests in the large proportion of pull projects, i.e., projects specifically demanded by headquarters series development, and in the resulting frustrations on both sides, given the inability of subsidiaries to meet these expectations. Furthermore, outsourcing series development to Silicon Valley is not only expensive, but also contradicts the subsidiaries' original exploratory purpose.

The prominence of pull projects further points to a certain level of collaboration between headquarters and the subsidiaries. Indeed, many interviewees discussed joint

projects and the tendency for headquarters engineers to spend time at the subsidiary for collaborative projects and vice versa. This suggests an imprecision in the broadcasting model for knowledge transfer widely used in the literature: knowledge transfer in this case is not linear, as indicated by the one-way arrow in the broadcasting model, but instead follows an iterative, non-linear path from headquarters to subsidiary, and back again.

Furthermore, knowledge transfer should not be limited to the subsidiaries as knowledge sources and headquarters as recipients, as depicted in the broadcasting model. Instead, the subsidiaries take on the role of knowledge recipient in their collaborative efforts with local Silicon Valley actors and often act as platforms connecting various knowledge sources to various knowledge recipients. Similarly, when creating the aforementioned three-way collaboration model between headquarters, start-ups, and Tier 1 suppliers, each participant often acts as both source and recipient of knowledge. The complexities revealed through these case studies indicate a fuzziness and ambiguity inherent to the context of knowledge transfer from automotive corporate innovation subsidiaries in Silicon Valley to their respective headquarters, which has previously not been sufficiently addressed in the literature.

4.9.7 Refinement of the Conceptual Framework

As discussed in Chapter 3, the above data was analysed following the Gioia method and resulted in a code tree, outlining the relation between the list of first-order codes and second-order categories. An example of this code tree, showing only those codes that are new to the literature and are thus used to modify the framework, is shown in Appendix D.

As can be seen in the code tree, elements such as the issues of *Death by PowerPoint* and timing knowledge transfer according to headquarters' roadmaps, as well as the dichotomy in expectations about the subsidiaries' role (the subsidiaries moving closer towards headquarters series development, and the idea of *innovation theatre*) have been included in the revised version of the framework, as illustrated in Figure 4.2. Note that while, in the interest of highlighting modifications to the framework, elements of the original framework have been placed in the background, these elements are not to be considered any less important than in the previous version of the conceptual framework.

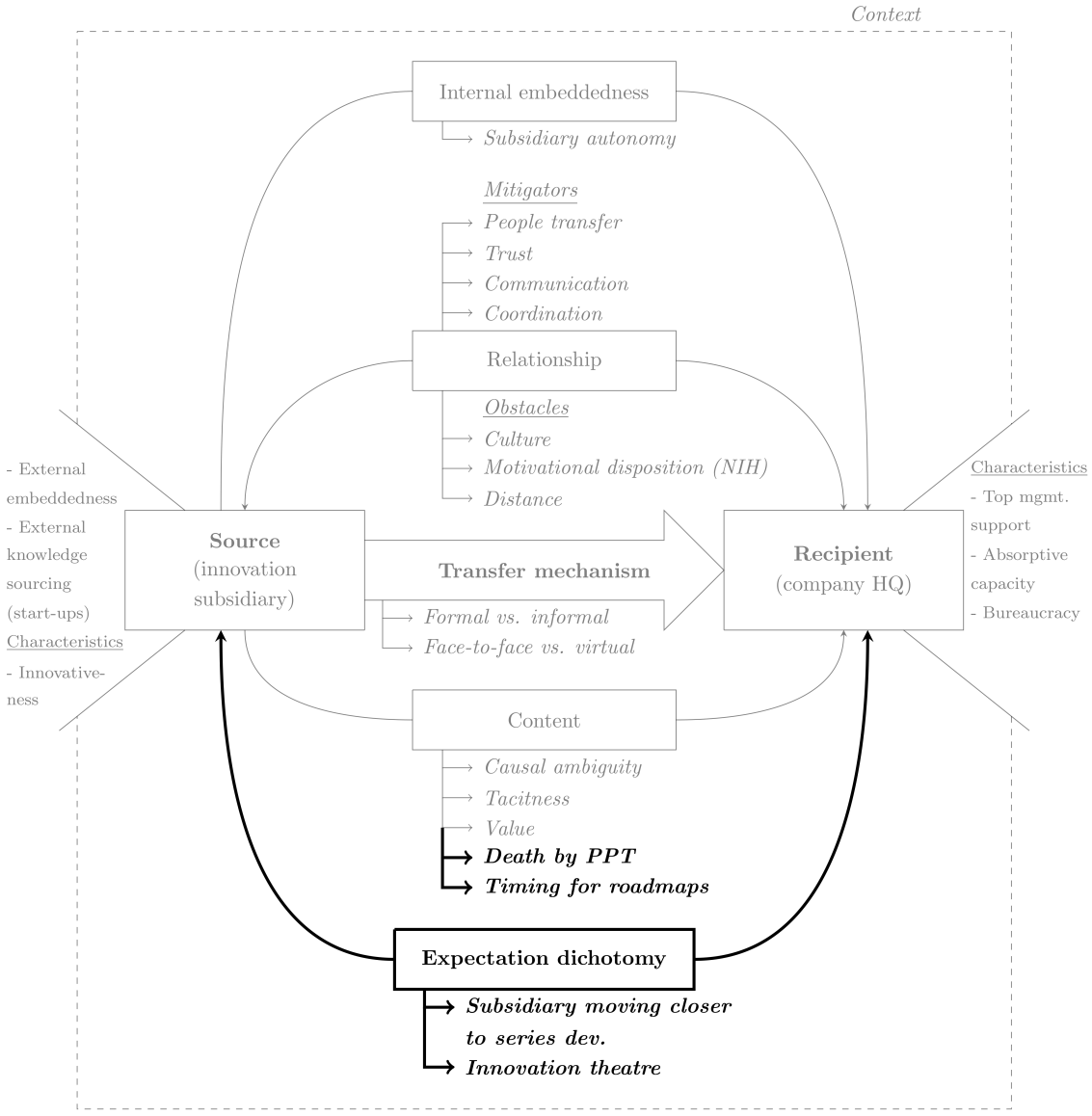


Figure 4.2: Initial modifications to the conceptual framework

Further to the above additional elements to the framework, a more fundamental modification is in order. As discussed, the knowledge transfer process from the corporate innovation subsidiaries to headquarters can no longer be considered as merely linear. While the linear knowledge transfer from the subsidiaries to their respective headquarters still exists, this process is more bidirectional than previously indicated. Similarly, the data analysis has shown that there are multiple players involved in an iterative loop of knowledge transfer, and that the roles of various actors in the framework have become more ambiguous. Instead of limiting the subsidiary to being the knowledge source, and headquarters to being the recipient, the subsidiary, headquarters, start-ups, and Tier 1 suppliers all provide and receive knowledge in their collaboration model. As discussed, these complexities suggest an inherent ambiguity in the knowledge transfer process. As a result, an extra layer

must be added to the conceptual framework, to highlight the ambiguity and non-linearity of the knowledge transfer process. This additional layer is shown in Figure 4.3 below, in which the thick arrows represent the non-linear flow of knowledge throughout the collaboration model of the various actors.

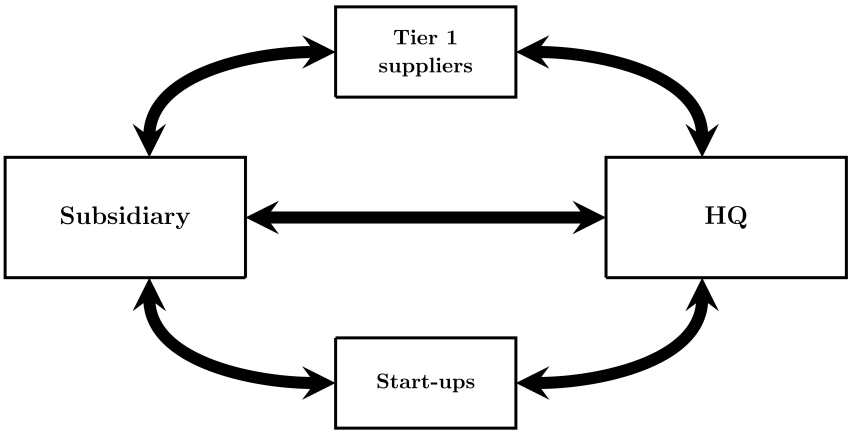


Figure 4.3: Additional layer to the conceptual framework

Finally, combining both layers together, a refined version of the overall conceptual framework emerges, as illustrated in Figure 4.4 below.

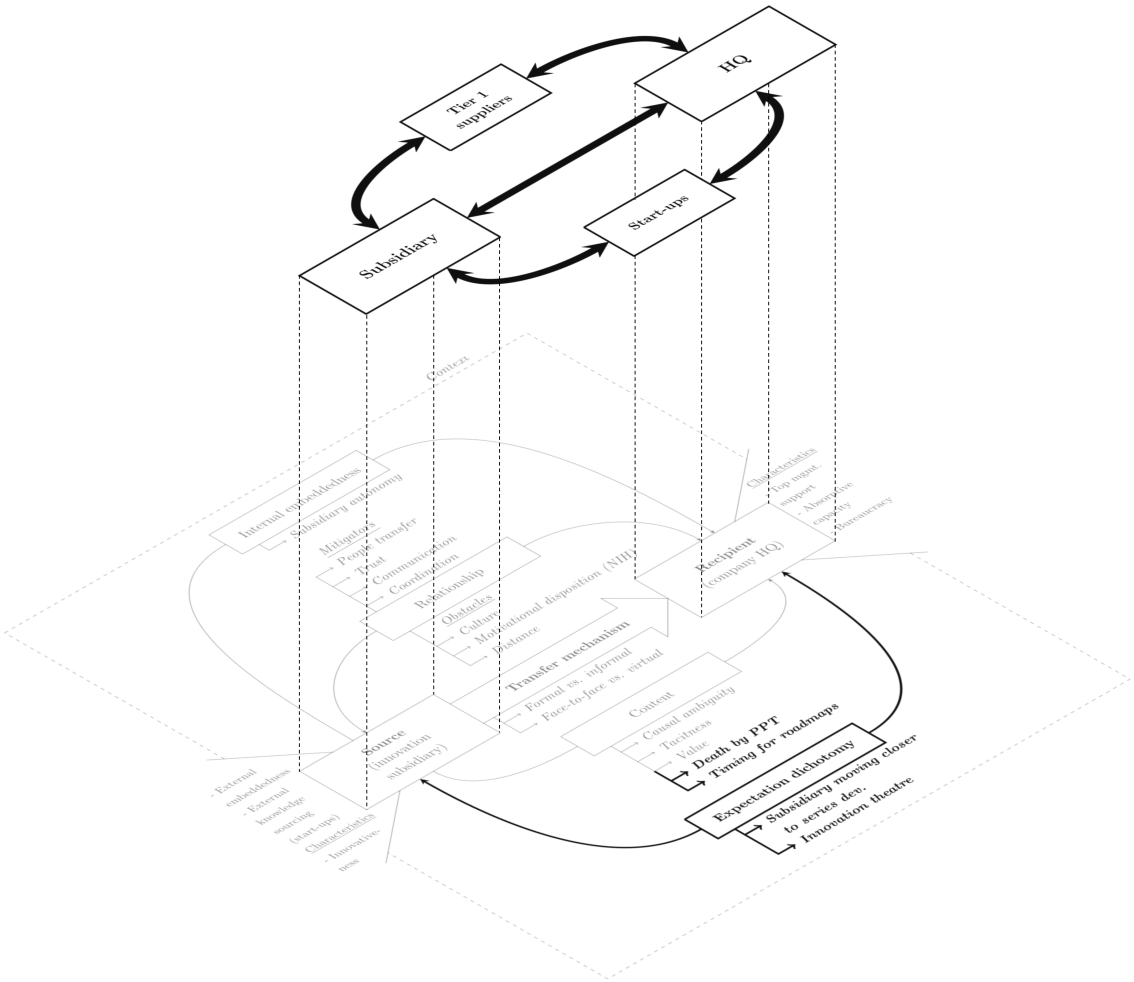


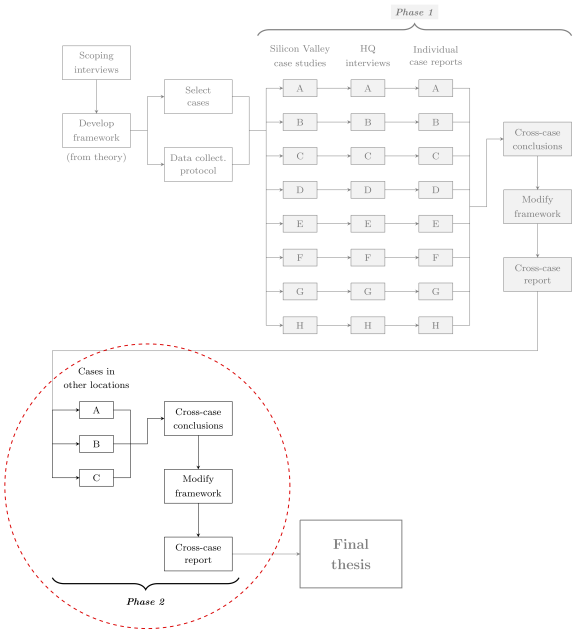
Figure 4.4: Modified conceptual framework, based on Phase 1 of this study

The following chapter will present findings from Phase 2 of this study, i.e., the global network of corporate innovation subsidiaries of Companies A, B, and C. Chapter 6 concludes with a discussion of the implications of these findings, in relation to the literature.

Chapter 5

Phase 2: Case Studies from Other Clusters

Following the conceptual framework modification in the previous chapter, Phase 2 now attempts to validate these findings by providing an analysis of the global network of corporate innovation subsidiaries of case Companies A, B, and C. As discussed in Chapter 3, Companies D–H are rejected for this phase, as they have no further corporate innovation subsidiaries similar in nature to their Silicon Valley offices.



In this chapter, each section discusses one case company's global network of corporate innovation subsidiaries, analysed using the same dimensions affecting knowledge transfer as used in Chapter 4. However, to avoid a tedious duplication of concepts from Chapter 4, the following sections mainly focus on how the subsidiaries in other locations deviate from the Silicon Valley subsidiaries, and what further factors are important when considering not only one, but a whole network of subsidiaries. Thus, if a heading from the Chapter 4 analysis is not included for a particular case below, this signifies that there are no significant differences to the Silicon Valley subsidiary in this area. This chapter concludes with a further refinement of the conceptual framework.

5.1 Case A

5.1.1 Background

In addition to its Silicon Valley subsidiary, Company A has a global network of four corporate innovation subsidiaries of similar purpose, with locations in Shanghai, Tokyo, Seoul, and Tel Aviv. These locations were chosen by Company A for their prominent innovation clusters and their *"propensity for entrepreneurship"* (A-14). The subsidiaries are all part of the open innovation department at Company A headquarters and thus have certain synergies and collaborative efforts between them (A-9). Table 5.1 provides a comparative overview of the five subsidiaries. As can be seen, the subsidiaries in Asia and Israel are much younger and smaller than the Silicon Valley subsidiary. Furthermore, where the Silicon Valley subsidiary develops projects to higher levels of maturity (approaching series development), the Asian subsidiaries focus on earlier stage POCs and homologation (adapting technologies to the local market). The Tel Aviv subsidiary was established midway through 2019 and thus does not yet conduct activities beyond technology scouting. The following sections therefore discuss only the Asian subsidiaries and how they compare to their Silicon Valley counterpart.

