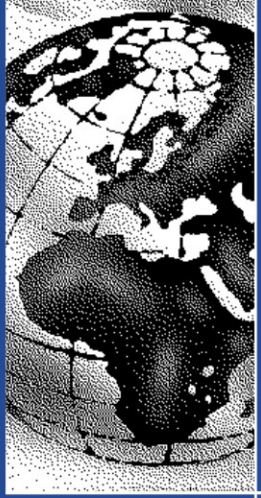

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Kay Oppat

Disseminative Capabilities

A Case Study of Collaborative Product Development in the Automotive Industry

GABLER EDITION WISSENSCHAFT

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Kay Oppat

Disseminative Capabilities

A Case Study of Collaborative Product Development in the Automotive Industry

With a foreword by Prof. Dr. Fritz Fahrni and Dr. Daniel Whitney

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Foreword

At first glance, the two topics - knowledge transfer and product development processes in the automotive industry - seem to have received abundant research attention and coverage over the last two decades. Can anything new, relevant, and interesting be discovered?
Oppat proves that this is not only possible but that it even can be exciting. Knowledge transfer has indeed been investigated thoroughly. Nevertheless the attention has been primarily on the success factors of the transfer process. In his work, the author focuses on the front-end part, i.e. on the input to the process. In dozens of interviews and careful observations Oppat determines the effects of the sender, the disseminative capabilities. These capabilities prove to be of importance for the receiving, the absorptive part of the transfer chain.
What makes it exciting to follow this research work is the combination of these rather theoretical and abstract ideas with a truly interesting and little known aspect of the automobile industry. The cases do not deal with "normal" supplier – OEM relations but with a much more intricate pattern of collaboration. It is the "outsourcing of the integral value chain", from the development process of a car model all the way to the manufacturing and even the distribution, which is investigated.
The fun of reading and following these thoughts is enhanced by fluent writing and smart illustrations.

Prof. Fritz Fahrni, PhD
Federal Institute of Technology Zurich and
University of St.Gallen

This research should be of interest to practitioners as well as researchers from several different communities. Managers wishing to build successful long term partnerships in complex system development need to understand what it takes to merge the methods, processes, IT systems, and assumptions of different companies in order to cooperate successfully. This can be surprisingly difficult even when – or especially when – the companies nominally make the same product (in this case automobiles). The topic here is more detailed and specific than the broader but vaguer task of merging "cultures." The present research lists a number of areas where people at different companies must learn about each others' work methods. Furthermore, it becomes clear that ongoing

effort is required to sustain the level of cooperation and knowledge exchange that is required for successful partnerships.

Researchers from a variety of fields will find useful insights and findings here: product development, joint ventures, outsourcing, knowledge management and transfer, and pedagogy. Oppat shows that each of these fields takes a view of a portion of this problem, but it is actually multi-faceted and requires the views of all to be merged.

While the research is entitled "Disseminative Capacity and Capability," the reader should be careful to note the places where it points out that the process of knowledge transfer is a two-way street. A good knowledge source can help a knowledge receiver to be a better receiver but a receiver can also help a sender to be a better sender. The responsibilities for making these exchanges successful lie not only with managers but also with individual members of the respective companies because these latter are the ones who actually send and receive the knowledge. The kinds of professionals who can help are surprising, including psychologists.

The research focuses on one particular kind of complex product, automobiles, and the focus on a specific kind of product naturally introduces some limitations on generality but more powerfully provides grounding for specific findings. Automobile companies do not see themselves as being in the teaching business (with the possible exception of Toyota) but the research shows that forming a partnership for the purpose of developing a complex product requires a lot of teaching.

The focus on the auto industry and particularly on Magna-Steyr as the "knowledge receiver" provides valuable detail as well as important learning opportunities. One point that is particularly interesting is the use of boundary objects by Magna-Steyr and partners in their more successful partnerships. Boundary objects are usually physical things that are the focus of exchanges across boundaries of one kind or another, such as between organizations in or between companies, or between people in different scientific fields. An example in the car industry is a prototype or physical mockup of a car or part of one. This performs many functions, including being a meeting place like a water fountain and providing opportunities for people with a shared interest in the same item (a part of the car, for example) to discuss it together. Boundary objects are different from boundary people (gate-keepers, liaison people) who can make connections but cannot be the common object of interest themselves.

Another point of interest in this research, less likely to be generalizable than the notion of boundary object, is Magna-Steyr itself. This company's business model is to partner with larger auto manufacturers while not becoming one itself. It is a full service supplier at the level of the car manufacturers and not a mere supplier at a lower tier. Given

its business model, it has had to learn how to absorb the methods of its customers in a way that typical suppliers do not have to do. It is also in a position analogous to Toyota in being world class in what it does. Remarkably, it is able to do something that nearly all companies want to do but have great difficulty doing, namely changing its product development methods. This simple fact is easy to pass over while reading this research, but it should be savored for what it is, an extremely unusual skill. Some, but not all, of its methods for doing this are revealed in this research, but more attention should be focused on this capability in the future.

Daniel E. Whitney, PhD
Massachusetts Institute of Technology

Preface

Writing a dissertation thesis is a long journey, starting with the initial research ideas, a closer examination of specific aspects, and the constant re-shaping of the research focus. I was lucky to find a topic fascinating from a theoretical perspective, attractive to companies so that I was able to do practice-oriented research, and of particular interest to me personally. The path to this thesis was full of doubts, fears, as well as enlightening moments. However, without the exceptional support of outstanding individuals this work might not have been finished at all. Fortunately, this research journey is not over yet; nevertheless, I want to thank those people accompanying me along the way to this milestone.

It has been an honor for me to have worked together with Fritz Fahrni for over three years now. I cannot imagine a better person, mentor, and thesis supervisor. Throughout my time as a research assistant he supported me in all work-related as well as private aspects, providing comments and guiding thoughts, and allowed me the necessary freedom to achieve the best I could.

I want to thank Georg von Krogh for his comments and thoughts on my dissertation project and the ideas I had. The insights provided from his wealth of experience helped me to look into new issues and to follow the research idea in the focus of this dissertation.

In 2007, I had the chance to work together with Daniel Whitney, who challenged my work and ideas with his vast wealth of practical and research experience. This proved an enormous help in improving and finalizing my dissertation work. You were my host during my time at the Massachusetts Institute of Technology, and in you I discovered a friend for life.

Without a doubt, the most important person in my whole support network is Anna. You modified your own expectations, sacrificed almost everything, but nevertheless, you always provided me with the strength to get through difficult situations and decisions, believed in my ideas and dreams - and all of this with a smile on your face. I will never be able to repay you for what you have given me during all these years. This work is for you alone!

Mom and dad, you did an outstanding job. You never doubted me - neither in the moment I decided to stay another three years in academia nor when I went abroad - and all the time you provided me with such a warm and hearty welcome in Berlin.

Besides the aforementioned people, there are many others who offered their thoughts on my work, who inspired hope and optimism, or who provided me with a break from

work when it comes to finalizing a work like this. All these little bits and pieces are highly important to finishing up a work like the one at hand and unfortunately I cannot mention every dimension of the impact you all had! In this vein I want to thank Thomas Allen, Mohammed Ayaz, Nick Berente, Sebastian Fixson, Dirk Gevers, John Grace, Stefan Graf, Jörg Güttinger, Daniel Arthuro Heller, Simone Janz, Axel Justus, Phillip Kirst, John Paul McDuffie and the IMVP, Thomas Mohr, Christoph Müller, Jehanzeb 'Dan fellow' Noor, Javier Perez-Freije, Regina and Lothar Raddy for their outstanding support, Maike Ratije, Eric Rebentisch, Gerrit Reepmeyer, Andreas Schreiner, Anja Schulze, Warren Seering, Markus Siegel, 02139 St. Mary Road research center and especially Naomi Mbaita de Almeida, Hanno Stegmann, the Swiss National Science Foundation for providing me with the opportunity to fulfil a dream, and the people I forgot to mention. Last but not least, I want to thank Magna Steyr, BMW, and Mercedes Benz for their incredible support as well as Carsten Henkel, Beatrix Morath, and Christian Krys of Roland Berger for publishing my work.

I am more than grateful!

Kay Oppat
St.Gallen, May 2008

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List of abbreviations

AG	Stock listed company (Aktiengesellschaft)
BMW AG	Bayrische Motorenwerke AG
DCV	Dynamic capability view
DiC	Disseminative capabilities
E-83/85/86	Internal project numbers BMW
Ed.	Editor
et al.	et alii
GM	General Motors
Hrsg.	Editor (Herausgeber)
KBV	Knowledge-based view
KG	Kommanditgesellschaft
MB	Mercedes Benz
MNC	Multinational company
MIT	Massachusetts Institute of Technology
No.	Number
NVH	Noise, Vibration, and Harshness
OEM	Original Equipment Manufacturer
PD	Product development
PSA	Peugeot Société Anonyme (Peugeot company)
R&D	Research and Development
RBV	Resource-based view
SAV®	Sports Activity Vehicle
SOP	Start of Production
SMS	Short message service
SUV	Sports Utility Vehicle
USA	United States of America
Vol.	Volume
W124/210/211	Internal project numbers Mercedes Benz (4-matic series)
X3	BMW model
Z4	BMW model

Summary

Why do companies like BMW and PSA jointly develop engines for cars like the new MINI; why did Bang & Olufsen together with Samsung jointly develop the Serene cell phone, or why did Saab and Magna Steyr co-develop the Saab 9.3 convertible?
Collaborating in product development (PD) seems to be a dominant strategy, as firms strive to increase efficiency and effectiveness in developing products by, e.g., sharing development-related costs and risks, or gaining access to critical knowledge assets. Utilizing existing knowledge bases to unleash the potentials of the partners' supplementary strengths, companies bridge islands of background and knowledge.
An important means for bridging those islands is knowledge transfer, and growing evidence can be found indicating that organizations successful in knowledge transfer outperform competitors. Although knowledge transfer and its success levers (e.g., absorptive capacity) are well-researched phenomena, equivalent investigations of the sender impacting inter-organizational transfer success are lacking. Investigations concerning the capabilities of the knowledge sender are sparse and fragmented. Addressing this issue, I introduce the concept of disseminative capabilities (DiC), assuming a positive impact of these capabilities on knowledge transfer performance. As the knowledgeable one in charge of 'teaching' her partner about project-relevant fields, she transfers knowledge by deploying communication approaches. The preceding concept provides the theoretical grounding of this work, which helped to shape the picture of the knowledge sender and the dimensions of her capabilities.
Initially, the theoretical streams mentioned above help to shape the picture of DiC, and empirical investigations revealed its eight dimensions impacting knowledge transfer performance. The in-depth cases conducted focus on joint car development projects between Magna Steyr, an Austrian-based company, and German-based BMW, Mercedes Benz, and Audi. The research results clearly indicate that DiC impact on the knowledge transfer process and explain why the analyzed projects differ in terms of transfer success.
When considering inter-organizational knowledge transfer as an increasing phenomenon, it is imperative that organizations develop DiC in order to succeed and hence contribute to collaboration success. Based on the research findings, this work provides managerial implications for all eight dimensions of DiC and, by deploying insights from the empirical investigations, outlines ways to develop them successfully. This helps companies across industries to become successful knowledge senders and hence to realize competitive advantage from collaborative PD.

Wieso entwickeln BMW und PSA die neue Generation der MINI Motoren gemeinsam? Welche Vorteile bietet ein kooperativer Ansatz Bang & Olufsen und Samsung im Falle des Serene Handy und wieso kooperiert Saab bei der Entwicklung des Saab 9.3 Cabrio mit Magna Steyr?

Kooperationen im Bereich der Produktentwicklung (PE) sind eine dominante Strategie. Firmen versuchen auf diesem Weg Ihre Effizienz und Effektivität in der PE zu verbessern durch eine schnellere Markteinführung, die Reduzierung der Entwicklungskosten und -risiken, oder einen Zugang zu kritischen Ressourcen. Um das Potential der sich ergänzenden Wissensbasen involvierter Partner und eine erfolgreiche PE zu realisieren, müssen Unternehmen diese Basen verbinden.

Wissenstransfer ist ein Weg diese Verbindung herzustellen und Untersuchungen zeigen, dass Unternehmen, die dies beherrschen erfolgreicher sind als Wettbewerber. Trotzdem der Transfer von Wissen und dessen Erfolgsfaktoren bereits umfangreich untersucht wurden, wird eine äquivalente Aufmerksamkeit in Bezug auf den Wissenssender vermisst. Untersuchungen der Sender Fähigkeiten sind derzeit noch fragmentiert und selten. Die Einführung von Disseminative Capabilities (DiC) adressiert diesen Misstand und postuliert einen positiven Einfluss dieser Fähigkeiten auf den Wissenstransfererfolg. Dabei hat der Wissende die Aufgabe den Partner in relevanten Bereichen zu unterrichten und Wissen mit Hilfe verschiedenster Kommunikationsansätze zu transferieren. Diese Vorstellung grenzt gleichzeitig die theoretische Fundierung der vorliegenden Arbeit ab und hilft das Konstrukt der DiC zu formen.

Aufbauend auf einem initialen Konstrukt der DiC und empirischen Untersuchungen identifiziert die Arbeit acht Dimensionen von DiC die den Transfererfolg beeinflussen. Referenzierte Fallstudien untersuchen die Entwicklung von Fahrzeugen zwischen Magna Steyr auf der einen und BMW, Mercedes und Audi auf der anderen Seite. Die Untersuchungen zeigen einen klaren Einfluss der DiC auf den Transfererfolg und erklären diesbezügliche Unterschiede zwischen untersuchten Projekten.

Firmenübergreifender Wissenstransfer ist eine zunehmend wichtigere Managementaufgabe, wodurch eine interne Entwicklung von DiC für Unternehmen erfolgsentscheidend für erfolgreiche Kooperationen wird. Basierend auf den Untersuchungsergebnissen leitet diese Arbeit die Auswirkungen für das Management ab und zeigt wie die acht Dimensionen der DiC erfolgreich entwickelt werden können. Hierdurch können sich Unternehmen aller Grössen und Industrien zu erfolgreichen Wissenssendern entwickeln und so einen komparativen Wettbewerbsvorteil aus kooperativer PE generieren.