Location	Year est.	# Employees	Scope
Silicon Valley	1998	50	Tech. scouting; POC; prototyping; ready for series development
Shanghai	2013	15	Tech. scouting; POC; homologation
Tokyo	2014	5	Tech. scouting; POC; homologation
Seoul	2015	2	Tech. scouting; POC; homologation
Tel Aviv	2019	6	Tech. scouting

Table 5.1: Comparative overview of Company A innovation subsidiaries

5.1.2 Internal Embeddedness

As similarly demonstrated for Company A's Silicon Valley subsidiary, *"being well connected in relevant business units [at headquarters]"* is a key success factor for the Asian subsidiaries (A-12). The network at headquarters is facilitated through expats who can leverage personal contacts, as well as through a designated team at headquarters that acts as a bridge-builder for the subsidiary (A-12, A-13, A-14). However, while the expats' role is highly emphasised in Silicon Valley, the Asian sub-

sidiaries instead highlight the importance of their local hires, given their superior understanding of the market and their resulting ability to help adapt technologies to local requirements (A-12, A-13, A-15).

For instance, an interviewee at the Shanghai subsidiary suggested having two possible means of justifying a project choice to headquarters to secure funding: *"The project has to be either unique because of its technology or unique because it offers features that are necessary for the Chinese market"* (A-15). Homologation is of key concern for the Asian subsidiaries, given the large differences between customer preferences of Company A's home market in Germany, and those of the Asian markets (A-12, A-13, A-15). On the other hand, the American market is much more similar to that of Company A's home country, thus resulting in the Silicon Valley subsidiary focussing less on homologation and more on developing new technologies.

5.1.3 External Embeddedness and Knowledge Sourcing

The Asian subsidiaries' focus on homologation suggests high levels of external embeddedness. The subsidiaries carry out similar activities in their respective environments as their Silicon Valley counterpart, attending *"fairs, conferences, presentations to find new technologies"* (A-13) and working with *"universities, research centres, start-ups, and established companies"* (A-12). However, in contrast to the Silicon Valley subsidiary, the Asian subsidiaries' activities are often marked by a focus on local market preferences.

The emphasis on homologation further manifests itself in where the subsidiaries transfer projects to. For instance, Company A has a large R&D centre located in Beijing, given that China constitutes the largest single market for Company A (A-15). As a result, *"[The Shanghai subsidiary] actually transfer projects to the China R&D Centre"* (A-14). Transferring to the China R&D Centre, rather than to Company A headquarters is further explained by the following:

> *[The Shanghai subsidiary] do a lot for the R&D centre in China. This means, they do Chinese business models for the Chinese market, tailored to Chinese needs, just because the Chinese market is large enough to justify this. We [the Seoul subsidiary] also do small things for the Korean market because we are located here and we breathe the air here. But our market is smaller than the Chinese market, so we tend to transfer more to [Company A headquarters]. (A-16)*

5.1.4 Actor Relationship

The NIH syndrome was discussed as a key obstacle to the relationship between the Japanese subsidiary and headquarters: *"You know the term, Not-Invented-Here? That means, when we throw something over the wall [to headquarters], then it's not their baby and so they drop it"* (A-17). However, while in Silicon Valley it appears that differences in organisational culture play the biggest role in impeding knowledge transfer (corporate versus start-up culture), in Asia *"the topics of distance, national culture, and language"* (A-17) constitute a key challenge. Working with a business unit at headquarters is *"definitely easier if you speak their language. If you are a Japanese start-up, very far away, and you don't speak English very well, then [headquarters] would prefer working with somebody else. That's too bad, but we cannot change that"* (A-17).

Furthermore, at the Shanghai subsidiary a challenge in managing the relationship between the subsidiary and headquarters involves understanding the requirements of Chinese customers because *"the Chinese market has very specific requirements. We [the Shanghai subsidiary] have proximity to the Chinese customers and understand them, but [headquarters] does not. We have to explain certain features that have to be prioritised here"* (A-14). Similarly, the local employees at the subsidiaries sometimes struggle given their cultural differences. For instance:

> *We have to find employees [at the subsidiary] who are open. Because Japanese culture is quite closed. Approaching a stranger directly is not common. [...] And this is a key success factor for transfer because the employees need to build a network in [headquarters]. (A-17)*

5.1.5 Further Considerations

Transferring knowledge to headquarters is of key concern to the Asian subsidiaries, given that *"30% of the work we do is finding technologies. 70% of the work we do is transferring to [headquarters]"* (A-12). While the Silicon Valley subsidiary takes projects to higher levels of maturity to enable an easier handover to series development, this is not possible at the Asian subsidiaries because *"we don't have the resources here"* (A-17). The Silicon Valley subsidiary *"is much bigger. They have a huge budget. They are their own department with a bunch of people. They have a very different standing and so they go in the direction of series development"* (A-17).

As the Asian subsidiaries cannot prepare projects to higher levels of maturity to ease transfer, these subsidiaries employ other means. In particular, they *"speak to [headquarters] in a really early phase"* (A-12), to avoid doing *"anything without*

ensuring [headquarters] is interested because this raises the chance of successfully transferring projects to them" (A-14). Furthermore, securing early support from a pre-development business unit provides the subsidiaries with vital resources needed for developing POCs (A-16). Indeed, the number of projects conducted in collaboration with a headquarters business unit has recently become a measured Key Performance Indicator (A-13), signifying the importance of securing buy-in from headquarters before starting a project.

A further consideration that comes with having a global network of corporate innovation subsidiaries is the concept of transparency across this network. Indeed, *"knowledge management is a very important topic"* (A-17), as demonstrated by the following concern: *"If [Company A] only knew what [Company A] knows"* (A-13). Not only is transparency important for spreading knowledge across the organisation, but also *"to ensure we are not doing things twice. We need to have more exchanges with one another. 'Is Korea already doing this? Then we don't have to.'"* (A-17).

This is particularly complicated given the *"distance and time zones"* (A-16) between Asia and Silicon Valley. As a result, the Silicon Valley subsidiary is *"pretty separate"* (A-16) from the others. While the heads of the three Asian subsidiaries have regular meetings to discuss their projects and avoid duplication of effort (A-16), on a global scale the company instead attempts to improve transparency by having a database on which information and projects can be deposited (A-13). However, *"this database is only as good as what people feed into it"* (A-17) and is often considered *"nothing, but a rubbish bin"* (A-13). Instead of simply relying on the database, *"we also need direct communication"* (A-17).

5.2 Case B

5.2.1 Background

Company B's global network of corporate innovation subsidiaries is large, far-reaching, and decentralised (B-17, B-18). The company has around 60 such subsidiaries around the world, also referred to as *"labs or hubs"* (B-17), with *"main hot-spots"* (B-18) in Silicon Valley, Beijing, Tel Aviv, and Berlin (B-17, B-18). These key locations (besides the Silicon Valley subsidiary) constitute the main focus of this section, with reference being made to the network as a whole where relevant. While Company A has centralised the organisation of their corporate innovation subsidiaries by having them all report to the same department at headquarters (as previously discussed), at Company B *"the organisation is very hierarchical and different parts don't necessarily talk to each other, so everybody has their own lab. Everyone is trying to do their own thing"* (B-15).

Table 5.2 provides a comparative overview of the Company B subsidiaries located in these hot-spots. As can be seen, the subsidiaries not located in Silicon Valley are much younger and somewhat smaller than their Californian counterpart. Furthermore, where the Silicon Valley team develops projects to higher levels of maturity (approaching series development), the other subsidiaries focus on earlier stage POCs. In addition, a key concern of the Beijing subsidiary involves homologation.

Location	**Year est.**	**# Employees**	**Scope**
Silicon Valley	1995	300	Tech. scouting; POC; prototyping; ready for series development
Beijing	2015	32	Tech. scouting; POC; homologation
Tel Aviv	2017	25	Tech. scouting; POC
Berlin	2018	150	Tech. scouting; POC; software development

Table 5.2: Comparative overview of Company B innovation subsidiaries

5.2.2 Internal Embeddedness

Like the Silicon Valley subsidiary, the other hot-spot subsidiaries depicted in Table 5.2 are tied to the designated unit at headquarters that facilitates the collaboration between headquarters business units and the subsidiaries. These designated bridge-builders know *"what [the subsidiaries] are working on and can connect us to the relevant technical partners [at headquarters]"* (B-11), thus strengthening the

subsidiaries' internal embeddedness. However, besides the hot-spot subsidiaries, Company B has a network of about 60 corporate innovation subsidiaries worldwide (B-17, B-18). These belong to a variety of departments and are thus not connected to the centralised bridge-builder unit at headquarters in Germany (B-17, B-18). These subsidiaries' internal embeddedness is limited to the direct contact they have with their founding department, limiting the breadth of potential recipients of their knowledge.

5.2.3 External Embeddedness and Knowledge Sourcing

To engage with its external environment, the Beijing subsidiary publishes *"problem statements"* (B-16) provided by headquarters business units, for which local start-ups *"can openly apply"* (B-16) with a solution. The subsidiary then meets with a shortlist of start-ups to decide on potential further collaboration. This is an efficient means for headquarters to find start-ups in Beijing.

The Beijing subsidiary's main focus is *"In China, for China"* (B-14), resulting in the subsidiary not having expats: *"We [the Beijing subsidiary] are focussed on China knowledge. So, we don't need expats, we need China experts"* (B-16). Furthermore, similar to Case A, the subsidiary often transfers projects to Company B's Beijing R&D centre, rather than to headquarters in Germany (B-14, B-16), thus allowing the subsidiary to *"realise our projects to series production in China"* (B-14). As demonstrated, the Beijing subsidiary heavily emphasises homologation, thus setting it apart from Company B's other corporate innovation subsidiaries.

Rather than focussing on engaging with its external environment, the Berlin subsidiary is positioned as a core part of headquarters' R&D department and concentrates on conducting software development (B-12). The subsidiary was set up after Company B struggled to conduct *"software-heavy stuff"* (B-12) at headquarters, given the difficulties of attracting global software talent to headquarters' non-lucrative location. Instead, the company wanted a separate space in a global city, where software developers could be more *"radical and fast"* (B-12).

5.2.4 Actor Relationship

As with the Silicon Valley subsidiary, the relationship between headquarters and Company B's other corporate innovation subsidiaries is characterised by a *"clash of cultures, a clash of centuries"* (B-12). On the one hand, this manifests in a *"power struggle"* (B-16) between the subsidiaries and headquarters because headquarters does not *"want to give up some decision powers"* (B-16) about which projects to

pursue, thus limiting the subsidiaries' autonomy. On the other hand, differences in agility and speed hinder knowledge transfer:

> *We [the Berlin subsidiary] have proven capability of developing a new software product from A to Z in six weeks, with high customer value, but the product never made it to the customer because the processes in [headquarters] are not geared towards this. They are too slow and convoluted to make fast roll-out happen. (B-12)*

Furthermore, similar to Company A's subsidiaries in Asia, Company B's Beijing subsidiary reported not just clashes of organisational culture, but of national culture as well: *"A big problem is really the language and the distance"* (B-14). As a result, *"we tried several times to transfer projects to [headquarters], but it did not work well"* (B-14) because *"[headquarters] is reluctant to work with foreign start-ups, [...] [as] there are many problems with communication"* (B-14). Instead:

> *We can just transfer prototypes to the China R&D centre. This often works better anyways because of our focus of 'In China, for China'. Many of our solutions are adapted to the local Chinese market so there is no point transferring to [headquarters] first and then back to China. We can just handle it in China. (B-14)*

Not only is there a language barrier between Chinese start-ups and headquarters, but also between the Chinese employees at the subsidiary and headquarters:

> *At [Company B], even as an international company, a lot of documents are still in [headquarters' local language], like meeting documents and the concept book. So, the language barrier is not to be neglected. This is also something which brings difficulties in the daily communication. [...] A lot of colleagues learn [headquarters' local language] because otherwise, you cannot communicate. (B-16)*

5.2.5 Further Considerations

Difficulties in transferring projects often result from headquarters being *"approached by many different innovation offices"* (B-14), but only being able to pick one offer. Furthermore, a start-up complained to Company B that *"multiple labs from [Company B] had approached them. [The start-up] told us [headquarters] to better agree on, and coordinate our efforts"* (B-18). This points to a lack of transparency and duplication of effort within the global network of the 60 Company B corporate innovation subsidiaries, which can appear unprofessional and result in missed opportunities with potential external partners. A lack of transparency in this network

is further evident as *"most of [the subsidiaries] don't know each other and don't know what others do"* (B-18). For instance, when asked how the Beijing subsidiary differs from Company B's other innovation subsidiaries, the response was the following: *"I think there are not so many innovation offices around the world"* (B-16).

To address these issues, Company B established a team on a high strategic level in 2017 with the aim of obtaining *"an overview of all the hubs and labs in the digital area that exist somewhere within [Company B] around the world"* (B-18). The goal is *"to learn about what labs and hubs exist and to build up a governance structure and synergy between them to avoid duplicated efforts and to encourage the exchange of knowledge and resources"* (B-18). This team collated a list of 60 corporate innovation subsidiaries, split into four categories: (1) start-up incubators; (2) incubators that can quickly develop ideas; (3) subsidiaries that are close to headquarters business units, but fairly independent; and (4) extended workbenches that can implement headquarters' ideas by being more agile and skilled at software development (B-18). Given that this unit was only founded in 2017, *"so far the exchange between hubs is not huge"* (B-18), but synergies are expected to improve in future (B-18).

There is high volatility in the number of corporate innovation subsidiaries at Company B because many are opened and closed each year (B-18). Reportedly, *"some hubs are founded purely because there is budget left over and the team [at headquarters] wants to do something innovative"* (B-18). This points to a concept introduced earlier in Section 4.1.7: *innovation theatre*, i.e., establishing a corporate innovation subsidiary not for the purpose of actually gaining technological value, but to instead appear innovative.

5.3 Case C

5.3.1 Background

Company C has a total of four corporate innovation subsidiaries, located in Silicon Valley, Tel Aviv, Paris, and Seoul (C-2). While the Silicon Valley, Tel Aviv, and Seoul subsidiaries' purpose is to develop technical POCs and prototypes, the Paris subsidiary focusses more on strategy and business models around future mobility (C-1, C-6). All subsidiaries are part of the open innovation department at Company C headquarters and thus have certain synergies and collaborative efforts between them (C-1). Table 5.3 provides a comparative overview of the four subsidiaries.

Location	Year est.	# Employees	Scope
Silicon Valley	2011	70	Tech. scouting; POC; prototyping
Tel Aviv	2016	4	Tech. scouting; POC; prototyping (cyber security and EV focus)
Paris	2016	160	Future mobility strategy and business models
Seoul	2017	7	Tech. scouting; POC

Table 5.3: Comparative overview of Company C innovation subsidiaries

5.3.2 Internal Embeddedness

Company C headquarters is located in France, far away from Silicon Valley, Tel Aviv, and Seoul. Thus, internal embeddedness of these subsidiaries is limited to having expats and conducting frequent business trips. Uniquely, the Paris subsidiary is *"close to headquarters"* (C-1), and so *"headquarters is constantly checking it out. It is not like Silicon Valley, which is very far and [headquarters] come there once a year. But for them [in Paris] they constantly have people coming from headquarters, so it is a different spirit"* (C-1).