Chapter 1 -

Research problem introduction

Audi[1] is a German-based car manufacturer well-known for luxury sedans and station wagons. The Audi A4 and Audi A6 street versions were already on the productions lines when the idea of adding an off-road version to the product portfolio arose. At the time, the development resources within Audi were limited. Audi had never before produced an off-road vehicle on their own, for which reason they looked for a capable partner to jointly develop and produce the Audi all-road Quattro, a cross-over between luxury driving comfort and off-road adventure. Magna Steyr, an Austrian-based automotive supplier company, appeared to be an appropriate partner to help Audi to overcome shortcomings in their technological knowledge portfolio on 4-wheel drive technology and provide development resources. Audi and Magna Steyr had already worked on joint development and production projects during the 15 years previous to the launch of this collaboration. Additionally, this vehicle concept required the integration of a new gas-filled spring device that none of the partners had been able to develop up to that point. Therefore, the project consortium was extended by another partner[2] company, which provided the missing technological knowledge to realize the new device.
All three partners involved held knowledge assets the other partners were lacking in order to realize the car on their own. Developing and producing the Audi all-road Quattro idea required the combination of the partners' capabilities (luxury car development and manufacturing expertise, 4-wheel drive technology, spring technology) in an efficient way to make the product a success. The challenge of the project then appeared to be the ways and processes to get the knowledge and capabilities from the project team members of the partner companies and deploy them in order to realize such an ambitious project.

This opening chapter introduces the research focus of the thesis, the knowledge sender's capabilities and her[3] impact on the success of the knowledge transfer. Nowadays,

[1] The Audi case is deployed as a storyline to guide the reader through the introductory chapters I, II, and III. This approach underlines the practical relevance as well as the origin of this doctoral thesis' topic. Within the following text I refer to certain aspects of this case and relate them to the upcoming topic of the actual chapter.
[2] The third partner in this consortium remains anonymous and will not be named in this work at all.
[3] I refer to the knowledge sender/provider/communicator/teacher as female and the knowledge receiver/seeker/student as male.

in the field of product development (PD), organizations strive to realize the potentials of joint work such as overcoming resource and competence limitations, increasing flexibility, leveraging their capabilities as well as sharing risks and costs. One important issue arising from joint work is the need to transfer knowledge and skills. The thesis at hand takes this challenge into account and seeks to contribute to an understanding of the mechanisms underlying the knowledge transfer process. Particularly, the impact of the knowledge sender and her capabilities to transfer know-how are of interest.

The motivation for collaboration in PD and the need for knowledge transfer are outlined first (1.1). This is followed by a review of existing research on this topic (1.2), after which the current research gap is delineated (1.3). Subsequently, research questions are derived (1.4). The chapter closes with the formulation of the research goals, the contributions (1.5), and the thesis structure (1.6).

1.1 Research relevance

Since the 1980s, we have seen a significant increase in the number of organizations cooperating with external partners in order to achieve competitive advantage and to create value (Axelrod 1984; Hamel 1991; Hagedoorn 1993; Parkhe 1993; Teece, Pisano, and Shuen 1997). According to Hagedoorn and Osborn (2002) and Miotti and Sachwald (2003), cooperating in product development is a dominant strategy. The phenomenon of inter-firm R&D was first recognized in the mid-seventies (about 50 partnerships established each year). From then on, the number of such governance forms rose steadily, peaking in the late eighties (>500 in 1989). After a brief decline, the numbers rose again until the second peak in 1996 (about 680). During this time period (1960-96), two more developments are noteworthy and important to consider. Firstly, the share of joint ventures dropped from 90% to fewer than 10% in all newly established R&D partnerships. Secondly, contrary to the trend with medium-tech and low-tech, the share of high-tech R&D partnerships continuously increased, peaking at 85%[4]. Firms strive to increase their efficiency and effectiveness by, e.g., shortening time-to-market (Hagedoorn 1993; Knudsen 2007), sharing development-related costs (Freeman 1991; Knudsen 2007) and risks (Badaracco 1991; Grant & Baden-Fuller 1995), overcoming market entry barriers through simultaneous launches in foreign markets (Dogson 1993), or gaining access to critical knowledge assets (Grant & Baden-Fuller 2004) and limited resources (Hamel 1991). A prominent example of this

[4] Figures are based on the findings of Hagedoorn and Osborn (2002)

trend is the collaboration between PSA and BMW to jointly develop the second-generation Mini engines. Just recently, these two partners announced their willingness to integrate Daimler as a third partner. Further examples of collaborating companies jointly developing successful products are e.g., Logitech and Carl Zeiss jointly developing a web cam, Bang & Olufsen together with Samsung developing the Serene cell phone by combining their specialized capabilities, or DaimlerChrysler, BMW and General Motors, which are utilizing their knowledge to develop a hybrid engine while sharing risks and development-related costs.

In order to jointly develop a product and to unleash the potentials of combining partners' capabilities, companies have to interlink their knowledge bases. Such interlinkage is realized by creating a limited, nevertheless purposeful, overlap of knowledge bases, which in turn requires knowledge transfer. Evidence has been found indicating that organizations successful in (inter-organizational) knowledge transfer and thereby able to exploit internally created advantages outperform competitors in terms of efficiency and are more likely to survive (Nelson & Winter 1982; March 1991; Liebeskind, Oliver, Zucker, and Brewer 1996; Almeida & Kogut 1999; Argote & Ingram 2000). Especially in PD, knowledge transfer is regarded to be a success factor (Purser, Pasmore, and Tenkasi 1992; Kanzanjian, Drazin, and Glynn 2000; Cummings & Teng 2003). Knowledge transfer has therefore become a subject of interest for researchers and practitioners (Levin, Cross, Abrams, and Lesser 2004; Joshi, Sarker, and Sarker 2007).

1.2 Status Quo - knowledge transfer success levers

> Development work was done at the Magna Steyr facilities in Graz, Austria, and prototype production took place at the Audi production facility in Regensburg, Germany. There was no co-location of the project team members, and so they traveled between the Audi and Magna Steyr facilities.
> As the challenge was to combine the knowledge assets of all three partners in the project, the team members involved established transfer procedures and exchange practices, enabling a constant information and knowledge flow. Magna Steyr, for example, taught Audi how to apply all-wheel technology to a luxury vehicle. Audi, on the other hand, enabled Magna Steyr to develop and produce this type of luxury car. Being more knowledgeable in certain fields than the other partners requires each company to transfer knowledge to the other partner.

Cummings and Teng (2003) build upon and categorize the findings of numerous studies on knowledge transfer success factors in four contextual domains. The domains include: knowledge context (e.g., characteristics of knowledge like articulability), relational context (e.g., organizational or knowledge distance), activity context (e.g., mechanisms of knowledge transfer), and receiver context (e.g., learning culture)[5]. So far there exists an imbalance toward the research investigation side, which focuses on the knowledge receiver and his capabilities. Seeing knowledge transfer as a reciprocal process with at least two actors involved in the transfer, hence exchanging knowledge back and forth, (Minbaeva 2007) underlines the need to extend their model by adding a fourth context domain (Szulanski 1996), as outlined in Figure 1.01. Management scholars repeatedly argue that the knowledge sender and her characteristics are influential for the knowledge transfer process (Arrow 1962; Teece 1977; Cohen & Levinthal 1990; Dixon 1994; Podolny & Stuart 1995; Haunschild & Miner 1997; Davenport & Prusak 1998; Gupta & Govindarajan 2000; Venzin, von Krogh, and Roos 2000; Amesse & Cohendet 2001; Husted & Michailova 2002; Lindsay, Chadee, Mattsson, Johnston, and Millett 2003; Martin & Salomon 2003; Michailova & Husted 2003; Minbaeva & Michailova 2004; Davis, Subrahamanian, and Westerberg 2005; Fahrni, Schulze, Oppat, and Ingenäs 2007; Minbaeva 2007). Accordingly, scholars have shown an interest in investigating the knowledge sender's influence on the transfer process and its outcome (Martin *et al.* 2003; Pedersen, Petersen, and Sharma 2003; Minbaeva *et al.* 2004; Lichtenthaler 2006).

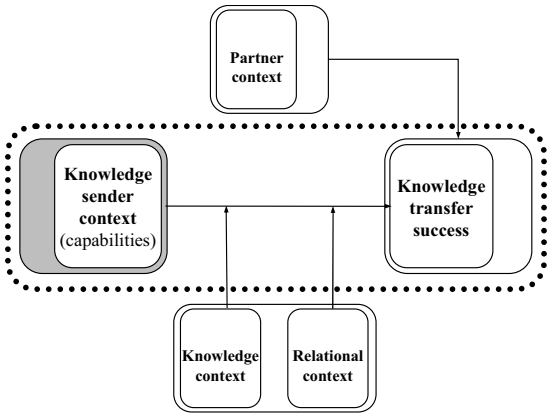


Figure 1.01 - Knowledge transfer success levers and research focus

[5] For detailed insights into context factors within each domain *see* chapter 3.2.1 or appendix A-3.1

Research on the knowledge sender's characteristics is not new. Constructs such as disseminative capacity (Minbaeva *et al.* 2004; Minbaeva 2007) or source transfer capabilities (Martin *et al.* 2003) have already been introduced. Current studies identify the following as success-driving determinants: motivation to transfer and share knowledge (Lamnek 1988; Constant, Sproull, and Kiesler 1994; Szulanski 1996; Inkpen 2000; Szulanski 2000; Bock & Kim 2002; Lindsay *et al.* 2003; Minbaeva *et al.* 2004; Minbaeva 2007), willingness (Minbaeva *et al.* 2004; Minbaeva 2007) and commitment (Amesse *et al.* 2001), trustworthiness (Szulanski 1996; 2000; Wasko & Faraj 2000; Cabrera 2003; Szulanski, Cappetta, and Jensen 2004), tolerance (Cohen *et al.* 1990), openness (Hamel 1991), knowledge transfer experience (Davidson & McFetridge 1985; Kogut & Zander 1992; Simonin 1999), or size, profitability, and its success (Haunschild *et al.* 1997)

Capability-focused research on the knowledge sender's role, which is the focus of this study (dashed box in Figure 1.01), has been conducted by Leonard-Barton (1988), von Krogh *et al.* (2000), and Martin and Salomon (2003), who investigate capabilities to evaluate the receiver's knowledge base and the possibilities available to him for using transferred knowledge. Others (Martin & Salomon 2002; Carlile & Rebentisch 2003; Martin *et al.* 2003; Pedersen *et al.* 2003; Minbaeva *et al.* 2004) identify the need to be able to de-contextualize knowledge from its embedding networks of people, interactions, social relationships, nomenclatures, tools, syntaxes, and organizational routines (e.g. Brown & Duguid 1992) and encode it for transfer purposes (Martin *et al.* 2002, 2003; Pedersen *et al.* 2003; Minbaeva *et al.* 2004). Dyer and Singh (1998), von Krogh et al. (2000), and Carlile and Rebentisch (2003) state that the knowledge sender has to be able to assess whether knowledge is valuable and relevant for the receiver and the purpose addressed. In addition, she is in charge of identifying potential uses for existing knowledge assets and the conditions of use (Nelson *et al.* 1982; Martin *et al.* 2003). Cohen and Levinthal (1990) and Dyer and Singh (1998) discovered that the assessment of knowledge assets and their value for the receiver addresses the capability to create partner-specific know-how. Furthermore, Szulanski (2000), von Krogh et al. (2000), and Carlile and Rebentisch (2003) investigate sender capabilities to support the integration and transformation of knowledge into capabilities in order to benefit from knowledge transfer. The integration and transformation of transferred knowledge require support activities. Emphasizing the importance of the channel and media on transfer success, researchers (Galbraith 1990; Gupta *et al.* 2000; Szulanski 2000; Murray & Peyrefitte 2007) highlight a resulting need for capabilities to deploy an adequate

transfer approach (Leonard-Barton 1995; Chini 2004). Table 1.01 gives an overview of capability-focused research in the knowledge sender domain.

Table 1.01 - Studies on knowledge sender capabilities

Author	Capability	Conceptualization	Validation	Outcome effect
Minbaeva (2007)	De-contextualizing and encoding	Disseminative capacity - ability to articulate knowledge.	Survey on intra-organizational knowledge transfer within an MNC and its subsidiaries. 92 participants.	The ability and the motivation to transfer knowledge are closely related to each other and have a positive impact on knowledge transfer success.
	Effective Communication	Disseminative capacity - ability to communicate knowledge.	*See above (s.a.)*	*s.a.*
Murray and Peyrefitte (2007)	Communication approach design	Deploying communication approaches according to a given setting for effective knowledge transfer.	Survey on intra-organizational knowledge transfer within hospitals (5). 287 respondents.	The deployment of an adequate communication approach impacts on the success of knowledge transfer. Employees are supposed to be educated in designing appropriate communication approaches.
Lichtenthaler (2006)	Application support	Desorptive capacity - the commercializing company has to support the technology transfer to facilitate successful external technology commercialization.	Survey on technology external commercialization. 154 participating companies.	Support of the technology transfer process helps to increase the success of external technology commercialization.
Chini (2004)	De-contextualizing and encoding	Not every piece of knowledge is amenable for transfer. Therefore, the knowledge sender and the receiver have to run transformation processes before knowledge sending is possible.	Survey on intra-organizational knowledge transfer between MNC's and their subsidiaries. 45 MNC's / 162 subsidiaries.	Positive impact on the knowledge transfer success (effectiveness of hierarchical transfer).
	Design transfer approach	To facilitate knowledge transfer, adequate infrastructure within the company is required. Additionally, the people involved need to know how to use the different tools.	*s.a.*	*s.a.*
Minbaeva and Michailova (2004)	Encoding and transmitting knowledge	Disseminative capacity - Due to the tacit nature of knowledge, the source is supposed to hold strong articulation abilities.	*s.a.*	The abilities of the sender impact significantly on the knowledge transfer success.
Pedersen et al. (2003)	Encoding	(Source) Transfer capability - Codifying tacit knowledge for transfer purposes.	Survey on intra-organizational knowledge transfer in a MNC. 198 participating companies.	The (source) transfer capability has a significant influence on the knowledge transfer success.
	Communication approach design	(Source) Transfer capability - choosing adequate media for transfer reasons.	*s.a.*	*s.a.*

Author	Capability	Conceptualization	Validation	Outcome effect
Carlile and Rebentisch (2003)	De-contextualizing and encoding	Present knowledge to external receiver in a way that they (outside experts or novices) can understand this specialized know-how.	Study no 1 - international joint ventures (128 cases of inter-organizational technology transfer, observations). Study no 2 - product development (PD) service provider and its customer (single-case observation).	Being able to transfer knowledge in its context a later transformation is more likely to be successful.
	Knowledge selection	Evaluation of knowledge from the source whether it is relevant to the task at hand.	*s.a.*	Seeding out the relevant knowledge and identifying the relevant assets helps to increase the success of knowledge transfer.
Martin and Salomon (2002; Martin *et al.* 2003)	Application support	Source transfer capacity (STC) - Assessing the needs and capabilities of the receiver as well as the strengths and weaknesses in assimilating and using the transferred knowledge.	No validation. Conceptual work.	As part of the STC concept, it helps to reduce the increase of transfer-related cost to transfer tacit knowledge.
	De-contextualizing and encoding	Articulation of knowledge.	*s.a.*	*s.a.*
	Proficient sending	Transmitting the underlying information in a proper form, duly arrayed and timed, and targeted to the right receiver for ongoing usage.	*s.a.*	*s.a.*
Szulanski (2000)	Application support	Providing experiences and knowledge that are lacking during the later phases of the transfer.	Survey on best-practice transfer within companies (8). 271 participants.	Crucial to meet costs and avoid delays in the transfer process. Little evidence is found indicating the impact of the source.
von Krogh et al. (2000)	Evaluation of strengths and weaknesses	Before transferring knowledge, the sender and the receiver should discuss the receiver's existing knowledge base, what is needed, how to sequence the transfer to enable an effective re-creation.	Explorative case study of a joint venture between two wholly owned subsidiaries. Intra-organizational production project (internally labeled as knowledge and technology transfer project).	Evaluation of needs helps to make the transfer more focused and effective.