Indeed, the founders of the Paris subsidiary are both employees of Company C headquarters, who often *"go around to different departments at [headquarters] and explain to the employees how they can benefit from [the subsidiary]. We explain to them that they have a place where they can go out of the company to try new ideas"* (C-6). Thus, the Paris subsidiary uniquely manages its internal embeddedness by having its founders actively self-promote at headquarters. As a result, the subsidiary *"always works with the experts of the company"* (C-6) and ideas for projects are *"generally created together [with headquarters]"* (C-6).

5.3.3 External Embeddedness and Knowledge Sourcing

Each Company C corporate innovation subsidiary was founded to *"leverage the ecosystem"* (C-1) in its respective location. While the focus in Silicon Valley lies on *"connected cars and autonomous driving"* (C-1), the Tel Aviv subsidiary emphasises *"electric vehicles and cyber security"* (C-1). The Seoul subsidiary aims to allow Company C to tap into the IT-focussed innovation ecosystem, with an emphasis on start-ups (C-6). Similarly, the aim of establishing the Paris subsidiary was to *"link [Company C] to partners with different cultures in the ecosystem; an ecosystem it didn't know before"* (C-6). The value of having a presence in Paris is the actors in this region: *"We were interested in not just start-ups, but also other players, such as think-tanks, universities, researchers, and other corporates [...] that will determine the future of mobility"* (C-6). As demonstrated, engaging with its external environment through forming partnerships is a core purpose of the Paris subsidiary.

However, collaborating with start-ups is not always compatible with headquarters, given that *"the decision-making process within the company is too heavy and too long for the start-ups"* (C-6). To counteract these heavy processes, an interviewee at the Paris subsidiary supports the view that: *"It is so important to co-innovate and integrate the business units [at headquarters] into the projects with the start-ups—all together"* (C-6). In other words, the subsidiary secures the support of headquarters business units before engaging in collaboration with start-ups, to ensure the project will eventually find a home within the company.

5.3.4 Further Considerations

The Paris subsidiary's governance system is unique. Rather than merely working with players in its external environment, the subsidiary thought: *"If we take all those players and we put them all in one place and link them with a common subject and a common passion, we could create value"* (C-6). As a result, the subsidiary created a co-working space in which external players (mainly start-ups) can move into, rent desks, and become *"partners"* (C-6) of Company C. Today, the subsidiary has 30 partners, each with *"their own activity, their own customers, their own market, and mission"* (C-6), but all centred around the theme of the future of mobility.

To flatten the hierarchy and encourage more trust between partners at the co-working space, the Paris subsidiary introduced a co-governance system, in which *"the decisions are made by the community, not by [Company C]"* (C-6). Each partner, *"no matter how big or small"* (C-6), gets one vote in management decisions made at the subsidiary. This approach is unique amongst all automotive cases in this study.

5.4 Cross-Case Analysis

This chapter presented findings from Phase 2 of the overall study, i.e., from three automotive companies' global network of corporate innovation subsidiaries. Given the aim of this chapter to determine if notable differences exist between subsidiaries in different locations and to understand how having a broad network of corporate innovation subsidiaries can influence the knowledge transfer process within the entire network, the above sections focus on dimensions in which the subsidiaries differ from the Silicon Valley subsidiaries, in particular: internal embeddedness; external embeddedness and knowledge sourcing; actor relationship; as well as further considerations outside of the initial conceptual framework. The following sections present a cross-case analysis of each dimension, culminating in a refinement of the conceptual framework. A summary table of the data is provided in Appendix F.

5.4.1 Internal Embeddedness

As demonstrated, where the Silicon Valley subsidiaries of Companies A, B, and C all rely heavily on expats for providing a network within the respective headquarters, the subsidiaries in Asia of companies A and B do not. Instead, the Asian subsidiaries highlight the importance of hiring locally, given the large differences between the local Asian markets and customer preferences, and the company headquarters' markets and customers in Germany. Company C's network of subsidiaries conversely discusses a similar expat rotation programme as its Silicon Valley counterpart, without mentioning homologation-focussed activities.

5.4.2 External Embeddedness and Knowledge Sourcing

The key differentiating factor concerning external embeddedness of corporate innovation subsidiaries in other locations is the concept of homologation, i.e., adapting technologies to the local market. While the American market is fairly similar to all three companies' headquarters in Europe and the Silicon Valley subsidiaries thus do not concentrate on adapting technologies to the American market, the subsidiaries of Companies A and B in Asia reported homologation as one of their key tasks. Indeed, both companies have R&D centres located in Beijing, to which the companies' Chinese corporate innovation subsidiaries often transfer projects, instead of targeting business units at headquarters in Germany.

5.4.3 Actor Relationship

Similar to the Silicon Valley subsidiaries, issues like the NIH syndrome and resulting adversities were still mentioned as driving factors affecting the relationship

between the subsidiaries and headquarters. However, in contrast to the Silicon Valley cases, more emphasis was placed on differences in national culture and language. For instance, challenges of headquarters collaborating with foreign (non-English speaking) subsidiaries were reported—a challenge that did not seem to be an issue with American start-ups, as English tends to be the common denominator across the world. Furthermore, headquarters' employees not understanding local market preferences of their global subsidiaries and key documents not being translated to English were mentioned as factors inhibiting the relationship between headquarters and subsidiaries.

5.4.4 Further Considerations

Analysis of case studies from Phase 2 suggests that, instead of thinking solely about individual corporate innovation subsidiaries and their dyadic transfer of knowledge to headquarters, one must consider a company's entire network of such subsidiaries holistically, as the activities and structures of one subsidiary affect those of the others. In particular, findings from this phase suggests that the conceptual framework needs to be extended significantly to include the entire network of subsidiaries, as subsidiaries transfer knowledge between each other, as well as between themselves and headquarters. While at the moment the companies' respective headquarters are still located centrally in this global network of corporate innovation subsidiaries, future trends of decentralisation of R&D and learning at the periphery of the organisation (Cantwell and Mudambi, 2005; Hurtado-Torres et al., 2018; Singh, 2007; Wolfram et al., 2018) may well reshuffle the layout of the network.

Thus, a key aspect emerging from the data of Phase 2 is the concept of transparency: coordinating synergies between, and an overview of, the activities of the global network of corporate innovation subsidiaries. This is particularly challenging at Company B, given the vast number of 60 subsidiaries that are not centrally incorporated into a single unit at headquarters. Repeated comments about duplication of effort across subsidiaries elucidate the significance of having a system of managing oversight across the network. At Company A, this is done through a database, though this has reportedly not been highly effective. However, given the small number of subsidiaries at Company A, personal exchanges appear to sufficiently inform each subsidiary of the others' activities. On the other hand, Company B has recently established a designated team in charge of collating information on, and facilitating communication between, all corporate innovation subsidiaries across the company, given the currently chaotic network of 60 such subsidiaries.

These considerations relate closely to the literature on global innovation (i.e., manufacturing, engineering, and R&D) networks, reviewed in Section 2.2. In particular, the complexity of the case companies' networks' configuration calls for high levels of coordination across these networks, and certain capabilities required to manage the successful sharing of knowledge within the networks. These topics will be discussed in more detail in the following chapter.

A further unique feature exhibited by Company C's Paris subsidiary is the concept of creating a co-working space with a co-governance system at the subsidiary. By incorporating start-ups into the subsidiary as partners with co-decision making abilities, the subsidiary is able to improve its relations to the external environment and build more trust with its partners.

5.4.5 Refinement of the Conceptual Framework

As discussed in Chapter 3, the case study data was analysed following the Gioia method and resulted in a code tree that depicts the relation between the list of first-order codes and second-order categories. An example of this analysis procedure from Phase 1 is shown in Appendix D. The analysis for Phase 2 followed the same procedure.

Based on this analysis, this chapter takes the modified framework resulting from Chapter 4 and makes additional changes, based on the discussed considerations of understanding the subsidiaries' local market and of requiring transparency throughout the network of subsidiaries. As previously, these changes can be represented as a modification to the additional layer of the framework, which is illustrated in Figure 5.1. Combining both layers together results in a refined version of the overall conceptual framework, as shown in Figure 5.2. Again, much of the conceptual framework has been moved to the background in this version, not because the concepts no longer apply, but to highlight the additions to the framework.

The following chapter will conclude the study with a discussion of the implications of the previously presented case study findings.

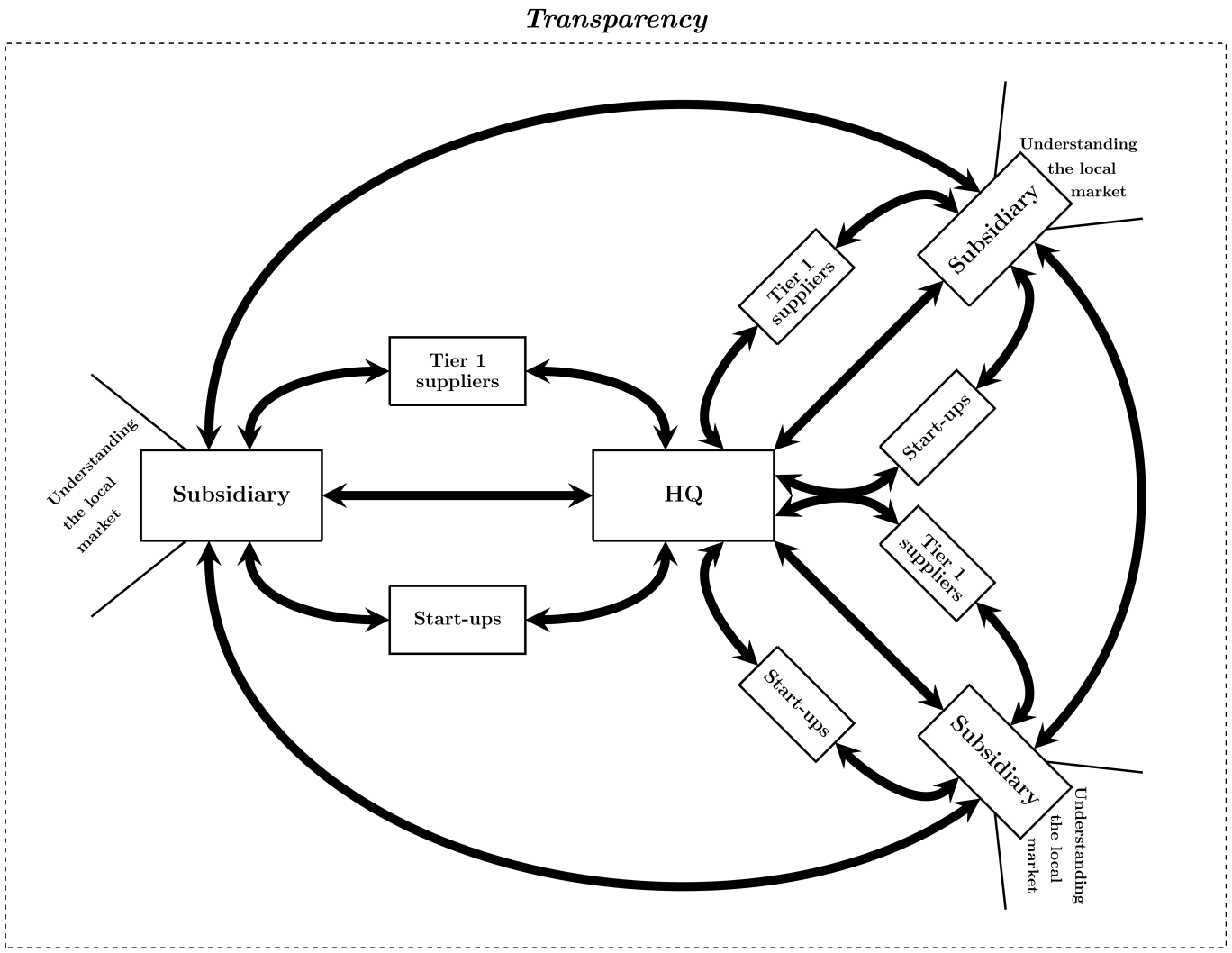


Figure 5.1: Additional layer to the conceptual framework

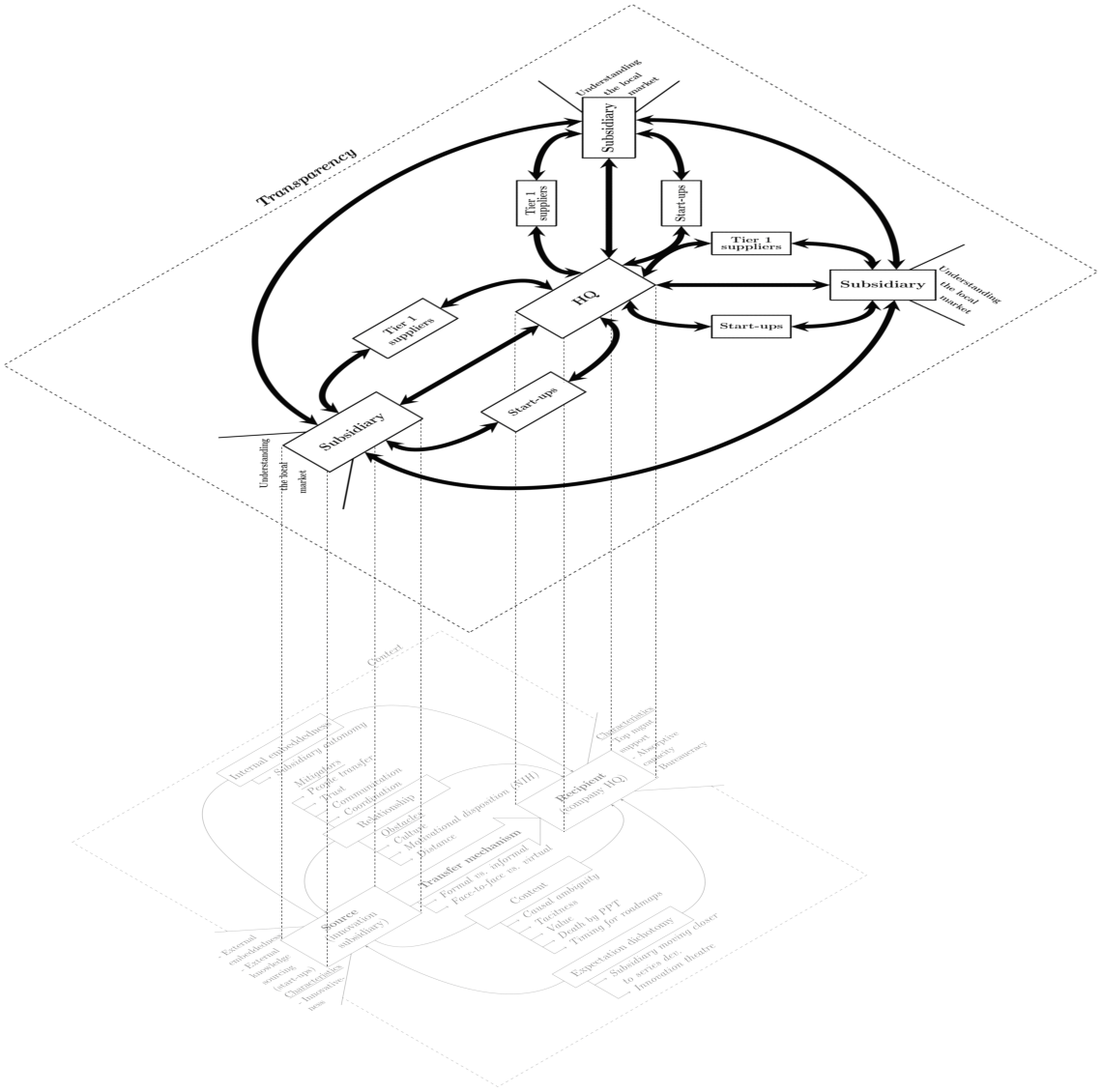


Figure 5.2: Modified conceptual framework, based on Phase 2 of this study

Chapter 6

Discussion and Conclusion

This chapter provides a discussion of the findings of the empirical research presented in this thesis, based on the following research question and corresponding sub-questions: *How is knowledge transferred from a corporate innovation subsidiary located in an innovation cluster to its company headquarters?*

1. What are the obstacles impeding the knowledge transfer from a corporate innovation subsidiary located in an innovation cluster to its headquarters?
2. How are these obstacles managed in practice?

In order to answer these questions, the following research objectives were set:

1. Understanding what a corporate innovation subsidiary is and what it does;
2. Identifying critical obstacles to the knowledge transfer from a corporate innovation subsidiary to its headquarters, as well as the measures that have been put in place to facilitate the process;
3. Developing a framework that conceptualises the knowledge transfer process from a corporate innovation subsidiary to its headquarters.

As shown in Figure 6.1 below, this research was structured into two phases: (1) eight case studies of automotive corporate innovation subsidiaries located in Silicon Valley (and their respective headquarters); and (2) further in-depth case studies of the global network of corporate innovation subsidiaries of case Companies A, B, and C. The data from these two phases presented throughout this thesis, as well as the resulting versions of the conceptual framework, have clearly achieved the above research objectives, as is evidenced in the following section, which provides a summary of the findings and uses these to answer the above research questions. Following the summary of research findings, this chapter discusses the contributions to theory and practice.

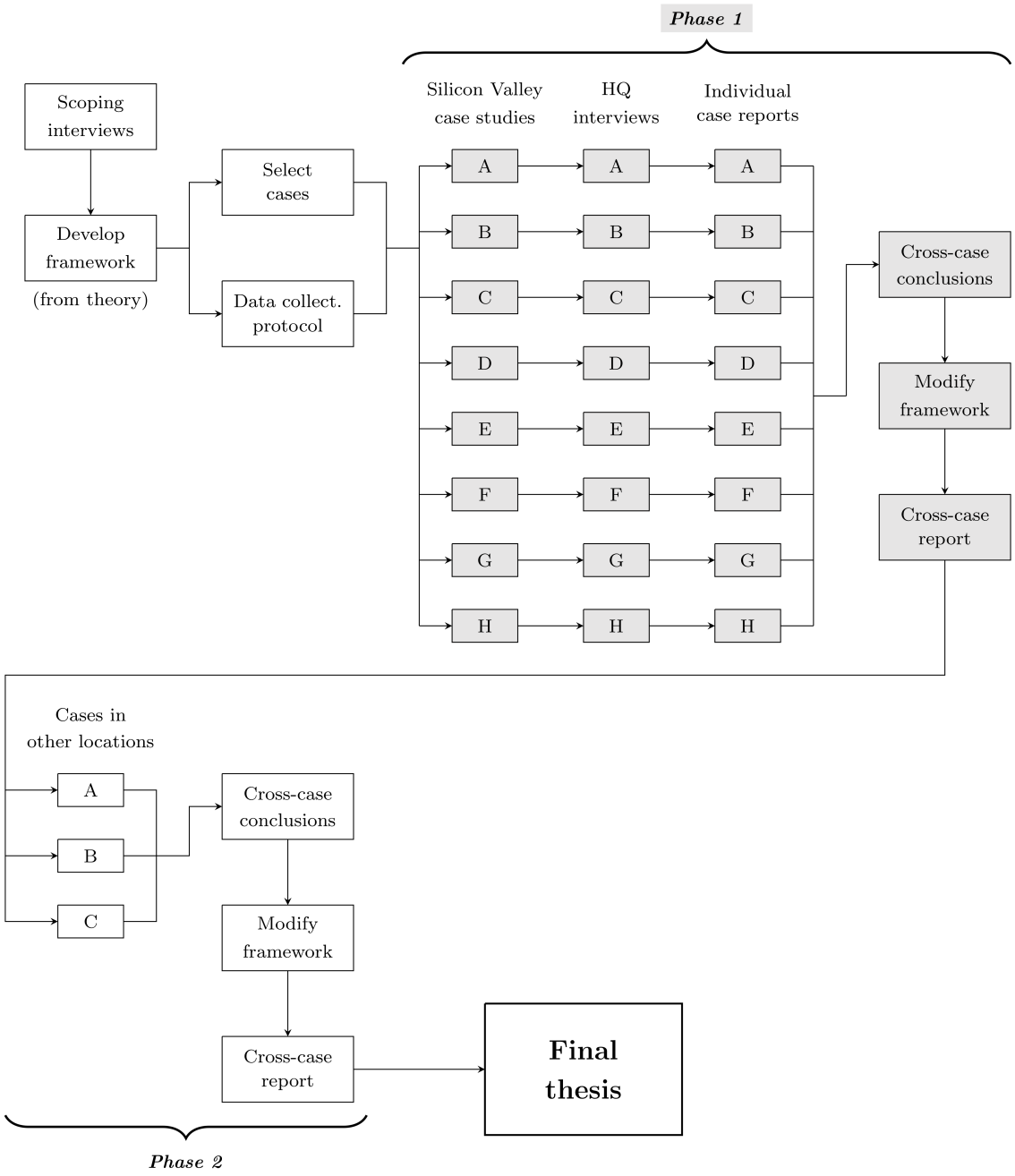


Figure 6.1: Overview of the research method, based on Yin (2003)

6.1 Summary of Findings

6.1.1 Phase 1: Case Studies from Silicon Valley

The in-depth case study data presented in Chapter 4 addresses the following dimensions of eight automotive corporate innovation subsidiaries located in Silicon Valley: internal embeddedness; external embeddedness and knowledge sourcing; actor characteristics; actor relationship; and transfer content and mechanism (as well as further considerations outside the initial conceptual framework).

These case studies revealed key challenges faced in the transfer of knowledge from the subsidiaries to their respective headquarters. In particular, the data emphasised the difficulty of balancing internal and external embeddedness, i.e., a trade-off between subsidiary autonomy, which allows the subsidiary to engage more effectively with its external environment and thus source more knowledge, versus maintaining close ties to headquarters, allowing the subsidiary to have a better overview for which unit or person would be the most relevant contact for a particular project. Furthermore, cultural differences between the subsidiaries and their headquarters are evident, resulting in adversity in the relationship between the two sides. The cultural differences seem to further result in difficulties when attempting to collaborate with start-ups, given the contrast in time-scales, agility, and entrepreneurialism between large, global automotive OEMs and Silicon Valley start-ups.

There appears to be a dichotomy of expectations regarding the role of the subsidiaries. Where the subsidiaries see themselves as focussing mainly on earlier stage research and technology scouting, headquarters often uses the subsidiaries as an extended workbench for their series development work. This manifests, for instance, in the struggle to transfer projects below a certain level of maturity, as well as in the large proportion of pull projects, i.e., projects specifically demanded by headquarters series development. Disagreeing about the role of the subsidiary (often inadvertently or even subconsciously) results in further adversities in the relationship between subsidiary and headquarters, as well as a contradiction of the subsidiaries' original exploratory purpose (not to mention the high cost of effectively "outsourcing" series development work to Silicon Valley).

The eight case companies implement various measures to address the above obstacles to the knowledge transfer process, which can loosely be categorised into human and structural measures. On the human side, the case companies commonly employ expat rotation programmes and have introduced designated knowledge transfer personnel either at the subsidiary, at headquarters, or both. However, despite the benefit of fostering the links between headquarters and the subsidiary, the common practice of employing expats on rotation results in periodic knowledge loss when the expats move back home. Furthermore, the case studies revealed the importance of gaining support from headquarters' top management to provide a top-down drive for headquarters' business units to accept projects from the subsidiaries. As discussed, however, the support from top management often fails to trickle down into the rest of the organisation, resulting in the Not-Invented-Here (NIH) syndrome prevailing and preventing knowledge from being successfully transferred to headquarters.

On the structural side, the autonomy trade-off is commonly addressed through the means of a dual-budget mechanism, in which part of the subsidiaries' budget for initial proofs of concept (POCs) is autonomous, but more complicated prototypes have to be carried out with the financial support of a specific business unit at headquarters. This practice helps avoid the concept introduced as *Death by PowerPoint* and the resulting *Catch-22* cycle: to pitch for funding for a project, the subsidiary requires a tangible POC to demonstrate its value, rather than merely delivering a slide presentation, but this is difficult to achieve before having been allocated any funding for that project. This idea relates to the concept of using replication and templates as a basis for knowledge transfer, as discussed by Jensen and Szulanski (2007) and Szulanski and Jensen (2004). A POC or working prototype serves as a template of the knowledge to be transferred, enabling a more exact replication of this knowledge at the recipient site than if the knowledge was transferred solely through a slide presentation.

Across most cases, software projects are reportedly easier to transfer to headquarters than hardware projects, particularly as it is cheaper and faster to develop a POC, thus enabling a more flexible fit into the stringent vehicle development cycle at headquarters. For hardware projects, timing of transfer needs to be carefully considered to avoid delays in headquarters being able to integrate the project.

A key trend evidenced throughout Phase 1 of this thesis involves the subsidiaries shifting ever closer to their headquarters' series development department, despite their original purpose being highly exploratory in nature. In other words, the subsidiaries are moving away from technology scouting and early-stage POCs and towards higher maturity projects that can be directly transferred to series development at headquarters, saving time and resources by skipping the pre-development department. As discussed, this trend may be explained by the focus on market success. Exploratory projects that have a long time horizon are too far-removed from the core scope of the organisation and can thus only be transferred to headquarters with great difficulty. Not being able to transfer immature projects, in turn, has driven the subsidiaries to develop projects further, thereby moving closer and closer to their headquarters' series development department and losing sight of their original purpose along the way.

While the idea that the shift towards series development improves market success for the projects from the subsidiary appears at first glance to be positive and desirable, this trend brings problems of its own. As discussed, headquarters and the subsidiaries often do not seem to agree on the latter's role as the subsidiaries nonetheless

continue to consider themselves as focussing on early-stage innovation. Furthermore, while headquarters believes that time and resources are being saved by skipping the pre-development department at headquarters, the resources are in effect merely being relocated to Silicon Valley—a region that tends to have significantly higher labour and rent costs in comparison to most automotive headquarters' locations.

Findings from Phase 1 result in fundamental alterations of the conceptual framework derived from the literature on knowledge transfer. Where the literature suggests a linear broadcasting model of knowledge transfer (Battistella et al., 2016; Minbaeva, 2007; Noorderhaven and Harzing, 2009; Szulanski, 2000), the case study data reveals collaboration between the subsidiaries (regarded initially as the knowledge source) and headquarters (regarded initially as the knowledge recipient), in the form of joint projects and the tendency for headquarters engineers to spend time at the subsidiary for collaborative projects and vice versa. This suggests an imprecision in the broadcasting model: knowledge transfer in this case is not linear, as indicated by the one-way broadcasting arrow, but instead follows an iterative, non-linear path from headquarters to subsidiary and back again.

The non-linearity of the knowledge transfer process is likely linked to another discussed factor of knowledge transfer: the corporate innovation subsidiaries moving away from their original exploratory purpose, towards series development and, as a result, taking projects to higher levels of maturity. Thus, the subsidiaries require closer collaboration with the recipient headquarters business unit, making the knowledge transfer a more iterative, and less linear, process.

Similarly, the roles of the key actors in the broadcasting model, i.e., the knowledge source and recipient, are more ambiguous than indicated in the literature. Instead of being limited to the role of knowledge source, the subsidiaries often take on the role of knowledge recipient in their collaborative efforts with local Silicon Valley players and often act as platforms connecting various knowledge sources to various knowledge recipients. Similarly, other stakeholders discussed throughout Phase 1, such as start-ups, automotive Tier 1 suppliers, and headquarters, all often act as both sources and recipients of knowledge, depending on the project and the situation.

These complexities revealed through the case studies indicate a fuzziness and ambiguity inherent to the context of knowledge transfer at automotive corporate innovation subsidiaries in Silicon Valley. As illustrated in Figure 6.2 below, the revision of the conceptual framework resulting from Phase 1 of this study reflects the discussed non-linearity and ambiguity.

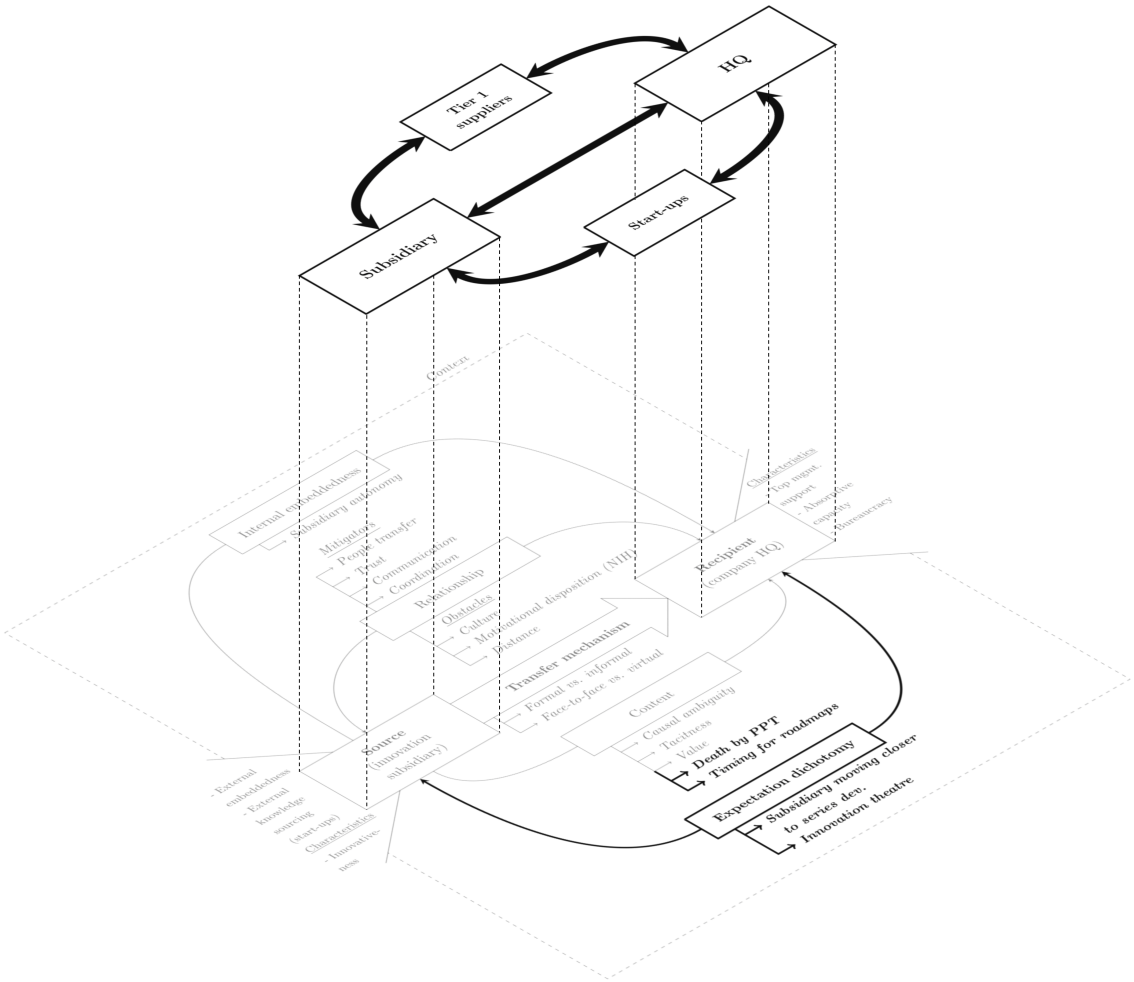


Figure 6.2: Modified conceptual framework, based on Phase 1 of this study

6.1.2 Phase 2: Case Studies from Other Clusters

Chapter 5 provided an analysis of the data gathered in Phase 2 of this study, concerning the corporate innovation subsidiaries of Companies A, B, and C in other locations. The case companies' global networks of corporate innovation subsidiaries are analysed using most of the same key factors affecting knowledge transfer as used in Phase 1, i.e., internal embeddedness; external embeddedness and knowledge sourcing; actor relationship; as well as further considerations outside of the conceptual framework. The aim of this phase is to validate findings from Phase 1 and explore other factors that need to be taken into consideration when looking holistically at the whole network of corporate innovation subsidiaries, rather than just an individual subsidiary and its dyadic knowledge transfer to headquarters.