Author	Capability	Conceptualization	Validation	Outcome effect
	Knowledge selection	*s.a.*	*s.a.*	An up-front knowledge selection helps to make the transfer more focused and effective.
	Application support	The sender provides necessary tacit knowledge. The receiver needs to fully make sense of the transferred knowledge.	*s.a.*	The ongoing support and transfer of additionally required knowledge enables the application of knowledge within the receiver.
Dyer and Singh (1998)	Knowledge selection	Partnering firms are supposed to invest in the build-up of internal search and evaluation capabilities. Based on that they can provide the partner required knowledge.	No empirical validation. Piecemeal examples to derive the hypothesis from. Inter-organizational view.	Selection of knowledge relevant for the allying partner helps to reduce time of knowledge searching, evaluation, and double work.
	Relational capital	The investment in inter-firm relation-specific assets (site specificity, physical assets specificity, and human asset specificity).	*s.a.*	Leads to efficient and effective interacting. This in turn enhances the quality and increases the time to market.
Leonard-Barton (1995)	Transfer approach design	Employees involved in knowledge transfer projects need to have profound know-how about the usage of transfer tools.	No validation. Conceptual work.	The better the understanding of how to deploy different transfer approaches, the better the result of the knowledge transfer.
Leonard-Barton (1988)	Evaluation of strengths and weaknesses	Assessing the needs and capabilities of the receiver as well as the strengths and weaknesses in assimilating and using the transferred knowledge.	No validation. Conceptual work.	An accurate assessment enables a more successful knowledge transfer through a better and faster understanding.
Nelson and Winter (1982)	Knowledge assessment	Identify potential uses of knowledge and conditions of applying it within the receiver.	No validation. Conceptual work.	The identification of potential uses and the conditions for ongoing application are supposed to increase the success of the knowledge transfer.

1.3 Research gap

The identified research gap consists of two dimensions. First, knowledge transfer theory lacks a satisfactory picture of the knowledge sender's capabilities and a related theoretical concept. Secondly, knowledge transfer presents a challenge for organizations; however, guidelines on how to enhance the transfer process from the knowledge sender are not available.

Over the last three decades research scholars in knowledge transfer theory have repeatedly emphasized the urgent need to investigate the sender's impact on transfer success and effectiveness (e.g. Teece 1977; Chini 2004; Minbaeva *et al.* 2004; Lichtenthaler 2006). Although the knowledge source is the subject of extensive research, investigations of knowledge sender capabilities are either neglected and mechanisms underlying these capabilities are not captured satisfactorily or are fragmented (e.g. Chini 2004). For example, theory on knowledge transfer has yet to answer such questions as how to encode transfer knowledge or how to utilize relational capital within collaborations. Existing research contributes to the understanding of the roles and abilities of the knowledge sender and serves as the foundation of this work. However, insights into the capabilities of the individual sender to contribute to the success of the transfer are selective and piecemeal. I agree with Chini (2004), who finds fault with existing research on knowledge transfer capabilities. This is in line with Minbaeva and Michailova (2004), who state that empirical studies capture evidence of the existence and the impact of knowledge sender capabilities on transfer success only partially at best. Detailed studies analyzing which capabilities for a successful transfer of knowledge from the sender's perspective would be effective are still lacking. A sound theoretical concept integrating the different capabilities is nonexistent (Amesse *et al.* 2001; Martin *et al.* 2003; Lichtenthaler 2005; Gupta, Smith, and Shalley 2006).

In addition, there exists little systematic evidence from empirical research on what actually promotes the effectiveness of knowledge transfer (Levin *et al.* 2004). Many existing studies focusing on the knowledge sender and her capabilities are of a conceptual nature and lack empirical investigations. Empirical studies have been conducted on, for example, "de-contextualization" or "application support" capabilities and comprise single (one up to three) capabilities exclusively. The knowledge selection capability has been analyzed in studies deploying quantitative (Szulanski 2000) as well as qualitative empirical designs (von Krogh *et al.* 2000), mostly in intra-organizational settings. Investigations of knowledge-selecting capabilities are either of a conceptual

nature or, as in the exceptional case conducted by von Krogh *et al.* (2000), based on an explorative single-case study. A review of capability-focused transfer studies (*see* Table 1.01) reveals that most insights come from intra-organizational knowledge transfer research. An exception is Carlile and Rebentisch's investigation (2003).

Given such piecemeal and selective research, the incompleteness of the current knowledge sender's capabilities set is self-evident. Additionally, the majority of investigations of knowledge transfer in general and sender capabilities in particular have emerged from intra-organizational, headquarter-subsidiary (for a review *see* Chini 2004, p. 30-33), joint venture, and strategic alliance settings as well as buyer-supplier relationships (*see* also Table 1.01). To the best of the author's knowledge, research in joint PD project settings on this topic providing guidelines for an organization's choice in managing the knowledge transfer process from the sender's side can scarcely be found (Murray *et al.* 2007).

Secondly, a question for every organization facing the need to transfer knowledge is "How do we do it?" Studies on knowledge transfer processes address this question, outlining detailed steps and tasks (Szulanski 2000). Nevertheless, keeping the general perspective on knowledge transfer but not focusing on the sender capabilities required in different process phases is insufficient. According to changing tasks along the transfer process, I assume that the capabilities of the sender to transfer knowledge follow a similar transformation. Unfortunately, few research works focus on the questions "How do we do it right?" and "How do we improve this process?" Research focusing on the development of knowledge sender capabilities to improve the process is piecemeal (e.g. Murray *et al.* 2007). Without knowing the critical linkages between the relevant sender capabilities associated with effective knowledge transfer, managers and practitioners alike are "left in the dark as to what they can do to foster valuable knowledge exchanges" (Levin *et al.* 2004, p.36), and as a result, expectations of knowledge transfer are often not met (Gupta *et al.* 2000). A clear guideline for practitioners, an important target group of this work, is lacking.

Addressing the outlined research gap in its two dimensions, I introduce the construct of *disseminative*[6] *capabilities* [7] *(DiC)* in order to create a clear and satisfactory picture

[6] [dis-sem-i-nate] means to scatter or spread widely, as though sowing seed; promulgate extensively; broadcast; disperse. I take this meaning of spreading as a starting point and deploy it in my research setting. This is in line with other researchers like (Nonaka & Takeuchi 1995; Demarest 1997; Daal, Hass, and Weggeman 1998) using the term disseminative as related to activities in the distribution stage of the knowledge management value chain (Chini 2004)

of knowledge sender capabilities. In particular, I define disseminative capabilities as the abilities of the knowledge sender that result in activities which impact the success of knowledge transfer. With this definition I follow Winter (2000), who notes that a capability is reflected in an activity which produces outputs that clearly matter to the organization's survival and prosperity. Moreover, the concept's focus underlines my understanding of successful knowledge transfer. I consider knowledge transfer successful if newly transferred knowledge is applied to commercial ends, in my case, for the advancement of the project work, and generates benefits for both of the partners involved. This even includes the support of the knowledge receiver in terms of adopting the related knowledge to advance the project. In the research setting outlined, this means that new knowledge is successfully integrated into the jointly developed product, technology, or in the processes to develop that product[8].

Additionally, disseminative capabilities represent the fourth dimension in the domains of sender-receiver impact on knowledge transfer processes, as outlined in Figure 1.02. This figure shows the possible ways for the sender as well as the receiver to impact knowledge transfer performance. It illustrates an imbalance on the side of capacity research and of the knowledge receiver. The following figure thereby underlines the potential of my research to provide a balance among the four domains.

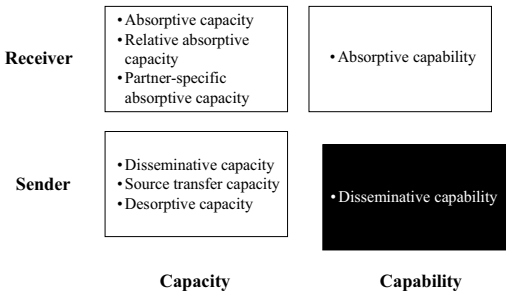


Figure 1.02 - Positioning of the disseminative capabilities construct

[7] In theory there exist different constructs aiming to cover the characteristics of the knowledge sender in the transfer process. Disseminative capabilities go along with these constructs, identifying the knowledge sender as an important determinant of knowledge transfer. Minbaeva and Michailova (2004)and Minbaeva (2007) relate disseminative capacity to *"…the ability and the willingness of organizational actors to transfer knowledge…"* (p. 667). Martin and Salomon (Martin *et al.* 2002; 2003) introduce the source transfer capabilities as *"...the ability to articulate uses of its own knowledge, assess the needs and capabilities of the potential receiver thereof, and transmit knowledge so that it can be put to use in another location...."* (p. 7) on an organizational level. Among others, Pedersen *et. al.* (2003) deploy source transfer capability.

[8] Although, I refer to PD in this work as the inter-organisational setting, this is not limited to a physical product. I also consider the development of new technologies and processes within the collaboration, assuming that this is not distinguishable from the product development.

In sum, there exist many open issues related to the research topic addressed. In keeping with the maxim of staying with a clearly defined research focus, I will answer selected questions, which are outlined as follows.

1.4 Research questions

Motivated by an increase in inter-organizational PD activities, this research centers on the phenomenon of knowledge transfer. As already outlined, one important precondition for the success of most time-critical PD projects is thriving knowledge transfer. Besides the transfer knowledge, the relationship, the interaction, and the receiver, knowledge transfer success depends on the capabilities of the knowledge sender. Scholars and practitioners alike are calling for investigations of knowledge sender capabilities. In introducing the construct of DiC, there is still un-clarity about their dimensions, potential performance outcomes, and approaches to developing them. Based on the research relevance and the outlined gap, I derive the following research questions:

Q Do *Disseminative Capabilities* enhance the success of knowledge transfer in inter-organizational PD projects?

Due to the complexity of this overall research question, the following sub-questions guide my research:

q^{one} What are the main dimensions of *Disseminative Capabilities*?

q^{two} Do *Disseminative Capabilities* explain why knowledge transfer success varies across inter-organizational projects?

q^{three} Can *Disseminative Capabilities* be developed; and if so, how?

1.5 Research objectives

Starting from the identified research gap, my research aims to emphasize and answer the outlined research questions. Focusing on the following objectives helps me to contribute theoretical implications and management recommendations:

- In particular, my research aims to contribute to the understanding of how to increase the success of knowledge transfer, especially by analyzing the role of the knowledge sender. Mechanisms underlying the knowledge transfer process will

be explored. Based on that, management implications are derived to increase the success of knowledge transfer from the sender's side.

- My research provides a systematic, structured, and fundamental work on knowledge sender capabilities impacting transfer success. In doing so, I structure the piecemeal and fragmented work on knowledge sender capabilities by integrating existing findings from knowledge transfer theory. Additionally, I supplement new capabilities from the empirical observations to develop the sound theoretical concept of DiC, observe this phenomenon in practice, and analyze its impact on knowledge transfer success. In doing so, I add an important aspect to knowledge transfer theory by answering the research questions outlined.
- While my research follows the design by Ulrich (1984), I will develop a practical guideline to increasing knowledge transfer from the sender's side, thereby solving the problem of establishing a successful knowledge transfer approach and consulting organizations in this field.
- Furthermore, I provide hypotheses that serve as a starting point for large-scale empirical testing.

Following Ragin (1994), I structure my work along the goals of social research. According to the research questions, I start with the exploration of general patterns underlying knowledge transfer processes with special regard to sender capabilities. These patterns are then related to the relevant theories. Based on the insights gained, I derive the overarching framework of my research and outline the working propositions guiding the case study investigations. Afterwards, I test the propositions and refine the framework. As a result, I derive hypotheses contributing to knowledge transfer theory. Finally, I derive recommendations for practice to help management to understand the new theoretical insights and to enable their application.

1.6 Thesis structure

This thesis is structured as outlined in Figure 1.03.

- The *introduction*, chapter 1, outlines the research relevance, introduces the research gap and addresses the research questions guiding my work.
- Chapter 2 outlines the *research approach* deployed to investigate knowledge sender capabilities. In particular, the selection process for an adequate research design is elaborated. Furthermore, I discuss the selection of the case study companies and define the unit of analysis.

- Chapter 3 provides the inter-linkage of existing *concepts* and *theories* contributing to the understanding of the addressed research gap.
- Based on that, I derive the *working propositions* and present the reference *framework* guiding the subsequent empirical investigations in chapter 4.
- Building on the reference framework, chapter 5 presents the *empirical* investigation, which introduces selected in-depth case studies on joint PD projects. The focus lies on knowledge sender capabilities and their impact on transfer success.
- In chapter 6, I provide the results of the *cross-case analysis* and integrate capabilities emanating from the empirical work into the construct of DiC. By referring back to the existing literature presented in chapter 3, I challenge the working propositions and derive empirically testable hypotheses.
- Chapter 7 presents the *guidelines for practice* and the *theoretical implications* by discussing the research findings. Furthermore, the research *limitations* and an outlook on research ideas for *ongoing investigations* on disseminative capabilities are given.