A key obstacle impeding knowledge transfer revealed through the Phase 2 case studies relates to differences in national culture between the subsidiaries and their headquarters. Many of the subsidiaries presented in Phase 2 are located in Asian

countries, such as China, Korea, or Japan, in which the cultural differences between the case companies' European headquarters and the subsidiaries' external environment tend to be larger than is the case for their Silicon Valley based counterparts, especially given English as the most common denominator language across the globe. As a result, challenges in the relationship between the subsidiaries and their respective headquarters are often based not only on organisational cultural differences (as similarly evident in Phase 1), but also on national cultural and language differences.

Related to this is the tendency of headquarters to struggle with understanding local market preferences at the subsidiaries in Phase 2. As a result, homologation, i.e., adapting products to local market conditions, is often a key focus of the subsidiaries investigated in this phase of the thesis. To enable homologation, the subsidiaries employ fewer, if any, expats than their Silicon Valley counterparts. This, on the other hand, can result in the subsidiaries not having a sufficiently strong connection to headquarters to successfully transfer knowledge across.

In addition to the issue of differences in culture, the complexities and a lack of transparency arising from having a wide global network of corporate innovation subsidiaries constitute key themes emerging from the Phase 2 case studies. Indeed, the findings from this phase suggest that one must consider a company's entire network of subsidiaries holistically, rather than individually, as the activities and structures of one subsidiary affect those of the others. The need for transparency, i.e., maintaining synergies between, and an overview of the activities of, the global network of corporate innovation subsidiaries, is particularly complex, given the often convoluted nature of this network. This finding is incorporated into the conceptual framework as shown in Figure 6.3 below. Note that, while, at the moment, company headquarters are still located centrally in this global network of corporate innovation subsidiaries, future trends of decentralisation of R&D and learning at the periphery of the organisation (Cantwell and Mudambi, 2005; Hurtado-Torres et al., 2018; Singh, 2007; Wolfram et al., 2018) may reshuffle the layout of the network.

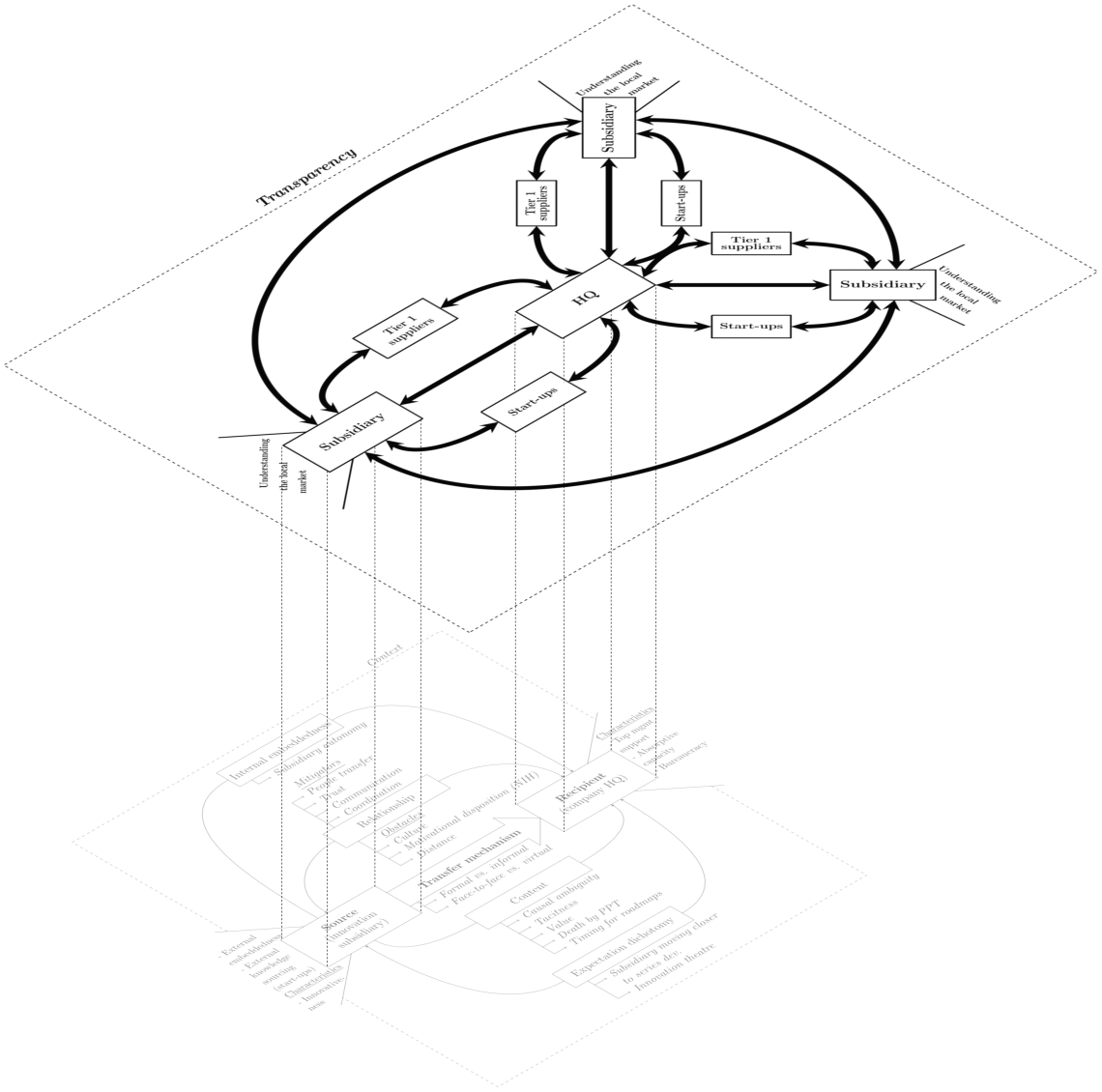


Figure 6.3: Modified conceptual framework, based on Phase 2 of this study

6.2 Contribution to Theory

As discussed in Chapter 2, this research is contextualised by the international business literature, particularly the topics of internationalisation, transfer of knowledge, and subsidiary-headquarters relations. Reviewing the existing research resulted in the identification of a gap in the literature: a lack of a holistic approach to reverse, intra-firm knowledge transfer. To address this gap, a conceptual framework was derived from the literature and applied throughout this work.

Multiple challenges of knowledge transfer predicted by the conceptual framework based on the broadcasting model have been confirmed through the in-depth case studies in this work. For instance, the trade-off between subsidiary autonomy and integration into the organisation is clearly evident, as predicted by Ghoshal and

Bartlett (1995), who suggest that, while autonomy is important: *"In the absence of such an integration process, decentralised entrepreneurship may lead to some temporary performance improvement as existing slack is harnessed, but long-term development of new capabilities or businesses is seriously impeded"* (p.148).

Furthermore, this study reflects the implementation of certain measures to help mitigate the challenges of knowledge transfer. For instance, the existing literature suggests that high levels of trust, communication, and coordination, i.e., *corporate socialisation*, help alleviate adversity in the relationship between actors of knowledge transfer (Björkman et al., 2004). One method of achieving this involves the transfer of people between the knowledge source and the recipient, which Harzing et al. (2016), Inkpen and Tsang (2005), and Szulanski (2000) suggest increases trust, reduces loss of information, and thus facilitates the implementation of transferred knowledge. Similarly, Vereecke et al. (2006) suggest that higher levels of people flow contribute to knowledge sharing in international manufacturing networks (IMN).

Looking more closely at the literature on global innovation (i.e., manufacturing, engineering, and R&D) networks, multiple aspects discussed by the reviewed studies are relevant to the data presented in Phase 2 of this thesis. For instance, considering the configuration of the networks of corporate innovation subsidiaries at case Companies A, B, and C, it is clear that these networks follow an autonomous, rather than integrated configuration, as defined by Zhang et al. (2008) in a study on Global Engineering Networks (GEN). In other words, the networks are characterised by dispersed and independent engineering centres, informal competitive mechanisms, strategic governance, and customised support systems. This makes knowledge management within and across the network highly complex. Furthermore, given that the studied networks are characterised as having effective, rather than efficient, performance (quick, agile, focussed on customer-driven innovation) (Zhang et al., 2008), they can be mapped onto the quadrant labelled GEN II in the framework shown in Figure 2.1. Indeed, as Zhang et al. (2008) suggest, Centres of Excellence (COEs), a term commonly used to characterise subsidiaries similar in nature to those studied in this thesis, fit in the autonomous configuration, effective performance quadrant (GEN II) of the GEN framework.

Furthermore, looking at various typologies of international R&D networks (Archibugi and Michie, 1995; Behrman and Fischer, 1980; Dunning and Narula, 1995; Ronstadt, 1978), the configuration of the networks of corporate innovation subsidiaries of case Companies A, B, and C can be characterised as having a world market orientation (Behrman and Fischer, 1980), following the purposes of global generation

of technology and asset-seeking R&D (Archibugi and Michie, 1995; Dunning and Narula, 1995), and consisting of corporate technology units established for long-term, exploratory purposes (Ronstadt, 1978). Following the typology developed by Gassmann and von Zedtwitz (1999), the networks studied in Phase 2 follow an R&D hub model, rather than an integrated R&D network model, as R&D activities are spread across different locations but are controlled and coordinated by headquarters, rather than there not being a distinct centre. Despite Case B having little oversight or control over its network of 60 global corporate innovation subsidiaries, the aim is nonetheless to maintain coordination centrally at headquarters.

Given the discussed considerations of the networks' configurations, the question remains of how to best manage knowledge transfer across these highly complex networks. While Szász et al. (2019) suggest that having a culture of knowledge sharing throughout the organisation, as well as introducing incentive systems for knowledge sharing and improved interaction between humans across the network improve knowledge sharing, these measures are, as of yet, lacking at the studied automotive companies. While the subsidiaries are nonetheless classified as net knowledge senders (Szász et al., 2019), the knowledge is not implemented successfully at the recipient (headquarters), possibly given the lack of knowledge sharing culture, incentives, and human interaction.

Digging deeper into the work by Shi and Gregory (1998), it becomes clear that the authors' statement that: *"As a whole system, the nodes still play a transformation role in the network, but the total configuration can generate more additional functionality for both corporation and its factories"* (p.209), while 20 years old, is no less relevant today. In particular, the authors' suggestion for network capabilities derived from the network's coordination are particularly relevant to the case studies presented in Chapter 5. Indeed, thriftiness ability, i.e. the ability to improve efficiency through networking, is suggested to reduce duplication of effort throughout the network. Furthermore, learning ability relates to the sharing and integration of knowledge between nodes in the network. Both are of high importance when trying to achieve knowledge transfer in networks of corporate innovation subsidiaries. Nonetheless, these capabilities appear to be lacking in the studied cases.

The analysis presented in this study clearly demonstrates that knowledge transfer persists to pose a challenge to be taken seriously if value is to be gained from corporate innovation subsidiaries, despite some subsidiaries having more than 20 years experience and despite all subsidiaries implementing measures to address the problem. Indeed, considering reverse intra-firm knowledge transfer holistically through-

out Phases 1 and 2 has alluded to deeper complexities of the research context that remain unaddressed by the existing literature:

- The subsidiaries are moving away from their original exploratory purpose, towards taking projects to higher levels of maturity and collaborating more with their headquarters' series development department. As a result, the knowledge transfer process between the subsidiaries and headquarters is not linear as previously suggested by the broadcasting model, but iterative;
- The roles of the actors in the framework are less clear-cut than suggested in the literature, but are instead ambiguous and variable;
- In practice, one must often consider a company's whole network of corporate innovation subsidiaries and the synergies between actors, rather than examining subsidiaries in isolation from one another.

As demonstrated, this study makes two main theoretical contributions. Firstly, it contributes to the literature on international business, particularly multinational subsidiaries and knowledge transfer, by developing a conceptual framework for the knowledge transfer from corporate innovation subsidiaries located in innovation clusters to their respective headquarters. This framework is refined through multiple phases of in-depth case studies, thus adding to the literature on obstacles to intra-firm knowledge transfer and how to manage them. Furthermore, the conceptual framework holistically integrates multiple factors affecting knowledge transfer, as well as the interactions between them, thereby addressing a key gap in the existing literature. Secondly, this study contributes to the literature on global innovation (i.e., manufacturing, engineering, and R&D) networks, by considering not just the dyadic relationship between a single corporate innovation subsidiary and its headquarters, but by also pointing out the challenges that arise when trying to manage knowledge transfer across a global network of such subsidiaries, for instance managing the transparency across the network to avoid duplication of effort.

6.3 Contribution to Practice

The findings from this study have three main implications for practitioners. Firstly, at a high level, this research draws attention to the practice of setting up a corporate innovation subsidiary in an innovation cluster such as Silicon Valley, Beijing, Tel Aviv, or elsewhere, for the purposes of staying abreast of new technological developments. This, in and of itself, constitutes a contribution to practice, as companies may not be aware of how to best access prominent innovation clusters.

Secondly, for those companies that already have a corporate innovation subsidiary in Silicon Valley or elsewhere, this work is highly relevant, as practitioners throughout this study seem to agree that transferring knowledge to headquarters is a core challenge faced by corporate innovation subsidiaries around the globe. Thus, developing a conceptual framework that demonstrates different obstacles to knowledge transfer, and how these obstacles are managed in practice by automotive case studies, provides practitioners from any industry with a valuable benchmark for the types of issues they ought to be aware of and how they might address them.