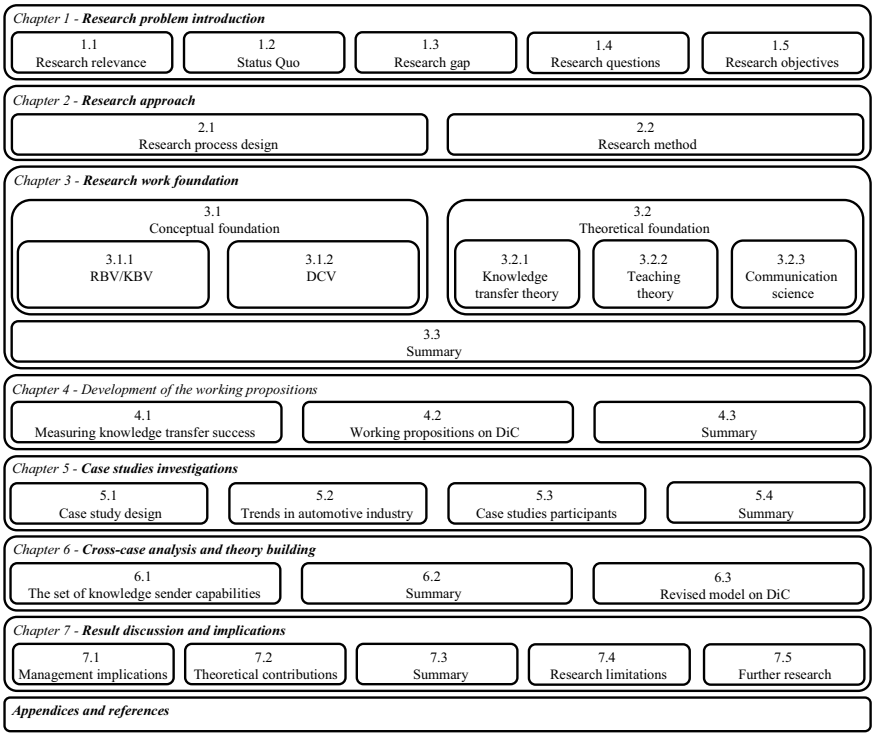


Figure 1.03 - Thesis structure

Chapter 2 -

Research approach

> The Audi-Magna Steyr collaboration to develop the Audi allroad Quattro indicated that the partners involved were urged to combine knowledge assets and leverage their capabilities in the joint work in order to be successful. How did Magna Steyr, Audi, or the third partner transfer their knowledge to the other partners, enabling the development of the new vehicle?
> As the transfer of knowledge was of a reciprocal nature between the three partners involved, the investigations have to take these alternating roles into account. From time to time Audi, Magna Steyr, and the third partner provided essential knowledge for the joint development. Furthermore, the team members involved in the project still were part of the organizations concerned and there exist important interfaces to the operating departments which have to be considered as well. Magna Steyr, Audi, and the third partner created a team for this project comprised of engineers from all partners. Knowledge transfer therefore took place between the organizations, as knowledge was channeled back to the focal company, between the individual team members as they interacted during their daily work, and between the project team and the related operating departments.

After outlining the topic of interest, an appropriate methodological approach must be designed in order to lay out the problem-solving process. Chapter 2 presents the development of the research approach. First, the research process designs (2.1) containing the steps guiding this analysis are outlined. I adjust Eisenhardt's (1989) and Yin's (2003) case study approaches to the characteristics of the research setting. This work follows Eisenhardt's (1989) structure for designing case studies. The development of the research method (2.2) deployed distinguishes between the case evaluation and selection step (2.2.1), the data collection step (2.2.2), and the ongoing data analysis for theory-building (2.2.3) purposes.

2.1 Research process design

The objectives of my research are the investigation of a practical problem, namely the way disseminative capabilities contribute to knowledge transfer success, to describe

practical issues related to knowledge transfer, and to come up with a model and methods for capturing and solving the practical phenomena addressed. As my research focuses on management-related issues, it belongs to the field of applied science and follows the principles of a generic research design introduced by *Ulrich* and *Krieg* (1974), *Ulrich* (1981) and *Bleicher* (1991). Deploying this design, I follow the research tradition at the University of St.Gallen.

Viewing management as an applied social science, the purpose of this work is the embodiment of rules and models to create new realities (Ulrich 1981). Based on an identified problem relevant to practice, theories related to this problem are identified and the application context is assessed to establish the conceptual model. This model consists of my preliminary understanding of the problem from a practical and a theoretical perspective (Kubicek 1977; Roessl 1990). By describing and interpreting specific cases in an explorative, empirical, inductive strategy, I further develop the initial model. The model creates an image of reality before collected data is analyzed critically to achieve differentiation, abstraction, and changes in the perspective. According to Kubicek (1977), Tomczak (1992), and Gassmann (1999), this approach is an iterative learning process.

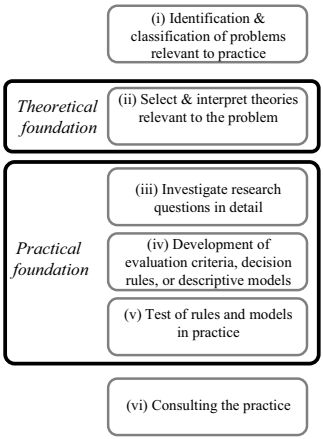


Figure 2.01 - Research process design according to Ulrich (1981)

I adapted Ulrich's (1981) research process for my work, as outlined in Figure 2.01. In interviews with participants of the working circle 'Anlaufmanagement erfolgreich umsetzen' in 2004-06, organized by the University of St.Gallen, the RWTH Aachen, and the Technische Universität Berlin, the design of effective and efficient knowledge

transfer procedures in collaborative settings, especially in PD, turned out to represent a general issue in the automotive industry. Organizations face the need to run a successful knowledge transfer process in order to stay competitive (i). Starting from this observed phenomenon, I analyzed relevant theories contributing to the understanding of knowledge transfer and the sender's capabilities (*see* chapter 3). A first conceptual model and working propositions were derived based on the results of my desk research and the aforementioned practitioners' interviews. The desk research continued throughout the complete dissertation process (ii). To investigate the research questions in detail, I chose a case study design containing three in-depth cases as the research method. Subsequently, data was collected and analyzed, after which the subject matter came under scrutiny (iii). The case study results helped to finalize the conceptual framework and to derive management recommendations for the design and the operation of a successful knowledge transfer process from the knowledge sender's side (iv). In one-day on-site visits, the final model and the management recommendations were presented and discussed together with the participating companies from the field work. In this way, I carried out the testing by experts (v). Finally, the model and the consequent rules may then serve as a basis for practice consulting (vi).

2.2 Research method

One essential objective of my research is to analyze and understand the dimensions of DiC and their impact on the knowledge transfer process. Particularly, the DiC necessary to enable a successful knowledge transfer are of interest. I aim to add the construct of DiC to knowledge transfer theory, thereby extending existing theory. Given this extension, my work belongs to the field of theory building. Furthermore, the impact of knowledge sender capabilities on transfer success is crucial for organizations and theory (Eisenhardt & Graebner 2007). I focus on the fragmented existing research work on this topic, as the phenomenon under study has only recently been empirically investigated, especially in the inter-organizational PD setting. Following Yin's (2003, p. 5) logic, the most adequate research methodology has to be selected according to three situations, namely the

- …research question form (how and why DiC impact on knowledge transfer success),
- …necessity to control behavioral events (the idea is to explore DiC in practice in direct observations and by interviewing the parties involved),

- …focus on contemporary events (analyzed cases take place now and knowledge transfer, especially the knowledge sender capabilities, are of interest).

My work analyzes in-depth case studies and follows the concept of qualitative research as proposed by Eisenhardt (1989) and Yin (1994). For my research, I chose a multiple-case design, with the joint PD project as the unit of analysis (Yin 1994). Selecting a proper research method represents one part of the work. Building in steps to ensure its quality throughout the designing of the research, selecting the cases sample, collecting and analyzing the data are the other significant elements. Following Yin's measures (2003), realizing validity (construct, internal, and external) and reliability throughout all research activities helps to ensure the quality of my case study work. Table 2.01 displays how I deploy the tactics mentioned.

Table 2.01 - Built-in quality tactics for case study work (adapted from Yin (2003))

Test[9]	Tactic	Applied in the case study work
Construct validity	▪ Using multiple sources of evidence	▪ Interviews (on-site, telephone), public company information, organizational charts, presentations, project plans, and observations.
	▪ Key informant to review draft case study report	▪ To review my draft case study report I use informants from practice as well as academia. Informants are indicated in the list of interviewees (*see* appendix A-2.1).
	▪ Chain of evidence	▪ Ensuring the traceability from conclusions to raw case study material back and forth through documentation, adequate citation of sources, and storage of all information sources deployed.
Internal validity	▪ Pattern matching	▪ Deploying one well-defined pattern to measure the impact of DiC; reducing the non-equivalent dependent variables to a minimum for redundancy.
	▪ Explanation building	▪ Theoretical significant working propositions and insights from the initial field work guide the case study work. As a result the derived hypotheses reflect upon these propositions and refine them. Therefore, I can ensure the theoretical significant grounding of the case work. Using propositions based on theory unified in the construct of DiC guide in the best case (correct propositions) to hypotheses contributing to the knowledge transfer theory.
	▪ Application of logic models	▪ The 1:1 direct relationship between one independent and one dependent variable is the ideal setting and does not occur in my case studies. In fact, analyzed DiC lead to some immediate outcomes, intermediate outcomes, which then impact on the transfer success. An illustrative example is the impact of a frequent knowledge application on the success of its transfer.
External validity	▪ Theory for single cases	▪ By providing a clear underlying theory and having detailed documentations about the field work, my findings can be generalized beyond immediate case findings.

[9] Yin (2003) gives a broad variety of criteria to test each one of the four quality measures for good case study research. I adjusted the variety of tactics according to my research setting and to the way I conducted my cases.

Test[9]	Tactic	Applied in the case study work
	▪ Replicate the logic in multiple-cases	▪ The multiple-cases approach allows me to generalize the findings from one case by replicating them in the second, or even the third case.
Reliability	▪ Document all the steps briefly	▪ By providing detailed minutes, protocols, management summaries, and finally case study reports, the cases could easily be done again by another researcher. ▪ All contact persons are named.

A roadmap for case study research is given by Eisenhardt (1989) and the steps are portrayed (in italics); however, it is important to recognize that deploying the process involves a constant iteration backward and forward between the steps. Before conducting the in-depth case studies, I introduce the working propositions based on the initial interviews and the literature review. Here, I slightly deviate from Eisenhardt's (1989) process. Nevertheless, this differentiation is perfectly in line with the aforementioned iterative character.

In order to *get started*, I determined a well-defined focus. This is important for systematically collecting specific kinds of data. Otherwise, one easily becomes overloaded with data and information. Through intense literature work, preliminary interviews, and exchanges with researchers and practitioners, I sharpened the focus of my research project, which now is to analyze the set of DiC and their impact on knowledge transfer success.

2.2.1 Case sample selection

Cases were *selected* and follow a 'T'-design (Thölke, Hultink, and Robben 2001), as outlined in Figure 2.02. In the first phase, which represents the horizontal axle of the 'T', the topic of interest emerged in a project with 12 companies from the automotive industry. The majority of the participants are 1st- or 2nd-tier suppliers[10]. All of the companies cooperate with various partners upwards and downwards on the value chain in the field of PD. Although the participants and their partners are located in German-speaking countries, they operate internationally. The geographical concentration minimizes the cultural differences, which was beneficial for my research project. The first investigation phase allowed for a better understanding of the topic from a practical perspective. Results from the literature review are enriched through the initial field

[10]The term tier supplier discribes the position in the value chain. The OEM represents the end of this value chain and from there on downwards the suppliers are characterized by numbers. The supplier delivering directly to the OEM is the 1st tier supplier.

work, added to the conceptual model, and integrated into the working propositions[11]. Throughout this initial phase the investigations concentrated on one side of the partnership, as described before. Figure 2.02 shows the T-design research structure deployed.

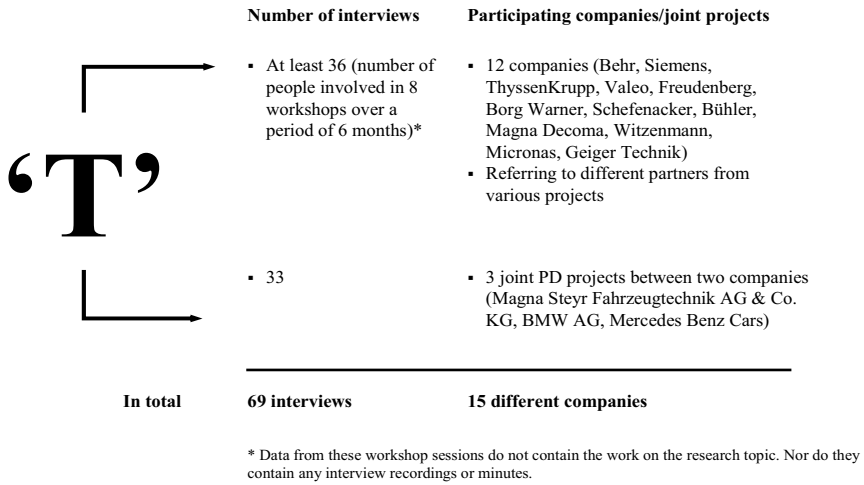


Figure 2.02 - T-design structuring the empirical data set (adapted from Thölke *et al.* (2001))

To design the vertical axle of the 'T' and to gain a deeper understanding of the dimensions of the DiC and their influence on knowledge transfer, I analyzed three PD collaborations. Although there is no ideal number of cases, I followed Yin's (2003) suggestion to find an appropriate number[12]. I concluded to utilize a multiple-case study de-

[11] I do not follow the ideas of the grounded theory approach of Glaser and Strauss (1967) and Miles and Huberman (1994). Before conducting the initial field work, I had a first, vague idea about the research focus. Based on that and in preparation for the one workshop in the 'Arbeitskreis Anlaufmanagement', this idea is investigated from a theoretical side. Within the workshop sessions the initial idea is further developed and new aspects are added. Following, the new picture is gain the starting point for a more detailed theoretical investigation. Finally, the derived working propositions serve as the guideline for the in-depth case studies. Therefore, my research design follows a two-iteration design.