Finally, reconciling various aspects of the knowledge transfer literature into an integrative conceptual framework based on the commonly-used broadcasting model, and modifying this framework through iterations resulting from the two phases in this work, provides practitioners with an understanding about the complexities involved in the knowledge transfer process. Indeed, this thesis highlights that attempts at managing the obstacles to knowledge transfer often do not suffice and the struggle thus persists. Instead, this study emphasises a deeper, underlying cause of the friction between headquarters and corporate innovation subsidiaries. While this implies that the challenges are much more difficult to manage than previously suggested (there appears to be a fundamental contradiction, rather than a superficial disagreement), having an awareness of the severity of the problem is vital for practitioners in order to avoid attempting to solve seemingly superficial problems through similarly superficial measures. While this is by no means an easy feat, and the purpose of this thesis is not to provide practitioners with a toolkit for achieving this goal, this thesis does provide an awareness for where to best concentrate and deploy resources.

6.4 Limitations

This study bears the usual limitations of case study research. First and foremost, the case studies conducted in this research stem from a single industry, the automotive industry. This points to a limitation of the study's external validity, i.e., its generalisability (Yin, 2003), given that it does not address similar issues in other contexts. The contemporary automotive industry has been characterised as highly mature and incumbent (Diehlmann and Häcker, 2013; Holweg and Oliver, 2016), which suggests that large automotive manufacturers are more prone to be resistant to change and radical innovation than companies in other, more agile industries.

While the limitations of conducting in-depth case studies are clear, the resulting benefits must also be noted. As suggested by Gioia et al. (2010):

> *Studies cannot be simultaneously simple, accurate, and general; rather, researchers must choose which one or two of the three to emphasise. A case study provides the benefit of accurate observation and relative conceptual simplicity, although it trades off some degree of generalisability. (p.37) (See also Thorngate (1976).)*

Furthermore, despite the number of cases researched (eight), the number of interviews conducted (79), and the triangulation of interview data from both the perspectives of the various subsidiaries and their respective headquarters, this study lacks data from different levels of the organisational hierarchy. The majority of interviewees hold managerial positions, either at a subsidiary or at headquarters. While these interviewees are able to provide a high level overview of activities concerning knowledge transfer, interview data from other levels of the organisational hierarchy would have provided valuable insight into more operational aspects of the research context—a possible avenue for further research.

6.5 Future Research Directions

The discussed limitations call for further future research. For instance, certain hypotheses could be developed based on the framework and findings developed throughout this thesis, which would provide the basis for a deductive study in the form of a large-scale survey. Such an endeavour addresses the limited generalisability of this study, as it would allow sector boundaries to be crossed and the context-specificity of the framework to be reduced.

Given the high levels of interest expressed by practitioners involved in this study, future research could explore this research context from other angles. For instance, a topic often touched upon by interviewees involves the efficacy of corporate innovation subsidiaries and the value that they can deliver to the organisation. While this is a highly complex question, it is also an important one, as corporate innovation subsidiaries' value can be manifold. On the most obvious level, they provide headquarters with new technologies that can be incorporated into the organisation's products and thus bring market value. However, given the often exploratory nature of many such subsidiaries, and their focus on early-stage technologies, many launched projects may never end up on the market. This does not mean that the subsidiary is not delivering value. Indeed, as suggested by a practitioner involved in this study: *"Perhaps the greatest value provided by an outpost is their contribution in changing mindsets at different levels in the mother organisation"*.

Furthermore, a concept introduced in Phase 1 of this study, *innovation theatre*, points at another possible type of value provided by corporate innovation subsidiaries. As discussed, innovation theatre involves large companies establishing a presence in an innovation cluster not for the purpose of actually gaining technological value from that region, but to instead appear innovative, new, and prepared for the future. Thus, the mere existence of a corporate innovation subsidiary may benefit the organisation by raising the image (and possibly shareholder value) of the company. These considerations of value and efficacy constitute a complex, yet fruitful potential topic for further investigation.

An additional avenue for future research in the context of corporate innovation subsidiaries located in an innovation cluster involves the location choice for setting up such a subsidiary. The reasons for choosing Silicon Valley (or Beijing, Shanghai, Tel Aviv, Berlin, etc.) as a location were discussed in detail by interviewees and are illustrated in the case studies in Phases 1 and 2 of this work. However, there appears to be a threshold involved, determining at which point a company might merely send a representative to an innovation cluster periodically, or instead decides to fully commit through the establishment of a subsidiary. This research avenue would suggest a more regional approach, including literature on Foreign Direct Investment (FDI), regional cluster theory, innovation policy, and other areas.

Throughout this thesis, it has become evident that the multinational corporations under investigation struggle with knowledge transfer despite many years of experience and despite measures in place to help address the issue. This suggests that perhaps there are underlying complexities at work that are not fully construed by the broadcasting model and the knowledge transfer literature. A further theoretical lens through which to view knowledge transfer may be the theory of institutional logics, which suggests that corporations are subject to certain values, norms, symbols, and beliefs that make the corporations what they are (Thornton and Ocasio, 2008). A corporation's institutional logic provides it with organising principles and a common purpose, thereby (often subconsciously) influencing employee behaviour and judgement (Greenwood et al., 2011; Ngoye et al., 2019; Pache and Santos, 2010, 2013; Reay and Hinings, 2009; Thornton et al., 2012). However, while early literature in the field suggests that organisations are characterised by a single logic, later work argues instead that multiple, often competing logics, can exist simultaneously within a single organisation, often in specialised units or spaces, with each unit or space adhering to a distinct logic (Besharov and Smith, 2014; Pache and Santos, 2010, 2013; Perkmann et al., 2019; Raynard, 2016; Reay and Hinings, 2009).

Corporations that comprise multiple, potentially incompatible institutional logics are known as *hybrid organisations* (Battilana and Lee, 2014; Pache and Santos, 2013). Managing these competing institutional logics *"is challenging for organisations because it is likely to trigger internal tensions that may generate conflicts among organisation members, who are ultimately the ones who enact institutional logics"* (Battilana and Dorado, 2010, p.1420). In hybrid organisations, one logic often dominates while the other struggles to have an impact (Baba and Sasaki, 2016; Besharov and Smith, 2014; Ramus et al., 2017). This may result in actors on the side of the more peripheral logic not being heard or included, especially as *"mutual adjustment [of competing institutional logics] is only evident when the logic held by powerful actors is not threatened"* (Currie and Spyridonidis, 2016, p.93).

Thus, perhaps the automotive corporations discussed in this study comprise hybrid organisations with competing institutional logics on the side of the corporate innovation subsidiaries, versus the side of their headquarters. These competing institutional logics consequently result in underlying tension between the two sides, preventing knowledge from being transferred between them. Taking a novel theoretical lens to knowledge transfer would make for an interesting avenue for future research.

6.6 Conclusion

This study set out to explore the context of automotive corporate innovation subsidiaries located in Silicon Valley (and other locations) by answering the question of: *How is knowledge transferred from a corporate innovation subsidiary located in an innovation cluster to its company headquarters?* The key research objective was to develop a framework that conceptualises the knowledge transfer process from the innovation subsidiary to the parent company's headquarters, including a discussion of the obstacles to knowledge transfer, as well as how these obstacles are managed in practice. The study set out to achieve its objectives in two phases: (1) eight in-depth case studies of automotive corporate innovation subsidiaries located in Silicon Valley; and (2) further in-depth case studies of the global network of corporate innovation subsidiaries of case Companies A, B, and C.

By integrating the literature on knowledge transfer into a conceptual framework based on the commonly-used broadcasting model, and modifying this framework using the findings from the case studies in Phases 1 and 2, this thesis contributes to the literature on international business, particularly the topics of internationalisation, transfer of knowledge, and subsidiary-headquarters relations. Furthermore,

by considering not only the dyadic relationship and knowledge transfer between a single corporate innovation subsidiary and its headquarters, but by also discussing the challenges that arise when trying to manage knowledge transfer across a global network of such subsidiaries, this study contributes to the literature on global innovation (i.e., manufacturing, engineering, and R&D) networks. It is the hope that this study will stimulate future discussion on the research context to help advance our understanding of corporate innovation subsidiaries located in innovation clusters and how these subsidiaries can successfully transfer knowledge to their respective headquarters.

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Appendix A

Case Study Protocol

The following line of questioning was used during interviews with employees of the corporate innovation subsidiaries and of headquarters, respectively. Note that, instead of the more academic term *corporate innovation subsidiary*, the term *innovation outpost*, used more widely in industry, was used throughout the interviews in keeping with the preferred terminology of the interviewees.

Interviews with Employees of Subsidiaries

- Introduction to interviewee's role, position, division, background (expat or local hire, time spent at outpost, etc.)
- When was the outpost established? Why here?
- How many people work at the outpost?
- How is the outpost staffed? Expats vs. local hires?
- What topic areas does the outpost cover?
- What day-to-day activities are carried out at the outpost?
- What facilities does the outpost have?
- Who, if anyone, does the outpost collaborate with in its local environment? Start-ups, universities, competitors, Tier 1 suppliers, large IT companies ...?
- Can you tell me about the evolution of the outpost? How has it changed since it was established? In size, purpose, who it works with, etc.?
- Can you tell me about an example of a project that was successfully transferred to headquarters?

- How are projects usually transferred to headquarters? Is there a standard process? Who takes responsibility for the transfer? At what level of maturity does transfer usually occur?
- Can you tell me about how the outpost communicates with people at headquarters?
- How does the outpost fit into the wider organisation? Is it part of R&D, engineering, IT...?
- Who at headquarters does the outpost report to?
- What budget mechanism does the outpost employ?
- Who has the power/responsibility to make decisions about what projects are followed?
- Who drives the projects? Are projects usually demanded ("pulled") from headquarters or are they suggested ("pushed") by the outpost?
- How does the company's top management level (C-suite) engage with the outpost?
- What are some of the main challenges of working at an innovation outpost? How are these tackled?
- Open discussion
- Other suggested interview partners?

Interviews with Employees of Headquarters

- Introduction to interviewee's role, position, division, background
- How has the interviewee been involved with the Silicon Valley innovation outpost? (If applicable, does the interviewee also have experience working with the company's innovation outposts in other locations? If so, what are the differences and similarities between the Silicon Valley outpost and the other subsidiaries?)
- What, in their eyes, is the main purpose of the outpost(s)?
- How are projects transferred from the outpost(s) to business units at headquarters? Can we discuss specific examples of successful or not successful ones? Have any ended up in the vehicle?

- What is the balance and differences between push vs. pull projects (projects driven by the outpost vs. projects driven by headquarters)?
- At what level of maturity do projects normally get transferred?
- Does the transfer process differ for collaborative projects with start-ups in comparison to projects developed internally by the outpost?
- How/when does a Tier 1 supplier get involved in collaborations with start-ups? Is it the supplier's headquarters or the supplier's (Silicon Valley) outpost?
- What are some of the major challenges in working with the outpost?
- How could the transfer of projects be improved?
- Does the outpost work with any other business units at headquarters besides that of the interviewee?
- Has the outpost always worked with the same business units at headquarters, i.e., has the organisational fit of the outpost changed?
- Depending on how long the interviewee has been with the company, what was the original purpose of the outpost and have there been any major changes in the outpost's evolution? In size, purpose, who it works with, etc.?
- Open discussion
- Other suggested interview partners?

Appendix B

Overview of Interviews

Case company	Interview ID	Subsidiary location	Role of interviewee	Subsidiary or HQ?	Medium	Duration
Company A	A-1	Silicon Valley	Former head of subsidiary	Both (expat)	Telephone	30min
	A-2	Silicon Valley	Former head of subsidiary, now CVC team	Both (expat)	Telephone	30min
	A-3	Silicon Valley	Head of subsidiary	Both (expat)	Telephone	30min
	A-4	Silicon Valley	Three senior engineers	Subsidiary	Telephone	45min
	A-5	Silicon Valley	Senior engineer	Both (expat)	Face-to-face	90min
	A-6	Silicon Valley	Former head of subsidiary, now CVC team	Both (expat)	Face-to-face	40min
	A-7	Silicon Valley	Two senior engineers	Subsidiary	Face-to-face	60min
	A-8	None (HQ)	Manager at HQ R&D	HQ	Telephone	60min
	A-9	None (HQ)	Manager at HQ R&D	HQ	Telephone	30min
	A-10	None (HQ)	Manager at HQ R&D	HQ	Face-to-face	30min
	A-11	None (HQ)	VP, Digital Strategy	HQ	Telephone	30min
	A-12	Seoul	Head of subsidiary	Both (expat)	Telephone	60min
	A-13	Tokyo	Head of subsidiary	Both (expat)	Telephone	50min
	A-14	Shanghai	Head of open innovation	Subsidiary	Telephone	40min

	A-15	Shanghai	Head of open innovation	Subsidiary	Face-to-face	60min
	A-16	Seoul	Head of subsidiary	Both (expat)	Face-to-face	60min
	A-17	Tokyo	Head of subsidiary	Both (expat)	Face-to-face	80min
Company B	B-1	Silicon Valley	Business innovation	Both (expat)	Telephone	30min
	B-2	Silicon Valley	Head of business innovation	Subsidiary	Telephone	30min
	B-3	Silicon Valley	Head of business innovation	Subsidiary	Face-to-face	60min
	B-4	Silicon Valley	Head of business innovation	Subsidiary	Telephone	30min
	B-5	None (HQ)	Manager at HQ business innovation	HQ	Telephone	30min
	B-6	None (HQ)	Manager at HQ R&D	HQ	Telephone	60min
	B-7	None (HQ)	Manager at HQ R&D	HQ	Telephone	30min
	B-8	None (HQ)	Product manager at HQ R&D	HQ	Telephone	30min
	B-9	None (HQ)	Manager at HQ R&D	HQ	Telephone	60min
	B-10	None (HQ)	Manager at HQ R&D	HQ	Telephone	30min
	B-11	Tel Aviv	Head of subsidiary	Subsidiary	Telephone	60min
	B-12	Berlin	CFO of subsidiary	Subsidiary	Telephone	45min
	B-13	Berlin	Product manager	Subsidiary	Telephone	30min
	B-14	Beijing	Innovation manager	Subsidiary	Telephone	30min
	B-15	Bremen	Quality control	Subsidiary	Telephone	30min
	B-16	Beijing	Innovation manager	Subsidiary	Face-to-face	60min
	B-17	Bremen	Founder	Subsidiary	Telephone	30min
	B-18	None (HQ)	Two members of corporate strategy	HQ	Telephone	40min
Company C	C-1	Silicon Valley	Manager, open innovation	Subsidiary	Face-to-face	60min
	C-2	Silicon Valley	Manager, open innovation	Subsidiary	Face-to-face	60min
	C-3	Silicon Valley	Head of subsidiary	Both (expat)	Telephone	60min
	C-4	Silicon Valley	Head of subsidiary	Both (expat)	Telephone	45min
	C-5	None (HQ)	Two Managers at HQ R&D	HQ	Face-to-face	60min
	C-6	Paris	Founder	Both (expat)	Telephone	60min
Comp. D	D-1	Silicon Valley	Three product managers	Both (expat)	Face-to-face	60min
	D-2	Silicon Valley	Head of operations	Both (expat)	Telephone	60min
	D-3	Silicon Valley	Head of subsidiary	Both (expat)	Telephone	30min
	D-4	None (HQ)	Manager at HQ R&D	HQ	Telephone	30min

Comp. D	D-5	None (HQ)	Manager at HQ R&D	HQ	Telephone	60min
	D-6	None (HQ)	Manager at HQ R&D	HQ	Telephone	60min
	D-7	None (HQ)	Manager at HQ R&D	HQ	Telephone	30min
	D-8	Silicon Valley	Head of operations	Both (expat)	Telephone	30min
	D-9	None (HQ)	Manager at HQ business innovation	HQ	Telephone	45min
Comp. E	E-1	Silicon Valley	Head of subsidiary	Subsidiary	Telephone	30min
	E-2	Silicon Valley	Head of subsidiary	Subsidiary	Telephone	30min
	E-3	Silicon Valley	Head of subsidiary	Subsidiary	Face-to-face	90min
	E-4	None (HQ)	Manager at HQ R&D	HQ	Telephone	60min
Company F	F-1	Silicon Valley	Senior manager	Subsidiary F1	Face-to-face	60min
	F-2	Silicon Valley	Senior manager	Subsidiary F1	Telephone	30min
	F-3	Silicon Valley	Manager	Subsidiary F2	Telephone	30min
	F-4	Silicon Valley	Head of subsidiary	Subsidiary F2	Face-to-face	30min
	F-5	Silicon Valley	Senior engineer	Subsidiary F2	Telephone	30min
	F-6	Silicon Valley	Manager	Subsidiary F2	Telephone	30min
	F-7	None (HQ)	Two Managers at HQ R&D	HQ	Telephone	60min
	F-8	None (HQ)	Manager at HQ R&D	HQ	Telephone	45min
Comp. G	G-1	None (HQ)	Manager at HQ R&D	HQ	Telephone	30min
	G-2	Silicon Valley	Head of subsidiary	Subsidiary	Face-to-face	60min
	G-3	None (HQ)	Manager at HQ R&D	HQ	Telephone	30min
	G-4	Silicon Valley	Communications lead	Subsidiary	Telephone	45min
Company H	H-1	Silicon Valley	Communications lead	Subsidiary	Telephone	30min
	H-2	Silicon Valley	Head of subsidiary	Subsidiary	Face-to-face	80min
	H-3	Silicon Valley	R&D engineer	Subsidiary	Telephone	30min
	H-4	Silicon Valley	Programme manager	Subsidiary	Telephone	30min
	H-5	Silicon Valley	Manager, open innovation	Subsidiary	Telephone	30min
	H-6	None (HQ)	Manager at HQ R&D	HQ	Face-to-face	60min
Other	N/A	N/A	Silicon Valley innovation outpost expert	N/A	Face-to-face	90min
	N/A	N/A	Silicon Valley innovation outpost expert	N/A	Face-to-face	60min
	N/A	Silicon Valley	Two co-heads of Tier 1 supplier subsidiary	Both (expats)	Face-to-face	45min
	N/A	Silicon Valley	Head of Tier 1 supplier subsidiary	Both (expat)	Face-to-face	50min

Other	N/A	Silicon Valley	Head of Tier 1 supplier subsidiary	Both (expat)	Face-to-face	50min
	N/A	N/A	Silicon Valley innovation outpost expert	N/A	Telephone	45min
	N/A	N/A	Silicon Valley innovation outpost expert	N/A	Face-to-face	45min
TOTAL:	**79**					

Appendix C

Examples of Coding Procedure

Interview D2

D2: So usually what we do is, for every single project that we are doing at the [subsidiary], we have a so to speak Godfather in [headquarters], like somebody who is just overseeing the project. Like a counter-part in [headquarters]. Because it is incredibly hard to transition anything to [headquarters] if you don't already have an evangelist, a partner so to speak, in place from early on. So what we are trying to do is, when we start with initial ideas, to not only sort of compare and share our roadmap at the beginning of the year with our stakeholders, but we are also trying to find the right potential partner in [headquarters]. So even if they are not yet maybe ready to invest or support the project, they are still accompanying the project throughout the process. And then, depending on our partner in [headquarters] or the group that we are working with, or what part of the process the project is in, then collaboratively we decide, ok, now it is time to hand over. Sometimes it is us asking: *"Hey, we are ready to hand over because we have done our part and now you need to take it for the rest of the way."* Or sometimes they say: *"Hey, we are ready now to include it in our production process"*. It really depends on the project itself and often how it fits into the typical timeline of new vehicle development or refreshers that we do of existing vehicles.

- Internal embeddedness
- Need HQ buy-in for transfer
- Early involvement of HQ
- Co-creation of projects with HQ
- Timing & roadmaps

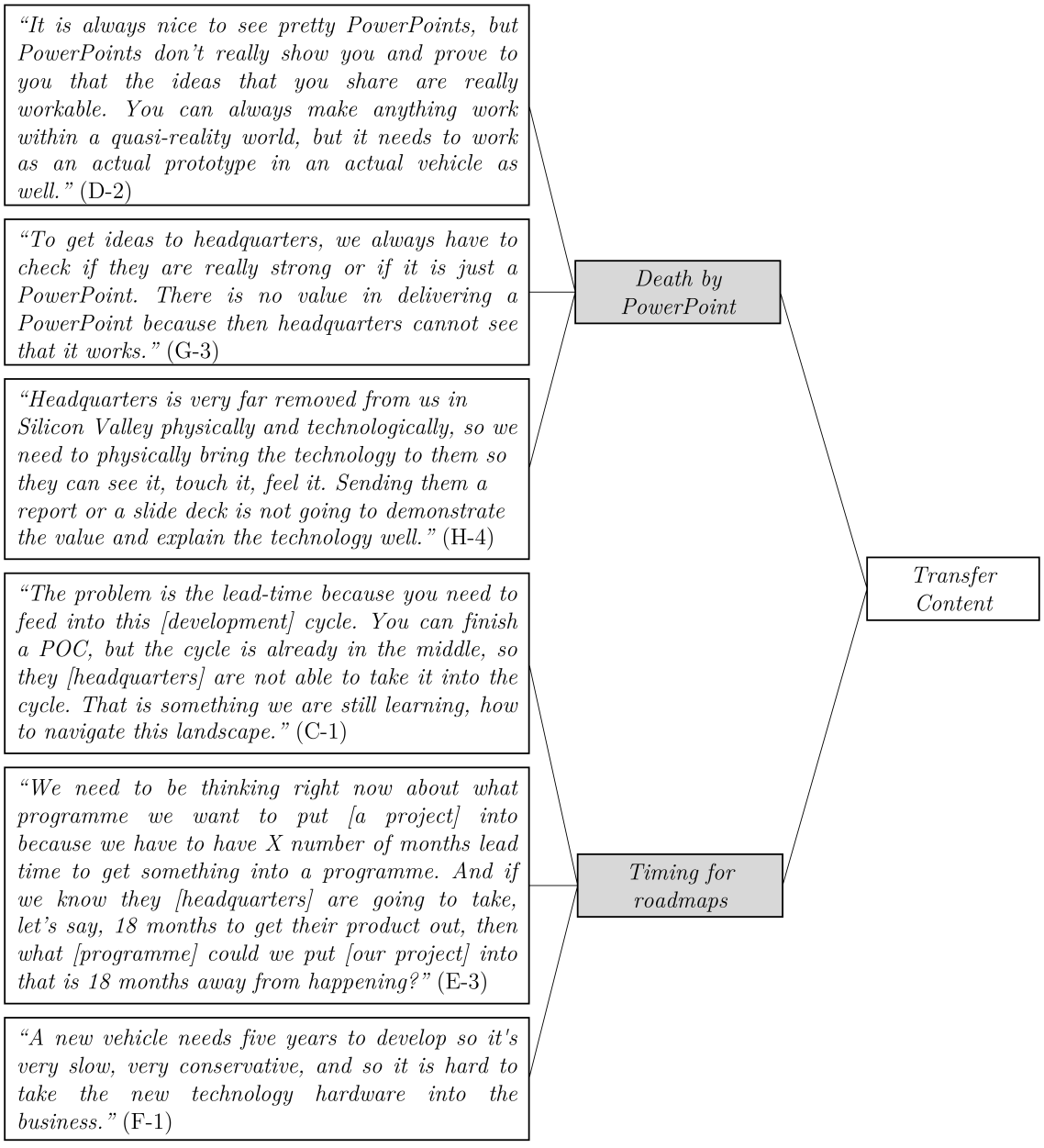
Interview E3

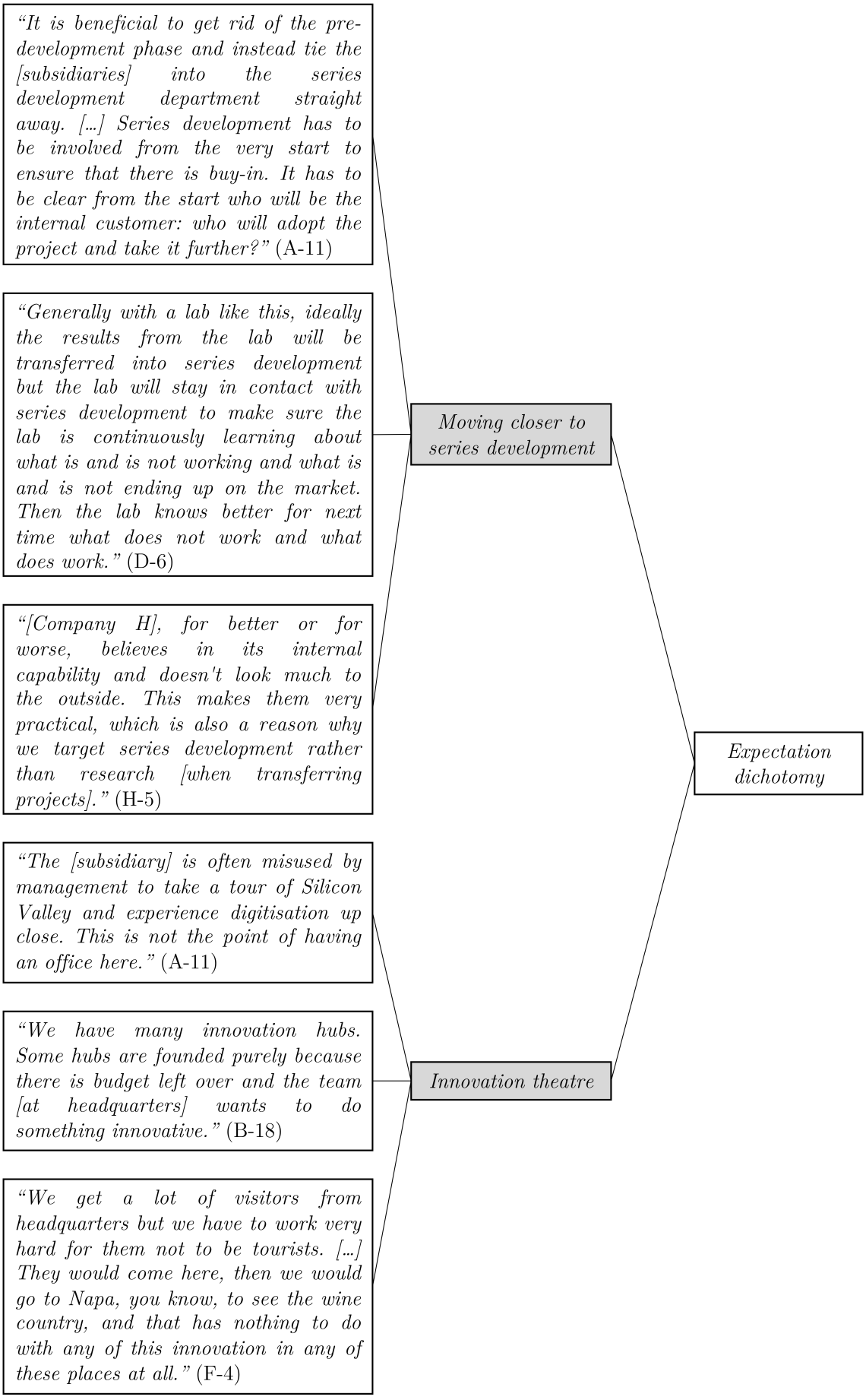
E3: I think there are a lot of missed opportunities. I think there are many things that we have seen in the past, where we have said that this is something that we need to pay attention to. And we either don't do it at all, or we are way too late, or we get scooped by one of our competitors. And it is just like *"Oh my God, if you would only listen to us more"*. We had been raising our hands as soon as we were hearing about Uber. Like: *"Guys you have to pay attention. This is important. I know it has nothing to do with building a car, but you have to pay attention."* Their response is like: And then *"What are you talking about? Sharing a ride? Calling some random person to take me? Why would I want to do that?"* I'm like: *"You guys live places where there is good parking all the time and it is not hard to get around. You all have cars. You don't understand what it is like. People want this service."* And they still say; *"Oh I don't know, I don't get it."* And then Uber and Lyft really took off, right? And then I got people going: *"Well why didn't we think of that?"* And it's like… *"First of all, we told you about it. Second of all, you were never going to think of that, because of the reasons that we just said"*. So there is plenty of stuff with missed opportunities. Part of it is a difference in culture. You talk to people who come from [headquarters] and one of the guys in my group likes to ask them: *"Have you ever used Uber or Lyft?"* A lot of the older guys say: *"No."* Their issues are different, so I say: *"Look, you need to trust us. You need to listen to us"*. And people have started trusting us and listening to us more, because we have turned out to be right a few times. Sometimes you have to have a couple of big misses and a big *"I told you so"*, for people to say: *"Ok fine, next thing that happens, you guys let us know"*.