[12] According to Yin (2003) the *"... the single-case design is eminently justifiable (...) when the case represents a critical test of existing theory, a rare or unique circumstance, or a representative or typical case or when the case serves a revelatory or longitudinal purpose"* (p. 45). The only characteristic my research fulfils is that of being a *representative* and *typical* case, I decide to deploy a multiple-case study approach. Concerning the exact numbers of cases, Yin (2003) suggested two different groups. Because, I *"...predict contrasting results but for predictable reasons..."* (p. 47) for my case study work, the group of 4 to 6 cases appears applicable. As few cases (2-3) are literal replication, the collaborative setting of my research design allows me to distinguish between two senders and two receivers in every case. This comes out to 6 'cases' of knowledge sending. This is also supported by Eisenhardt suggesting at least 4 cases for theory building research.

sign containing three single cases. I selected the cases based on the transparent observability of the topic of interest, the potential for learning, and the representativeness (Eisenhardt 1989). The three joint PD projects from the automotive industry are the development of the BMW X3 series by Magna Steyr and BMW; in the same partner setting the development of the BMW Z4 coupé; and Magna Steyr and Mercedes Benz's development of the 4-matic version of the C-/E-/S-class. These collaborations are of a buyer-supplier nature. One partner towers above the other in terms of its role and power in the value chain. Recently, however, horizontal alliances and collaborations in the automotive industry have occurred, such as Porsche and VW, Ford and Mazda, Nissan and Renault, or BMW, DaimlerChrysler and GM.

The collaborations selected are an exception. Magna Steyr is one of only a few companies, like the German company Karmann Group, which have a special relationship to Original Equipment Manufacturer (OEM) companies. Positioned as an equal partner, they created a niche between the OEM and a 1st-tier supplier. Magna Steyr works together with the majority of OEMs in the field of PD, where joint project work is part of daily business. Even though Magna Steyr does not have direct end-user contact, they are fully capable of developing and producing vehicles on their own.

The automotive industry faces resource limitations in PD because companies increasingly rely on new products with decreasing life-cycle times (*see* chapter 5 for industry trends). Companies in this industry face intense and international competition as well as an evolving scientific base. I selected these joint projects as the case study design because the chosen companies have to rely heavily on the success of the collaboration and underline the need for knowledge transfer to take place. The aforementioned companies and collaborations thus represent state of the art cases. Although all three collaborations succeeded in launching the final product to the market, the success in the market and of the collaboration itself differed among the cases. More important the selected projects differ in terms of knowledge transfer success which enables the identification of causes for the differing success.

Investigating both partners of the collaboration as the sender and the receiver separately enables the observation of changing senders, the same sender over different projects, as well as the same sender with changing receivers. Additionally, the selected case study design reveals differences between the collaborating partners as it features two OEMs and a 1st-tier supplier.

Knowledge transfer - a real-world phenomenon

To gain valuable insights into the research topic addressed, the selected partner constellations need to display knowledge exchange processes between the partners in both directions. Furthermore, the need and the motivation for successful knowledge transfer have to be indicated. Scholars argue that the motivation to collaborate originates from the perceived access to capabilities that one lacks (Hamel 1991; Doz & Hamel 1998). Once a suitable partner who provides the required know-how, skills or capabilities is found and the collaboration is set up, a race for learning kicks off. 'Partners' try to gain knowledge from each other as quickly as possible. This phenomenon occurs in horizontal collaborations. Scholars emphasize that in vertical collaborations the relationships between buyers and suppliers is contract based. All necessary specifications to develop and produce a product are clear from the very beginning and the know-how exchange between 'partners' is limited to information and money (Hart 1988). Accordingly, neither horizontal nor vertical collaboration seems to be an illustrative and representative case for the addressed research topic. A race for learning would deny the observability of knowledge sender capabilities because none of the partners has the motivation to transfer knowledge to its partner. According to (Grant *et al.* 1995), knowledge transfer is gratuitous in the presence of a detailed contract in the buyer-supplier relationship[13].

That picture, which a number of scholars tend to draw, is not generalizable. Inkpen (2000), Zhao *et al.* (2004), and Heller (2006), among others, explicitly point out recent and well-known examples of reciprocal knowledge transfer in horizontal (VW and SAIC, Ford and Mazda, Toyota and GM) as well as vertical (VW and Delphi) collaborations. Furthermore, a highly complex product like a car demands close interaction in the PD phase in order to transfer know-how. This is even observable in buyer-supplier collaborations. Although scholars highlight examples of reciprocal knowledge transfer, I selected in-depth cases for this work based on ex ante interviews evaluating the nature of knowledge transfer[14].

For my research I chose the joint PD project as the unit of analysis in order to decipher the mechanism underlying the impact of the DiC on knowledge transfer. I assumed a sound empirical base for the data collection as collaborations in the PD field have increased over the last several years. Concerning firm size, there were no delimitations

[13] This problem discussion is all about the explicit and tacit nature of transferred knowledge. Following Grant and Baden-Fuller (1995) the reciprocal transfer of knowledge is unnecessary if every single specification of the contract is made explicit. Required information is then easier to transfer via market mechanisms.

[14] In the introductory part of the case study the reciprocal character of the selected case studies is outlined, indicating their illustrative and representative character and the learning potential.

made in advance; nevertheless, I focused on conducting data collection from bigger organizations due to resource aspects and, in tendency, a higher affinity for research.

2.2.2 Data collection

Based on the conceptual framework and the working propositions, I designed a semi-structured interview guideline. This guideline, along with an outline of the research project and a confidentiality agreement[15], was sent to the interviewees in advance to avoid confusion and conflicts. This was done only for the in-depth cases. The questions are of an open nature. I considered it important not to limit the investigations to the knowledge sender, her capabilities, and the propositions derived in order to account for all phenomena which occur in reality. Especially in the first phase of the data collection process, I used more open and explorative questions to gather as many insights as possible. Due to its theory-extending character, this research deploys *multiple data collection methods* and uses various data *sources*. Throughout both case study phases, I used observations, interviews (telephone and on site), supplementary, and secondary data (project plans and presentations) when *entering the field*. Eisenhardt (1989) recommends the deployment of *multiple investigators* to ensure the quality of the data collection process. Unfortunately, it was not possible to access additional resources; hence, I was not able to attain the multiple investigators' perspectives while collecting data. To avoid pitfalls related to the single investigator approach I additionally used supplementing and secondary data sources, involved external people while analyzing the data, and deployed feedback from other researchers on my cases. For the in-depth cases, I investigated both sides of the selected collaborations and talked to three people from each partner, a minimum of two project team members, and the project leader to gain a more strategic view. Interviewees were selected based on their positions in the project team and their availability. Furthermore, I tried to match the interviewees according to their project roles and responsibilities. Interviewing people involved in the same function helps to create a more detailed picture as both sides are talking about the same work from unique viewpoints. Additionally, Strategic Alliance Managers, people from Business Development, and external experts (e.g., professors) participated[16]. The average interview lasted between 45 and 90 minutes, and interviewees commented on the written minutes, correcting mistakes, misinterpretations, and other noise interfering with an accurate understanding. Case study results, interpreta-

[15] See the interview guideline, the project description, and the confidentiality document in the appendix A-2.2 of this work.
[16] For a detailed list of interviewees *see* appendix A-2.1.

tions, and the management recommendations derived were confirmed in follow-up meetings with the participating companies. Throughout these sessions, additional data was gathered as well.

2.2.3 Analyzing the data and building theory

The main characteristic of qualitative research approaches is the continuous and iterative character of the data analysis. Data analysis and ongoing investigations proceed back and forth, enriching each other during the iteration loops. Following Eisenhardt's approach (1989), I started with the design of the conceptual framework that underlies the exploration of the knowledge sender's capabilities impacting on the transfer success (Eisenhardt 1989; Miles *et al.* 1994). This framework selects and explains the main aspects to be studied. It is based on a literature review and the initial field work (Voss, Tsikriktsis, and Frohlich 2002).

In the three in-depth case studies the impact of DiC on knowledge transfer success in the joint PD setting is investigated. To analyze the data and reveal cause-effect relationships, I deploy the method of construct coding. For this purpose I categorize relevant constructs emerging from the field work according to different dimensions and characteristics. I label all collected data and regroup them in sub-categories. This sub-categorizing allows playing with the grouped data and combining them in various new ways to group and relate sub-categories in a coherent way. This re-grouping allows the identification of core categories and the creation of a hierarchical network of related categories and sub-categories. Additionally, the coding approach identifies relationships for the refined conceptual model and provides explanations. These explanations form the basis of the hypotheses shaped in the ongoing analytical steps (Voss *et al.* 2002).

Deploying a multi-case design offers the possibility of cross analyzing the case data for theoretical replication (Yin 2003) reasons. This ongoing analysis provides explanations for the emerging construct and the postulated inter-linkage of constructs in every single case. Each single dimension of the construct of DiC is analyzed in a detailed manner over each single case before the generalization based on the population of cases takes place (Eisenhardt 1989). Adapted from these findings, the conceptual framework, the working propositions, and hypotheses are derived to extend the theory on knowledge transfer. In this way, the existing body of literature on knowledge sender capabilities is grounded in new data, formulating the emerging theory. In addition, I

integrate the literature by examining research which discusses similar findings as well as literature which conflicts with the extended theory.

Lastly, two issues are important in *reaching closure*: when to stop adding case studies, and when to stop iterating between theory and data collection. Ideally, one stops adding cases and iterating when theoretical saturation is reached. There is no generally accepted set of decisive factors for this assessment. The research process can be finalized once the concept or the hypotheses that emerge from the research are testable and logically coherent or hypotheses can be proven false.

Chapter 3 -

Research work foundation

> In the Audi all-road Quattro project the criterion for the three partners and especially for Audi and Magna Steyr for collaborating was the need to combine certain capabilities required for the new vehicle concept. Each of the companies relies on their own core knowledge assets to generate rents in their market. Nevertheless, in order to survive, be successful, and realize the project, partners combined their assets. The better the partners performed the transfer process, the more successful the Audi all-road Quattro project was.
> In looking at this collaboration, it is clear that sending knowledge involved more than providing knowledge over a dedicated line or giving access to databases. During the interactive work, the team members involved deployed, e.g., face-to-face meetings or joint review meetings. Approaches differed in the degree of need for interactive communication. In addition to the communication of knowledge, the sender took care that her partners understood the new knowledge and were able to apply it on their own.

The purpose of this chapter is the exploration of conceptual and theoretical approaches relevant to the addressed research gap. Conceptual theories on the one side help to focus on the research from a certain angle, namely the theory of the firm perspective. Therefore, the knowledge-based view (KBV) and the dynamic capabilities view (DCV) of the firm are outlined first (3.1). On the other side, the conceptual foundation enables the understanding of the research phenomenon addressed. That is followed by an elaboration of the theoretical approaches used to describe the research phenomenon as outlined in the chapter opening, which will contribute to the understanding of the nature of DiC (3.2). The chapter closes with a summary on the contributions of all referred theoretical streams as well as occurring contradictions (3.3).

3.1 Conceptual foundation

Two issues were of importance while selecting the conceptual foundation for this research. First, there is unanimous agreement among researchers and academics that companies nowadays operate in a knowledge-based economy that is moving towards the conceptual age (Garrett 2006). Over the last decades, therefore, a spotlight has

been cast on knowledge-related activities requiring integrated processes like knowledge management, e.g., creation, storage, transfer or utilization, in order to generate corporate rents (Spender & Grant 1996). When it comes to joint work, the utilization of knowledge in collaborations with external partners represents one important aspect. Therefore, knowledge transfer and exchange with outside partners are considered to be a value creating processes. As knowledge management in general and transfer-related capabilities in particular have become success-critical activities, companies have to develop and deploy available resources to build up capabilities to meet these newly arising challenges. Since I focus on the capabilities of the knowledge sender and her ways of increasing the success of the collaborative PD project, theories about the firm provide an appropriate basis for my research. Improving knowledge transfer performance, on the other hand, helps the focal participating organization to build up a competitive edge.

3.1.1 Knowledge-based view

Firms within and across industries vary in terms of their resource endowments (Barney 1991). Under the super-ordinate concept of the resource-based view (RBV) of the firm, researchers establish three conditions of resources necessary to create economic rents. These conditions are rareness, imperfect mobility, and the impossibility to imitate (Hamel & Prahalad 1994; Foss 2000; Barney 2001). In the general understanding of the RBV, the term resource does not discriminate between tangible and intangible assets.

However, another research stream singles out knowledge as the intangible asset for further considerations as this is regarded as the main resource for creating economic rents in the knowledge society. The main idea underlying the knowledge-based view (KBV) of the firm is how knowledge as the dominant resource of the firm (Grant 1996b) is handled to generate sustainable competitive advantages (Grant *et al.* 1995). Rather than assuming the value of a company in the knowledge itself, the KBV regards knowledge-related activities as the source of competitive advantage. Organizations create rents and an increase in the firm's growth by both widening and deepening their knowledge bases, the storage and integration of a variety of knowledge assets, or the utilization of knowledge for a successful PD (Kogut *et al.* 1992; Grant 1996a). Therefore, the transfer of knowledge in joint work with external partners represents an essential process to realize corporate rents. The basic assumptions underlying this theory are (Grant *et al.* 1995):

- Knowledge is the key productive, strategically significant resource of the firm (Grant 1996b).
- Knowledge comprises explicit and tacit (Polanyi 1962) parts; the latter are more difficult to communicate and transfer.
- Knowledge is acquired by individuals and in the case of tacit knowledge also stored by individuals.
- Cognitive and time limitations force individuals to sacrifice either the depth or the breadth of acquired knowledge.
- Product development and production requires the application of different types of specialized knowledge.

More specifically, Grant *et al.* (1995) analyze the existence of inter-organizational collaborations, such as joint PD from the knowledge-based view, transferring the underlying ideas for this specific governance structure. Inter-firm collaborations are likely to occur if:

- knowledge cannot be fully embodied in the exchanged products,
- an incongruence between a firm's knowledge and product domains exists,
- uncertainty about the upcoming product generation and the resulting knowledge requirements exists, or
- there is a high attraction related to high benefit for the company to fill the role of the early-mover.

The overall rationale of the KBV of the firm and of the inter-organizational collaboration is the creation and the ongoing application of knowledge whether internally or together with external partners. Differences in firms' success in this understanding occur due to dissimilar knowledge bases and capabilities to develop and deploy them (von Krogh & Grand 2002).

The knowledge-based view of the firm constitutes the value of knowledge and emphasizes the importance of knowledge management related activities in order to generate economic rents. Moreover, this concept explains the occurrence of collaborations in the field of PD. Nevertheless, the KBV does not deal with the capabilities required to execute, e.g., knowledge creation, storage, utilization, or even transfer. The dynamic capability view takes a closer look at firms' specific capabilities to deal with changing environments in order to generate competitive advantages.

3.1.2 Dynamic capabilities view

Companies follow industry-specific life-cycle curves, whereas markets constantly change. Therefore, organizations heavily relying on markets and their conditions in consequence face ever new and rapidly changing challenges. To meet these challenges or even to initialize market changes in order to stay ahead of competitors, organizations integrate, reconfigure, gain, and release internal resources (Eisenhardt & Martin 2000). As collaborating is one option to jointly create competitive advantages, organizations have to master knowledge transfer to succeed. Following the DCV, this in turn implies the need to develop knowledge transfer capabilities on the sender and the receiver side to achieve congruence with the outlined business dynamics (Teece *et al.* 1997).

In theory there exists almost complete unanimity about the concept of 'capabilities'. In general, capabilities refer to the capacity of a company to deploy internal resources in organizational processes. This underlines an intra-organizational view. Amit and Schoemaker (1993) along with Eisenhardt and Martin (2000) go even one step further and regard capabilities as processes embedded in the organization. The process embeddedness can be traced back to lasting and complex interactions within the organization's resources. At this point I extend this view as DiC are also influenced by the interaction with an external partner - the knowledge receiver in this work. The execution of these path-dependent processes requires a set of intangibles and tacit knowledge. Unfortunately, the need for intangibles and tacit knowledge to execute the processes in turn increases the likelihood of casual ambiguity[17]. Deploying capabilities therefore requires a full understanding of their nature, while a lack of such comprehension leads to failure in the execution and achievement of managerial goals (Dosi, Nelson, and Winter 2000; Winter 2000). Based on these ideas and thoughts about the nature of capabilities, I follow the 'intention and outcome' idea of Dosi *et al.* (2000). The knowledge sender intends to transfer knowledge to the receiver in such a way that an ongoing application generates benefits and enables project advancement. To fill the gap between the outlined intention and the resulting outcome (knowledge transfer success) and to enable the realization of the intended outcome, the knowledge sender deploys her DiC in such a way that *"... outcomes bear a definite resemblance to what was intended."* (Dosi *et al.* 2000, p. 2).

[17] Causal ambiguity is the situation where it is hard or even impossible to relate the consequences or effects of a phenomenon to its initial states or causes. This phenomenon is very common in strategy, where it is often impossible to determine whether the success of a company is due to solid strategic thinking or due to sheer luck Lippmann and Rumelt (1982).

The aforementioned changes in markets and the environment force organizations to constantly develop and renew resources and their combinations. The term 'dynamic' mirrors the required change of resources and capabilities within the organization to meet challenges brought on by market changes as they emerge, collide, split, evolve, and die. Dynamic capabilities are higher order capabilities and routines to alter a given organizational resource base (Eisenhardt *et al.* 2000). Do the theoretical foundation and especially the term 'dynamic' capture the underlying idea of the DiC construct? Referring to the definition of DiC given in chapter 1, partners always deploy capabilities, resulting in knowledge transfer activities like knowledge encoding or decontextualization impacting the transfer success. According to this interpretation, a 'dynamic' nature of disseminative capabilities has to be rejected because these activities are always required to enable knowledge transfer and are therefore less dynamic. In my understanding, the knowledge sender aims to consider partner-specific and environmental attributes as well as different types of knowledge while transferring her knowledge to the receiver. This in turn leads to ever new and constantly changing challenges as knowledge transfer is influenced by multiple levers. Following this understanding of knowledge transfer, the sender needs to constantly adjust her activities to enable the transfer according to the actual setting (receiver, knowledge, relationship etc.). Now one can argue that this adjustment requires only a 'dynamic-aligning' capability and it does not represent a reason to accept the dynamic nature for all DiC dimensions. Nevertheless, I state that this adjustment in knowledge transfer requires a dynamic nature inherent in the disseminative capabilities. Following Eisenhardt and Martin's (2000) idea of aligning capabilities to the life-cyclical transformations of markets DiC have to be aligned to industry, market, and partner changes, different collaboration and projects phases, just to name a few.

After analyzing the explanatory adequacy of DCV, the underlying ideas of this theory have to be investigated. The core concern of the DCV is the reconfiguration of resources and capabilities available within a company. In this sense the DCV focuses mainly on three guiding thoughts:

- How a company internally develops combinations of processes, routines, and resources.
- How these combinations can be utilized in order to alter the resources and capabilities to desired ends.
- How the company can protect these combinations from obsolescence in means of a deteriorating impact in creating sustainable competitive advantage.

3.2 Theoretical approaches

As the research topic has been embedded in an adequate conceptual foundation, the purpose of the following section is to elaborate theoretical approaches in order to describe and explain the phenomenon of knowledge transfer with special regard to the role and the capabilities of the knowledge sender.

The relationship between two collaborating actors combining capabilities and related knowledge assets to realize a jointly developed product is in the focus of this research. As the described setting represents the core underlying mechanism this draws attention to those theoretical stream dealing with at least two actors involved in interactions aiming at the reciprocal exchange of knowledge. Therefore, limiting the investigations of knowledge sender capabilities to the field of knowledge transfer theory is not sufficient to capture this phenomenon. The need to account for theoretical perspectives other than knowledge transfer theory is already indicated as research in this field has drawn the attention of scholars from strategic management, psychology, or organization theory. Additionally, knowledge transfer theory does not address the capabilities of the knowledge sender - the outlined research phenomenon of this work - in a sufficient and satisfactory way (*see* Chapter 1.3 for details).

What else constitutes the knowledge sender's role in that reciprocate and interactive relationship? Which other theoretical research stream focuses settings alike two partners exchanging knowledge back and forth to combine existing knowledge bases? Following these guide lining questions, this work centers the idea of the knowledge sender as a teaching communicator. The underlying assumptions forming this idea are the following. Two partner companies collaborate and exchange capabilities and know-how in those fields where they provide different levels of expertise. Such a discrepancy defines the actual roles of the knowledgeable or 'teacher' and the attendant or the student in one specific field. For the purpose of equaling this expert discrepancy the exchange - and in the snapshot version with fixed roles transfer - of knowledge requires communication between the two involved actors.

A relationship between a teacher and her students in class provides a valuable analogy (Lane & Lubatkin 1998). For teaching purposes the teacher shares her knowledge with her students through different ways of communication. And as Zhao *et al.* (2004) state, while knowledge transfer between two partners is always a combination of teaching and learning, the source is in charge of the teaching dimension. Zander and Kogut (1995) refer to teachability as a critical dimension of knowledge to be transferred. Their reference denotes the differing transferability of knowledge types. They deploy

teachability as a measure of knowledge tacitness, while the transfer of tacit knowledge requires actual teaching (Winter 1987).

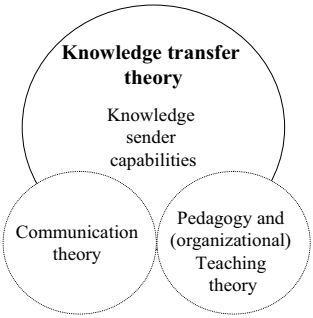


Figure 3.01 - Deployed research streams underlying the *disseminative capabilities* concept

The analogy underlines that knowledge transfer, teaching and pedagogic, as well as communicative, aspects are tightly interwoven (*see* Figure 3.01). This inter-relatedness is clear when considering that communication processes enable the actual transmission of knowledge between the sender and the receiver or that teaching activities are required to support and enable the application of transferred knowledge in a new context or its retention and thereby tends to center on long-term success. Outlined idea of deploying other than knowledge transfer theory to capture the DiC phenomenon are not new as knowledge transfer theory already borrows ideas and models from these two supplementary streams to fill 'blind spots'. Consequently, I have chosen knowledge transfer theory (3.2.1), pedagogy and (organizational) teaching theory (3.2.2), as well as communication theory (3.2.3) to elucidate the multi-dimensional nature of DiC and utilize findings on capability oriented research from these fields.

3.2.1 Knowledge transfer theory

Following a sequenced knowledge management value chain which contains vision and strategy, creating, storage, distribution, and application, knowledge transfer is one, if not the main, process activity within the knowledge distribution phase (Chini 2004). The objective of any transfer activity is to transfer information, data, and knowledge from a sender to a receiver deploying a transfer approach (channel, media etc.) which contains interactive processes (Cummings *et al.* 2003). Herein, the knowledge sender is the party who possesses the knowledge, which is transferred to the knowledge re-

ceiver. Joint PD projects, as a possible way to combine the knowledge of the cooperating partners, in turn comprises transfer activities in both directions (Amesse *et al.* 2001). Joint project work is a social, interactive process of mutual activities and interaction where knowledge is transferred from one partner to the other and *vice versa*. Deploying the transfer process steps given by Szulanski (1996), Figure 3.02 indicates this reciprocal character. The analysis of the transfer process is based on a snapshot of reality featuring one sender and one receiver. This simplification helps to reduce the complexity of the transfer process interactions and to uncover the underlying mechanisms. Later, findings have to be adjusted to the reciprocal nature of this process. However, one has to keep in mind that this represents only a slice of reality.

Research on knowledge transfer starts with works on technology transfer and special regard to transfer costs (Teece 1977) and speed (Mansfield & Romeo 1980). Over the last several decades the research focus has adjusted to a more knowledge-oriented transfer approach. The initial research focus on intra-organizational settings has shifted slightly to inter-organizational settings such as strategic alliances (Simonin 1999) following the trend of an increase in cooperative governance structures (Argote *et al.* 2000; Hagedoorn 2001).

Various scholars identify knowledge transfer as a multi-phase process (e.g. Szulanski 1996; Hansen 1999; Szulanski 2000; Kwan & Cheung 2006) containing administrative and set-up phases followed by more interaction-focused ones (dashed box in Figure 3.02) such as ramp-up and knowledge application. Knowledge transfer occurs in various forms and mechanisms[18], as one can observe personal movement (Almeida *et al.* 1999), technology transfer (Galbraith 1990; Rebentisch 1995), or customer integration (von Hippel 1988), and is influenced by the knowledge type and the transfer circumstances (Rebentisch 1995), the receiver (Cohen *et al.* 1990) and the sender.

[18] For a summary of different modes and knowledge transfer mechanisms *see* Rebentisch (1995, p. 19).

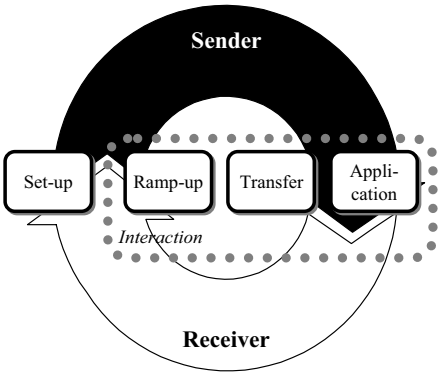


Figure 3.02 - Knowledge transfer as reciprocal process (following Szulanski 1996)

Regardless of the form or the cooperative setting, the purpose is to transfer knowledge from the sender to the receiver in a successful way. Boisot (2002) states that knowledge transfer is considered successful if the targeted project partner obtains the knowledge (i.e., understood) and if benefits are created by applying that knowledge. Other scholars characterize knowledge transfer success as the number of engaged knowledge transfers in a specific time period (Hakanson & Nobel 1998), based on project management measures such as on time, on budget, and with the desired quality (Teece 1977; Mansfield *et al.* 1980; Galbraith 1990; Pinto & Mantel 1990; Szulanski 1996; Rogers 2003), as the re-creation of knowledge within the receiver to develop products (Nelson 1993) if the receiver obtains ownership of, commitment to, and satisfaction with the transferred knowledge and the transfer outcome (Szulanski 1996; Cummings *et al.* 2003; Martin *et al.* 2003; Chini 2004; Lucas & Ogilvie 2006), or more generally, if the receiver is affected by the experience of the sender (Argote *et al.* 2000; Argote, Ingram, Levine, and Moreland 2000). Furthermore, management scholars analyze organizational-level performance indicators such as costs, risks, or innovativeness before and after the knowledge transfer (Kotabe, Martin, and Domoto 2003). The combination of qualitative and quantitative measures provides a common appropriate approach (e.g. Almeida *et al.* 1999).

At the center of knowledge transfer research is the evaluation of success factors[19]. Some researchers focus on the knowledge context and investigate effects of knowledge types on the transfer (Zander *et al.* 1995; Ranft & Lord 2002; Murray *et al.* 2007). Others analyze governance structures of the relationship as well as interaction modes and their impact on transfer success (Szulanski 1996; Strang & Soule 1998;

[19] For an over view of selected studies on knowledge transfer success factors *see* appendix A-3.1.

Argote *et al.* 2000). Here, especially processes to transfer knowledge have attracted the interest of scholars (Hansen 1999; Szulanski 2000; Kwan *et al.* 2006). The receiver context domain appears very well researched and over-emphasized (Choi & Lee 1997; Davenport *et al.* 1998) as the benefits of the knowledge transfer are erroneously assumed to occur exclusively on the receiver side (Heller 2002, 2006). Research so far misses a theoretical construct for the knowledge sender that is equivalent to the receiver-focus information processing theory (Lucas *et al.* 2006). Especially the construct of absorptive capacity (Cohen *et al.* 1990) has drawn great attention to the receiver domain (Mowery, Oxley, and Silverman 1996; Lane *et al.* 1998; Lane, Koka, and Pathak 2006; Lucas *et al.* 2006). According to the prevailing theory, absorptive capacity of the knowledge receiver impacts the success of knowledge transfer (Cohen *et al.* 1990; Mowery *et al.* 1996; Lucas *et al.* 2006). Others (Dyer *et al.* 1998; Lane *et al.* 1998) take Cohen and Levinthal's (1990) concept even further, introducing relative or partner-specific absorptive capacity referring to the knowledge transfer between two partners. Analyzing similarities of knowledge bases, organizational structures, and dominant logics of partner firms these authors find evidence for the impact of relative absorptive capacity on inter-organizational and thereby inter-personal learning.
In view of the above, it becomes apparent that there is an emphasis on the knowledge receiver, while a contextual domain focusing on the sender in an similar way is missing from their model (Cummings *et al.* 2003). Nevertheless, knowledge transfer theory gives a good basic understanding and shapes a solid picture about the characteristics of the knowledge sender. Thereby, this research stream helps to shape this phenomenon of DiC.