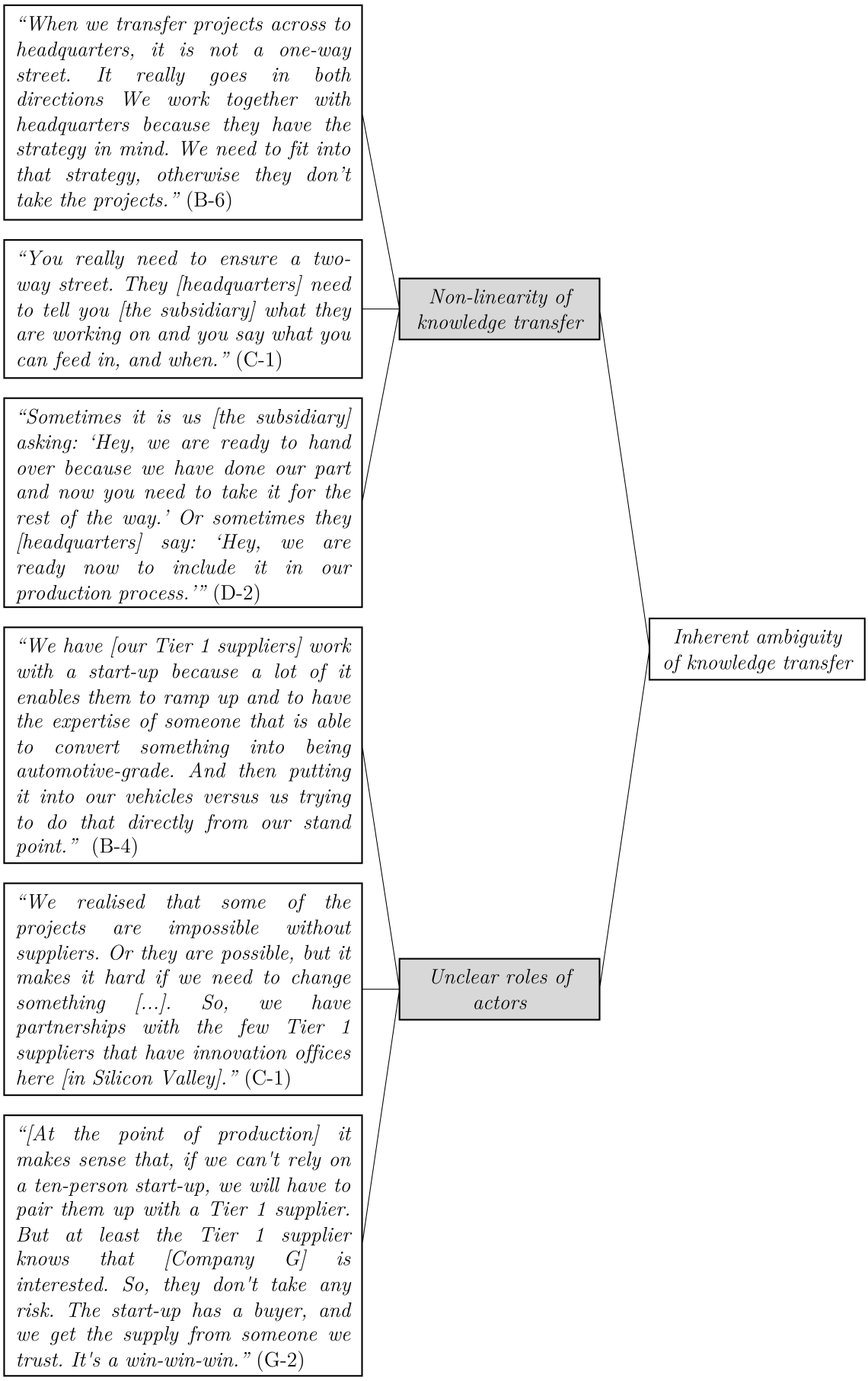
- Frustration at HQ for being slow and not listening / trusting
- Lack of trust / interest from HQ
- Difference in culture
- HQ struggles to innovate
- Difference in culture
- Building credibility

Appendix D

Illustration of Data Analysis Procedure




"It is beneficial to get rid of the pre-development phase and instead tie the [subsidiaries] into the series development department straight away. […] Series development has to be involved from the very start to ensure that there is buy-in. It has to be clear from the start who will be the internal customer: who will adopt the project and take it further?" (A-11)
"Generally with a lab like this, ideally the results from the lab will be transferred into series development but the lab will stay in contact with series development to make sure the lab is continuously learning about what is and is not working and what is and is not ending up on the market. Then the lab knows better for next time what does not work and what does work." (D-6)
"[Company H], for better or for worse, believes in its internal capability and doesn't look much to the outside. This makes them very practical, which is also a reason why we target series development rather than research [when transferring projects]." (H-5)
"The [subsidiary] is often misused by management to take a tour of Silicon Valley and experience digitisation up close. This is not the point of having an office here." (A-11)
"We have many innovation hubs. Some hubs are founded purely because there is budget left over and the team [at headquarters] wants to do something innovative." (B-18)
"We get a lot of visitors from headquarters but we have to work very hard for them not to be tourists. […] They would come here, then we would go to Napa, you know, to see the wine country, and that has nothing to do with any of this innovation in any of these places at all." (F-4)
Moving closer to series development
Innovation theatre
Expectation dichotomy


"When we transfer projects across to headquarters, it is not a one-way street. It really goes in both directions We work together with headquarters because they have the strategy in mind. We need to fit into that strategy, otherwise they don't take the projects." (B-6)
"You really need to ensure a two-way street. They [headquarters] need to tell you [the subsidiary] what they are working on and you say what you can feed in, and when." (C-1)
"Sometimes it is us [the subsidiary] asking: 'Hey, we are ready to hand over because we have done our part and now you need to take it for the rest of the way.' Or sometimes they [headquarters] say: 'Hey, we are ready now to include it in our production process.'" (D-2)
"We have [our Tier 1 suppliers] work with a start-up because a lot of it enables them to ramp up and to have the expertise of someone that is able to convert something into being automotive-grade. And then putting it into our vehicles versus us trying to do that directly from our stand point." (B-4)
"We realised that some of the projects are impossible without suppliers. Or they are possible, but it makes it hard if we need to change something [...]. So, we have partnerships with the few Tier 1 suppliers that have innovation offices here [in Silicon Valley]." (C-1)
"[At the point of production] it makes sense that, if we can't rely on a ten-person start-up, we will have to pair them up with a Tier 1 supplier. But at least the Tier 1 supplier knows that [Company G] is interested. So, they don't take any risk. The start-up has a buyer, and we get the supply from someone we trust. It's a win-win-win." (G-2)
Non-linearity of knowledge transfer
Unclear roles of actors
Inherent ambiguity of knowledge transfer

Appendix E

Summary Table of Phase 1 Case Studies

See below for a summary table of the cross-case analysis of Phase 1 of this study (i.e., case studies of automotive corporate innovation subsidiary located in Silicon Valley). Note that an empty cell in the table does not indicate the absence of this particular category from a case, but merely a lack of conclusive data about it. Instead, absence of a category from a case is explicitly stated in the table.

	Case A	Case B	Case C	Case D
Internal embeddedness				
Expats	Expats as network in HQ	Expats as network in HQ	Expats as network in HQ	Subsidiary consciously reducing number of expats
KT personnel	Designated KT personnel at HQ fosters the network	Designated KT personnel at both HQ and subsidiary fosters the network	Newly introduced designated KT personnel at subsidiary fosters the network	Designated KT personnel at HQ fosters the network
Autonomy	Dual-budget system; Limited subsidiary autonomy (requires buy-in from HQ)	Dual-budget system; Limited subsidiary autonomy (mainly conducts projects requested specifically by HQ); Lab-B is separate legal entity for more autonomy	Autonomous budget; High subsidiary autonomy, but too fast for HQ as a result; subsidiary gets buy-in from HQ before starting project	Dual-budget system; Limited subsidiary autonomy (requires buy-in from HQ)
External embeddedness and knowledge sourcing				
Local hiring			Aim of office is to learn from local hires and industries	Aim of office is to learn from local hires
Start-ups	Cultural differences between HQ and start-ups hinder the collaboration so link is established to Tier 1 suppliers	Cultural differences between HQ and start-ups hinder the collaboration so link is established to Tier 1 suppliers; Not demanding exclusivity from start-ups	Start-up technology must fit into larger system so link is established to Tier 1 suppliers	Start-up technology must fit into larger system so link is established to Tier 1 suppliers
Accelerator partner	No partnership with accelerator	No partnership with accelerator	No partnership with accelerator	No partnership with accelerator

	Case E	Case F (F1 & F2)	Case G	Case H
Internal embeddedness				
Expats	No expats at this subsidiary	Expats from both subsidiaries as network in HQ	Expats as network in HQ; Co-leadership approach improves both internal and external embeddedness	Expats as network in HQ
KT personnel	No designated knowledge transfer personnel	No designated knowledge transfer personnel	No designated knowledge transfer personnel	Designated KT personnel at HQ fosters the network
Autonomy		F1 dual-budget system and limited subsidiary autonomy (requires buy-in from HQ); F2 has autonomous budget and is separate legal entity for high level of autonomy	Dual-budget system; Limited subsidiary autonomy (mainly conducts projects requested specifically by HQ)	Separate legal entity, but nonetheless limited autonomy because of dual-budget system
External embeddedness and knowledge sourcing				
Local hiring	All employees are local hires	Aim of office is to learn from local hires	Aim of office is to learn from local hires	
Start-ups	Cultural differences between HQ and start-ups hinder the collaboration so link is established to Tier 1 suppliers	F1 struggles to work with start-ups because of lack of autonomy; F2 mainly works with start-ups by investing equity	Start-up technology must fit into larger system so link is established to Tier 1 suppliers	Providing collaborative workspace for start-ups; not demanding exclusivity from start-ups
Accelerator partner	Partnership with accelerator to find more start-ups to work with	No partnership with accelerator	Partnership with accelerator to find more start-ups to work with	No partnership with accelerator

	Case A	Case B	Case C	Case D
Actor characteristics				
Top mgmt. support	Has recently been improving through executives visiting subsidiary; HQ is busy and slow by definition	Has recently been improving through executives visiting subsidiary	Has recently been improving through executives visiting subsidiary	Has recently been improving through executives visiting subsidiary
Actor relationship				
Adversity	Strong NIH syndrome at HQ; HQ employees envious of subsidiary; one-sided relationship because subsidiary is loyal to organisation despite HQ having decision-power	Strong NIH syndrome at HQ; misunderstanding by HQ about the way of working of the subsidiary	Strong NIH syndrome at HQ; frustrations because of differences in culture and speed	Strong NIH syndrome at HQ; expats are not enough to ease NIH and transfer issues, so structures need to be put in place; lack of trust by HQ to subsidiary; envy, competition, threat, resentment from HQ to subsidiary
Culture	HQ is bureaucratic, subsidiary is like start-up, this results in friction and incongruities	HQ is bureaucratic, subsidiary is like start-up, this results in friction and incongruities	HQ is bureaucratic, subsidiary is like start-up, this results in friction and incongruities	HQ is bureaucratic, subsidiary is like start-up, this results in friction and incongruities
Transfer cont. & mech.				
Death by PPT	Subsidiary needs to develop POC rather than present PPT to HQ	Subsidiary needs to develop POC rather than present PPT to HQ	Subsidiary needs to develop POC rather than present PPT to HQ	Subsidiary needs to develop POC rather than present PPT to HQ
Transfer timing	Timing of transfer must fit with HQ roadmap		Timing of transfer must fit with HQ roadmap; knowledge transfer must be two-ways instead of just linear to ensure timing is correct	Timing of transfer must fit with HQ roadmap

	Case E	Case F (F1 & F2)	Case G	Case H
Actor characteristics				
Top mgmt. support	Has recently been improving through executives visiting subsidiary; HQ is busy and slow by definition	F1 has little support from top management because visiting executives end up being tourists; F2 has top management support through direct links to board and dual mgmt. role of subsidiary head	High management support because of direct links to executives, but subsidiary projects outside scope of HQ so knowledge transfer is still difficult	Good support from top management in driving projects
Actor relationship				
Adversity	Strong NIH syndrome at HQ	Frustrations because HQ is slow and does not implement projects	Strong NIH syndrome at HQ; HQ dismisses subsidiary because of added work; need to transfer projects at exactly right level of maturity	Strong NIH syndrome at HQ; HQ sees subsidiary as threat
Culture	HQ is bureaucratic, subsidiary is like start-up, this results in friction and incongruities; Subsidiary provides mentors from HQ for start-ups as bridge	HQ is bureaucratic, subsidiaries are like start-ups, this results in friction and incongruities	Subsidiary loyalty swings from start-up to HQ at point of production	HQ is bureaucratic, subsidiary is like start-up, this results in friction and incongruities; Subsidiary provides mentors from HQ for start-ups as bridge
Transfer cont. & mech.				
Death by PPT			Subsidiary needs to develop POC rather than present PPT to HQ	Subsidiary needs to develop POC rather than present PPT to HQ
Transfer timing	Timing of transfer must fit with HQ roadmap	Timing of transfer must fit with HQ roadmap		Timing of transfer must fit with HQ roadmap

	Case A	Case B	Case C	Case D
Mechanisms	Expats, business trips, calls, newsletter, company innovation fair day	Expats, calls, newsletter	Constant communication	Business trips, calls, newsletter, company innovation fair day
Further considerations				
Closer to series	Subsidiary purpose is moving from exploratory nature towards series dev.; Subsidiary secures early buy-in from HQ before starting a project	Most projects are requested by HQ series dev. and the subsidiary is moving closer as a result	HQ thinks the subsidiary is closer to series dev. than it actually is (see differing expectations below)	Subsidiary purpose is moving from exploratory nature towards series dev.
Expectation dichotomy	Subsidiary used as extended workbench for outsourcing series dev. work; Innovation theatre	Subsidiary wants to make whole company better at innovation; HQ sees subsidiary as extended workbench for series dev.	Unrealistic expectations by HQ about what subsidiary can do because subsidiary demonstrates prototypes without mentioning limitations of the prototpyes; Subsidiary has introduced a failure KPI, but this is not well understood by HQ because of a contrast in culture	
KT non-linear	More collaboration with HQ results in iterative KT process	Most projects requested by HQ series dev., so KT process is iterative	Knowledge transfer must be two-ways instead of just linear to ensure timing is correct	Most projects requested by HQ series dev., so KT process is iterative

	Case E	Case F (F1 & F2)	Case G	Case H
Mechanisms	Business trips, calls, newsletter	Expats, calls, reports, company innovation fair day	Co-leadership approach, business trips, calls	Expats, business trips, calls, newsletter
Further considerations				
Closer to series		Most projects are requested by HQ series development and the subsidiary is moving closer to series development as a result	Most projects are requested by HQ series development and the subsidiary is moving closer to series development as a result	Subsidiary purpose is moving from exploratory nature towards series dev.
Expectation dichotomy	Talent circulation between research and series dev. at HQ is reducing expectation dichotomy	Subsidiaries see themselves as being focussed on research, while headquarters series dev. requests projects of subsidiaries, resulting in mismatch in expectations about subsidiaries' role		F2 became separate legal entity to be more like start-up, but still has to target series dev. for KT
KT non-linear		Most projects at F1 requested by HQ series dev., so KT process is iterative	Most projects requested by HQ series dev. and most projects done in conjunction with HQ, so KT process is iterative	Improve transfer success by sending HQ series dev. people to subsidiary for short stays (train more catchers), making the knowledge transfer process less linear

Appendix F

Summary Table of Phase 2 Case Studies

See below for a summary table of the cross-case analysis of Phase 2 of this study (i.e., the global network of corporate innovation subsidiaries of case Companies A, B, and C). Note that an empty cell in the table does not indicate the absence of this particular category from a case, but merely a lack of conclusive data about it. Instead, absence of a category from a case is explicitly stated in the table.

	Case A	Case B	Case C
Internal embeddedness			
Expats	No expats at Asian subsidiaries, given focus on homologation	No expats at Asian subsidiary, given focus on homologation	Expats as network in HQ; Paris subsidiary physically close to HQ so more interaction
KT personnel	Designated KT personnel at HQ fosters the network	Designated KT personnel at HQ fosters the network	No designated knowledge transfer personnel
External embeddedness and knowledge sourcing			
Homologation	Mainly local hiring; transfer projects directly to R&D centre in China	Mainly local hiring in China; transfer projects directly to R&D centre in China	Homologation not mentioned
Actor relationship			
Adversity	NIH syndrome at HQ	NIH syndrome and power struggle at HQ	
Culture	Differences in national culture and language cause misunderstandings; HQ doesn't understand the local market	Differences in national culture and language cause misunderstandings; HQ doesn't translate key documents into English	Heavy-weight processes at HQ hinder subsidiaries' collaboration with start-ups
Further considerations			
Transparency	Having transparency across the network of subsidiaries is key to spread knowledge and avoid duplicated efforts; database introduced to help with this, but effectiveness is limited	Having transparency across the network of subsidiaries is key to spread knowledge and avoid duplicated efforts; 60 subsidiaries with little communication between them	Transparency not mentioned
Other	Other subsidiaries conduct projects to lower maturity than Silicon Valley subsidiary	Innovation theatre (subsidiaries established just for the purpose of appearing innovative)	Co-working space and co-governance of subsidiary with external partners