3.2.2 Pedagogical theory and (organizational) teaching theory

As mentioned before, the cooperating partners provide different levels of expertise among the fields of their interaction initiate the roles of the more and the less knowledgeable. Existing discrepancies in expertise initiates knowledge exchange processes from the knowledgeable or the 'teacher' and the 'student'. The following section outlines the traditional theory of classroom teaching which is deeply rooted in pedagogical science and psychology and evaluates the capabilities of the teacher to successfully disseminate her knowledge to the less knowledgeable student. This serves as a valuable starting point for investigating the role of the teacher in learning processes and pioneers the way towards a teacher-oriented research stream within (organizational) learning theory.

Pedagogical and educational teaching theory

The objective of teaching is to transmit know-how to one or more student(s) for the purpose of learning (Zhao *et al.* 2004). Learning in turn facilitates behavioral changes or at least the potential to do so by assisting and supporting the learning process of the student (Knowles 1981). Research on teaching underlines this point and puts the learner in the focus as the benefits of teaching are mainly assumed on the learner side. Existing studies trying to analyze teacher capabilities and their impact on the success of the learning process do not shape a consistent picture (Rheinberg, Bromme, Minsel, Winteler, and Weidenmann 2001). In fact, the close relationship of the teacher and her student(s) makes it quite difficult to identify factors and especially capabilities for successful teaching. Rather, three dimensions of teaching capabilities and attributes to increase learning success can be recognized, including didactic, social communicative, and self reflective capabilities (Euler & Hahn 2004). Mietzel (2001) follows a dichotomous analysis of teaching capabilities introducing two strongly inter-related components, namely expert and pedagogical knowledge.

The former refers to the knowledge a teacher possesses about the topic she is going to teach. The successful teacher has expert knowledge in her teaching field (Cochrane, DeRuiter, and King 1993). In various self-reflections loops and continuous practical (teaching) applications, the know-how base further develops its value. This in turn enables the teacher to align the teaching content to the know-how base of her students to minimize comprehension problems due to different knowledge bases (Kauchak & Eggen 1993). A teacher of first or second grade students teaches different content and deploys other methods teaching her students than a high school teacher. In this regard feedback plays an important role for the teacher as its value increases with the expertise of the teacher. Having in-depth knowledge in a specific field facilitates the identification of gaps in the learners' knowledge bases causing misunderstandings. Furthermore, deeply understood knowledge increases the teacher's self-confidence, enables her to give more illustrative examples and to deploy clear, instead of vague, explanations (Cruickshank 1985). Druva and Anderson (1983) analyzed the relationship between the expertise of teachers and the student's learning progress and found a weak coherence. The successful teacher is more than a scientific expert; she is master of the entire complexity of teaching (Cruickshank, Bainer, and Metcalf 1995; Good & Brophy 2000).

What else besides expert knowledge characterizes a good teacher? Many researchers refer to science and art when it comes to teaching (Rubin 1985; James 1992). The above section considers the scientific side of teaching capabilities. From the art pers-

pective, the good teacher has pedagogical qualifications, enabling a self-reflection process upon her teaching practices and the accumulated experiences over time (Henderson 1992). The pedagogical side of the teacher's capabilities aim at the process of conveying know-how to the learners by creating and maintaining an adequate learning setting (Mietzel 2001). Therefore, good teaching for successful learning requires knowledge about the addressed learners, the teaching environment, and experience in creating a teaching setting according to the given situation. Although pedagogical capabilities such as creating the motivation to learn, supporting knowledge retention, changing teaching methods, or coordination of students' activities are independent from the content of the course, teachers have to focus on a specific field and a certain education level in order to succeed. The synergy between 'science and art' results in effective pedagogical content know-how and, consequently, effective teaching (Cochrane *et al.* 1993).

(Organizational) Teaching theory

Traditional teaching and learning theories focus on education processes in schools, universities or at home. Nevertheless, an organizational focused research stream has spun off from this theory. Organizational or inter-organizational learning theories focus on the learning processes taking place within as well as between collaborating companies on the individual, group, team, and organizational levels (Kogut & Singh 1988; Mowery *et al.* 1996). As in education, mechanisms of learning as well as teaching have to proceed. However, research on organizational (Smith 1982; Levitt & March 1988) and inter-organizational learning (Hamel 1991; Lane *et al.* 1998; Dyer & Nobeoka 2000; Inkpen 2000; Kale, Singh, and Perlmutter 2000; Inkpen 2002, 2005) in corporate settings is also very much limited to the learner perspective due to the same reasons.

The term 'learning' in the theory title does not properly cover the reciprocal nature of this process; nevertheless, it reflects the traditional view of researchers. Following the idea of teacher-learner interactions (Argote *et al.* 2000) research calls for investigations of the teacher dimension in order to capture the dynamics of learning in organizational settings (Heller 2002; Inkpen 2002; Heller 2006).

Recent works focus on this under-researched element in the (inter-)organizational learning process and underline the necessity and the impact of the teacher (Zhao *et al.* 2004). Heller (2006) finds evidence for performance improvement in alliances and reciprocal benefits for the teacher and the learner which can be traced back to three fundamental elements of teaching. First, teaching contributes to the partner's learning.

Secondly, teaching requires the understanding of the learning side, which in turn allows the teacher to investigate the strengths and sources of capabilities of the learner. A partner-specific adjustment of ongoing activities and learning on the teacher side are enabled. Thirdly, the teacher must analyze and understand the know-how in order to successfully teach her partner. This self-reflection helps the teacher even to improve her own understanding. A better understanding in turn facilitates better teaching. Summing up, Heller (2006) introduces the teaching effect in learning alliances. This lays the foundation for (organizational) teaching theory or at least a more strongly teacher-focused research stream within the organizational learning theory. Although these studies underline the need to put more effort into investigating the teacher, insights into her capabilities are limited so far.

3.2.3 Communication theories

Once it became clear what knowledge needs to be transferred between the involved partners they start to interact, communicate, and thereby physically execute this process for the purpose of exchanging relevant assets. What make a communicator a successful one and especially which capabilities enable that success? Introductions into the field of human communication typically start with communication models and their major ingredients. So does this work. Most communication models include a sender/communicator and a receiver, the message, the channel, the transmission, encoding and decoding activities, meaning, feedback, and a communication effect (Berlo 1960; Krone, Jablin, and Putnam 1987; Joshi *et al.* 2007). The sender is the actor who transmits the message to the receiver, the message destination. The allocation of roles represents a snapshot of reality; the sender acts simultaneously as receiver and *vice versa*. In order to transmit the message, the sender deploys various channels and media. The transmission captures the dynamic of communication describing the actual ongoing process activities, whereas encoding and decoding activities describe the process of creating, transforming, and deciphering messages (Krone *et al.* 1987). Interpreting and making sense of the message creates the meaning and is facilitated through the use of feedback. Finally, the results of communication are summarized as the communication effect. What Shannon and Weaver (1949) introduced for electronic communication with the noise or factors distorting the equality of the signal has to be added to the human communication model as well. Noises appear within the outlined elements for communication processes and impact on communication outcomes. The challenge for the sender is to reduce the communication noise (Berlo 1960). Commu-

nication is considered successful when the absorption of the transmitted message within the targeted receiver takes place; this again underlines the receiver oriented focus. The outcome of this absorption process is a behavioral change (Hewes, Planalp, and Streibel 1980; Hewes & Planalp 1987)[20] or inter-subjectivity[21] (Hewes *et al.* 1987). Success measures from communication theory such as entity's performance or satisfaction with the message (Joshi *et al.* 2007) are deployed to qualify a knowledge transfer process.

The complexity of communication, especially in case of face-to-face communication is not considered in a satisfactory way in the outlined communication models. First, the reciprocity of the communication process requires a circle-shaped or at least a two-direction model to underline the relative roles of the partners involved. By referring only to alternating roles seemed to be insufficient to fully capture this dynamic. For example, the communicator constantly receives intermittent signals from the receiver affecting her behavior. A received message is interpreted and feedback is encoded (Dehees 1994). Secondly, communication occurs as a multi-channel system transmitting signals via various channels and media in parallel, e.g., visual or oral. For this reason, the single unidirectional connection of communication flows outlined in most models is unambiguous and practically wrong (Lewin 1963). Third, the selectivity of the communication process is not taken into account, which obscures an essential aspect of human communication (Merten 1999). Nevertheless, the models contain essential elements influencing the communication process and hence contribute to understanding communication mechanisms.

In general, human beings are not able not to communicate (Watzlawick 1967). As researchers emphasize, communication theory appears to be valuable in examining the topic of knowledge transfer. Communication is regarded as the mechanism underlying and explaining the organizational-level phenomenon of transferring knowledge (Murray *et al.* 2007). Along this argumentation, Garrett (2006) nails the point, stating that *"...knowledge cannot be retrieved or exchanged without communication..."* (p. 466), while Winter (1987) narrows it down to tacit knowledge requiring teaching for transfer purposes. Within knowledge transfer literature, a communication-oriented research stream is emerging as, e.g., 'classic' communication models are adopted to analyze knowledge transfer processes (Gupta *et al.* 2000; Joshi *et al.* 2007). A know-how

[20] Hewes and colleagues (Hewes *et al.* 1980; Hewes *et al.* 1987) underline the difficulties of relating communication impacting on the behavioral change on the receiver side. They identify the urgent need to explore the underlying mechanisms to understand the impact.

[21] Intersubjectivity is a contributor to and a result of communication referring to common experiences of the communicating partners. This construct helps partners to share perspectives.

transfer through communication processes requires the use of language or other information types such as gestures, tones, body language or social presence (Daft, Lengel, and Trevino 1987; Rice & Shook 1990). Buckley *et al.* (2005) identify the language itself as well as the deep-rooted company individual knowledge (Grant 1996a) as success drivers for knowledge transfer via communication processes. Social knowledge in this case refers to a mutual understanding of behaviors and enables the interpretation of language use in communication processes (Buckley *et al.* 2005). Social communication describes the process of interaction between individuals, while interaction and communication are mostly used interchangeable. To delineate communication from interaction *Watzlawick* (1967) defines communication as the name for what takes place in interactive processes.

Communication is regarded as a reciprocal process with alternating sender and receiver roles. Even though sender and receiver are clearly distinguishable in the model, research on communication competencies does not follow the separation. Therefore, communication competence targets both partners and is considered to increase the likelihood of successful communication. Research on human communication leaves no doubt about the significance and the impact of the communicator on the message sending process, the message clarity, the reception, and the communication effect (Axley 1984; Krone *et al.* 1987; Garrett 2006). Emphasizing this impact, behavioral and cognitive-oriented research analyzes the dimensions of communication competence to design a situational appropriate message. Following the alternating nature of the roles and the resulting interchangeability of the partners, the dimensions listed in Tab. 3.01 represent the communication competencies of the sender and the receiver.

Table 3.01 - Individual level communication competencies

Study author	**Behavioral**	***Study author***	**Cognitive**
Jablin and Sias (2001)	Goal achieving skills, understand, select, and display appropriate communication behavior according to given situations, knowledge about communication rules and norms, communication capacity (e.g., perspective taking, encoding and decoding skills, resource availability.	Duran and Spitzberg (1995)	Anticipating potential contextual variables, monitoring the transpiration of the conversation, performance reflection to eliminate unsuccessful communication parts. A process to continually refine one's social communication repertoire.
Reinsch and Shelby (1997)	Enhanced self-confidence, persuasive power, abilities to express ideas clearly, the control of communication fear.	Jablin *et al.* (1994)	By-product of an individual's understanding of the organization's 'master contract', as well as the constitutive rules and regulative rules which guide interaction.

Study author	**Behavioral**
Haas and Arnold (1995)	Listening-related behaviors.
Jablin *et al.* (1994)	Listening, feedback giving, advising, persuading, instructing, interviewing, motivating.
Scudder and Guinan (1989)	Encoding abilities (getting to the point, writing ability, clarity of expression), decoding abilities (listening, activeness, sensitivity), maintaining communication, maintaining relationships.
Wheeless and Berryman-Fink (1985)	Intuition, listening, supportiveness, other orientation. Appropriate turn-taking, episode punctuation.
Snavely and Walters (1983)	Empathy, listening, self-disclosure, social fear, universalism.
Monge *et al.* (1981)	Encoding capabilities, decoding abilities.

Study author	**Cognitive**
O'Keefe (1988)	Message design logics.
Sypher and Zorn (1986)	Social-cognitive abilities.
Sypher and Sypher (1981)	Cognitive differentiation, perspective taking, self-monitoring.
Fisher (1978)	Deployment of conceptual filters consisting of communicators' attitudes, cognitions, and perceptions influencing which and how information is attended, conveyed, and interpreted.

Postulating the multi-dimensional character of communication models, the outlined competencies cover only two of them (sender/communicator and receiver dimension). Another important aspect is the communication channel. Media richness theory provides insights into this issue, adding an important piece of the puzzle to communication models.

Media richness theory (MRT)[22]

Besides various types of information or knowledge which can be transmitted, we further see a variety of possible transfer media for this purpose to choose from. Therefore, the spectrum or the variety of knowledge types a certain media type is able to transfer becomes an important parameter of this selection process. Herein, the ability of information and knowledge to change understanding within a time period defines the degree of media richness (Carlson & Davis 1998). Daft and Lengel (1986) find that, depending on the type of information and knowledge, different communication media have to be deployed. Pedersen *et al.* (2003) or Murray and Peyrefitte (2007) for exam-

[22] Media richness theory is strongly interwoven with the information processing theory stating that information processing in organizations is generally defined as including the gathering of data, the transformation of data into information, and the communication and storage of information in the organization (Galbraith 1974; Egelhoff 1982). This theory describes different structural mechanisms and their impact resolving the goal conflict between uncertainty and equivocality in means of processing information on an organizational level (Daft & Lengel 1986).

ple analyze in recent studies the range of potential communication media and their impact on the transfer of knowledge in intra-organizational settings. In the case of tacit knowledge, the use of richer communication media such as face-to-face communication or informal interaction represents the most appropriate way to proceed (Pedersen *et al.* 2003; Murray *et al.* 2007). Imperfect communication resulting in misunderstandings or misinterpretations due to ambiguity or equivocality requires feedback to correct errors caused by communication-noises. Feedback loops, on the other hand, cause additional resource expenses. To minimize the errors from the outset, media have to be selected according to the transfer knowledge and richness to enable the completion of certain tasks (Daft *et al.* 1986). Various studies confirm that certain task situations require specific types of information and knowledge to be transferred and that according to these assets, specific communication procedures need to be chosen (Daft *et al.* 1987; Rice *et al.* 1990; Keller 1994; Webster & Trevino 1995; Pedersen *et al.* 2003; Lin, Geng, and Whinston 2005; Murray *et al.* 2007). Even though studies have confirmed the validity of the MRT, new media like email show differing support for this theory (Markus 1994). Individual preferences as well as irrational media selection behavior occur in practice too (Rice *et al.* 1990; Rice, Chang, and Torbin 1992; Lin *et al.* 2005). MRT provides insights into the necessity to match the transfer knowledge and the transfer media. This theory draws thus attention to the need to choose an adequate media mix for the transfer.

3.3 Summary

This chapter outlined the conceptual as well as the theoretical foundation of the research. After embedding the topic of interest in a conceptual foundation of KBV and DCV, relevant theoretical contributions were elaborated.

As the addressed research topic needs a conceptual foundation, KBV and DCV are deployed. Both theories provide guidance in similar directions. They are not redundancy-free as they try to identify the roots of competitive advantages of the firm. The explanatory contributions of both theories of the firm underline the motivation for this research. Furthermore, these two streams provide a framework of thoughts, guidelines, and perspectives which helps to focus and to give this work its analytical perspective. Deploying these two theoretical stream underline the idea of DiC creating a competitive advantage and being valuable capabilities to collaborate in inter-organizational PD projects. Thereby, the KBV highlights the necessity to manage and leverage knowledge asset to generate competitive advantages which can be scarcely imitated; in other

words provides the motivation to collaborate and to transfer knowledge with the partner in order to succeed with the product launch. As outlined in the research setting collaborating partners are even more successful if they develop capabilities to transfer knowledge more efficiently. To be able to succeed in knowledge transfer from a sender perspective she has to adjust her activities according to the actual collaboration setting and to ensure to provide the required knowledge assets. Executing this adjusting process requires dynamic capabilities.

The theoretical foundation introduced a basic idea underlying this work, the supplementation of knowledge transfer theory. The identified research gap draws attention to knowledge transfer theory, pedagogy and (organizational) teaching theory, and communication theory. Arguments, motivations, and contributions of these theoretical research streams serve as the starting point to derive the working propositions. Deploying a multiple-theory approach facilitates a broader understanding of the subject matter, namely, disseminative capabilities, than a single-theory approach would. As knowledge transfer in general and the knowledge sender capabilities in particular represent multi-layer challenges for organizations in joint PD, a single theoretical approach does not cover these phenomena appropriately.

All three theoretical streams referred to one core idea; analyzing the relationship between a sender[23] and her addressed receiver unit[24]. Table 3.02 summarizes the focus, the contributions for this work as well as the strengths and weaknesses of the combined research streams/theories applied for the base of the construct of DiC. The table underlines on the one hand the necessity to consider the applicability of existing findings to the analyzed setting in this work. On the other hand it supports the idea of combining these three streams to base the DiC concept upon. While this work investigates the impact of the knowledge sender on transfer success, all three theoretical approaches helped to draw a clear and substantial picture of DiC. These contributions are also indicated in Table 4.02 in the following chapter where theoretical dues from the referred research streams are clustered along the dimensions of DiC they are related to.

Knowledge transfer theory, as the central theory, provides the motivation for, and lead-off ideas about DiC in inter-organizational settings. Pedagogy and (organizational) teaching theory put emphasis on the process of education in classrooms, universities, or at home. Research in this field helps to identify the drivers of a successful teacher, which can be used analogically to examine knowledge transfer capabilities. According to Watzlawick (1967), interactive work represents communication and every knowledge transfer requires communication activities. Communication theory

[23] Other research perspectives name this unit source, communicator, teacher, etc.
[24] Other research perspectives name this unit learner message destination, etc.

incorporates engineering as well as human aspects of transmitting messages and this work benefits from the insights this theory provides on the core aspect of transferring knowledge between involved partners.

Table 3.02 - Contributions of the deployed theories for the theoretical foundation

Research stream/ theory	Focus	Contribution to addressed phenomenon	Strengths	Weaknesses
Knowledge transfer theory	▪ Success factors (cluster, domains) of knowledge transfer (knowledge, interaction, relationship, receiver, and sender).	▪ Addresses the core process in the focus of this work. ▪ Knowledge sender capability oriented research recently emerging from this theory. ▪ Constructs like, e.g., source transfer capability, disseminative capacity, desorptive capacity contribute to the concept of DiC.	▪ Capability based research newly/recently existent. ▪ Starting point for this work. ▪ Research stream focuses the knowledge sender, her characteristics, and just recently capabilities.	▪ Mainly intra-organizational and ▪ Conceptual investigations. ▪ No integral approach existent testing the set of capabilities. ▪ So far peace-meal picture of DiC.
Teaching and Pedagogy theory	▪ Classroom teaching (teacher - student (s)) ▪ The art and science of transmitting knowledge to the student(s). ▪ *Science* (teaching theory) focuses how much expert the teacher is required to be in order to teach successfully. ▪ *Art* (pedagogy theory) focuses the creation and maintaining of a learning setting.	▪ How is knowledge transferred from a knowledgeable teacher to the student(s)? ▪ *Science* - self-reflection to deepen knowledge, receiver aligned according to the student(s) portfolio, being able to give illustrative examples, self-confidence through being knowledgeable. ▪ *Art* - creating an appropriate teaching environment, learning motivation, supporting knowledge retention, changing teaching methods, coordinate students' activities.	▪ Realistic analogy for one direction of the knowledge transfer. ▪ In inter-organizational (PD) project settings one partner partly maintains the teacher role for a specific knowledge asset.	▪ Single-direction knowledge transfer analyzed (from the teacher to the student). ▪ Focuses the knowledgeable teacher and her less knowledgeable student. No switching roles considered. ▪ Only long-run (educational) considerations. ▪ Classroom and at home teaching settings.
Communication science	▪ Success factors to transmit signals from a sender to a receiver (sender, receiver, message, channel, situation, interaction). ▪ Emerging from electronic communication science.	▪ Communication as the core part of knowledge transfer. ▪ Identification of communication competencies (capabilities). ▪ *See* Table 3.01 for communication competencies. ▪ Identification of sources of noise the sender has to reduce to transmit her mes-	▪ Analyzes the core and critical parts of knowledge transfer. ▪ Closing an important gap/blind spot within knowledge transfer theory.	▪ No consideration of different knowledge bases and related know-how. ▪ Mainly focuses technical aspects and thereby centers the designing

Research stream/ theory	Focus	Contribution to addressed phenomenon	Strengths	Weaknesses
	▪ Technical focus. ▪ Media richness theory focuses exclusively on the channel adequacy.	sage.	▪ Evaluation of communication capabilities - 1:1 transferable.	and executing of the transfer approach. ▪ Maintain/retain knowledge is not considered.

The conceptual and theoretical foundations deployed provide a framework to develop the model of DiC and subsequently test it. In the next chapter, the working propositions are derived based on the initial fieldwork and the literature review. The propositions serve as a guideline for the in-depth case studies.

As the deployed theories seem to be of supplementary nature they are not free of contradictions and in some cases these streams diverge. One of the main success factors teaching theory underlines is the level of expert of the teacher (Cochrane, DeRuiter, and King 1993). This theoretical stream relates the level of expert to the success of the teaching. Contrary to this in knowledge transfer theory this is true to certain extends and limited by the transfer to novices. While in teaching theory the increase of the teacher's existing knowledge has a positive impact on the teaching success knowledge transfer from an expert to a novice or a less knowledgeable expert is limited due to, e.g., a different organization of knowledge or a wrong assumed existing knowledge base enabling the understanding. These contradictions have to be kept in mind when applying the outlined theories to shape the construct of disseminative capabilities.

Chapter 4 -

Development of working propositions

Employing the outlined conceptual and theoretical foundation and insights from the initial field work as a basis, I develop the preliminary conceptual framework of DiC (*see* Figure 4.01) and derive the working propositions. The success measurement, the preliminary conceptual framework, and the working propositions provide a guideline for the empirical case study work presented in chapter 5 later on. Figure 4.01 outlines the knowledge sender capabilities, which contain the groups of initial and reflective DiC, the moderating capability, the dependent variable (knowledge transfer success), and their interrelations, and serves simultaneously as the structure for chapter 4. Each of these dimensions, which form the proposed conceptual framework, is now described in detail, resulting in working propositions.

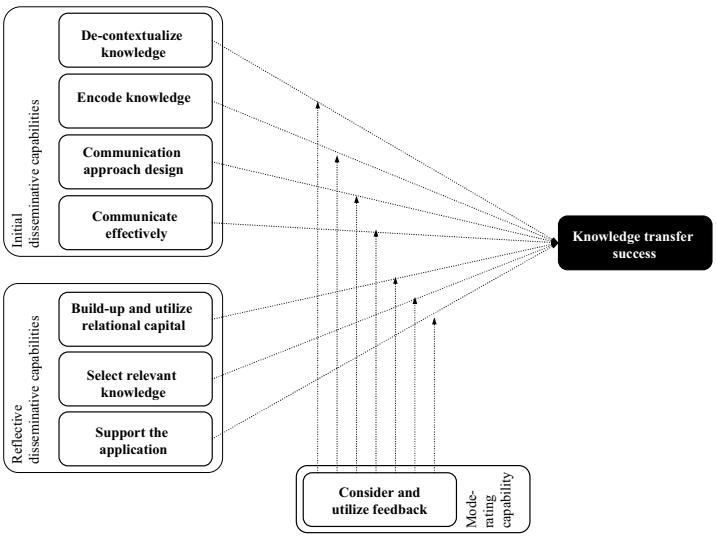


Figure 4.01 - Preliminary model of DiC in inter-organizational knowledge transfer

According to the research questions, the work at hand focuses on the relationship between the DiC and their impact on knowledge transfer success. Therefore, this chapter starts with the introduction of the approach to measure the knowledge transfer success (4.1). The working propositions are subsequently derived (4.2).

4.1 'Measuring' knowledge transfer success

As is the case for the propositions and the preliminary conceptual model, the success measure approach is designed to gather valuable information during empirical investigations. According to the definition given, I consider knowledge transfer successful if transferred know-how is applied to commercial ends, in my case, for the advancement of the project work, and generates benefits for the involved partners. As there is no single indicator capturing all aspects related to successful knowledge transfer and the ongoing application, I design my own approach to 'measure' the knowledge transfer success. In theory-building research the investigator is obliged to provide evidence rather than quantifiable empirical measures to indicate relationships or to outline identified structures (Eisenhardt *et al.* 2007). While assuming DiC to have a positive impact on knowledge transfer success, the issue now is to identify and select appropriate indicators that detect knowledge transfer outcomes and results. The unit of analysis in my research is the project level. Besides the project level success measure, the knowledge transfer has an impact on the individual level outcomes, e.g., an employee's understanding of a certain development task or firm-level outcomes such as changes in the company's PD process based on experiences from a joint project. As of this moment, neither the dimensions of the construct of disseminative capabilities nor their impact on knowledge transfer success have been completely captured. In order to be able to understand the impact of the knowledge sender's capabilities adequately, I did not limit the success measures and indicators from the very beginning of the empirical investigations.

In building the construct of disseminative capabilities on three literature streams, namely knowledge transfer, pedagogy and (organizational) teaching theory, and communication theory, one could assume that in consequence the measurement approach unifies success indicators from all deployed theoretical streams. The main objective of this research can be narrowed down to the question of whether the construct of DiC explains the success of knowledge transfer. Integrating insights from supplementing theories into knowledge transfer theory serves to complete the dimensions of DiC. Nevertheless, when focusing on the above research question, it appears to be relevant whether integrated dimensions from supplementing theories have an impact on success measures emerging from knowledge transfer theory. In order to contribute and extend knowledge transfer theory, the measure approach designed has to focus especially on this theoretical stream. To make this clearer, e.g., for the research topic addressed, it does not matter whether feedback has a positive impact on the communication process

rather than on the knowledge transfer result. Overall, this relationship has already been shown in communication theory (e.g. Jablin *et al.* 2001). Figure 4.02 therefore displays the selected knowledge transfer success indicators.

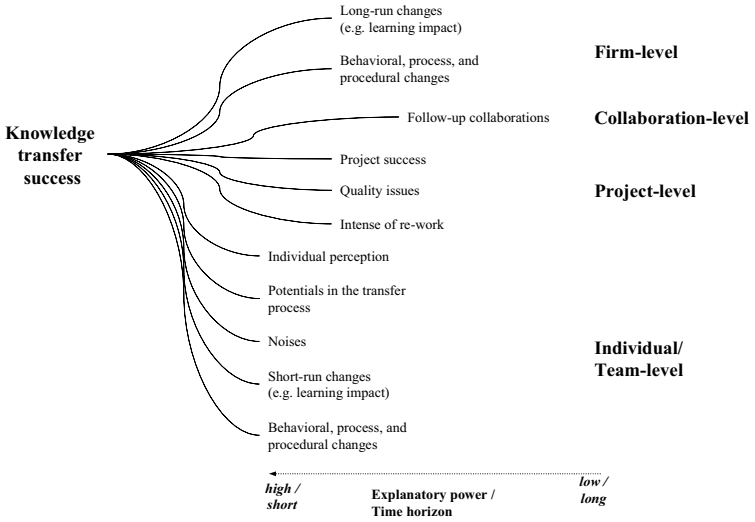


Figure 4.02 - Knowledge transfer success indicators

Recapitulating, scholars deploy various approaches to measure the success of knowledge transfer including quantitative, qualitative, and approaches combining both measures (e.g. Martin *et al.* 2003). Success measures and indicators differ in their explanatory power of the dependent variable as it results from various direct and indirect impacting factors characterizing a highly complex network of interdependencies. For example, the success of a company might not have its root cause solely in the success of knowledge transfer in one of the analyzed projects. Nevertheless, it can, among various other impact factors, provide a 'small' contribution to overall company success. Contrarily, the explanatory power indicating knowledge transfer of the personal learning impact or adapted product development procedures from a joint project work appears to be much bigger. In order to capture the impact and the importance of successful knowledge transfer adequately, I use different indicators representing various consideration levels as outlined in table 4.01

Table 4.01 - Indicators and measures of knowledge transfer success

Level	Indicator	Description
Individual-level	*Individual perception*	Measures of personal satisfaction with the transferred knowledge, e.g., was it easy to understand or to apply for the project work, etc.
	Identified potentials in the transfer process	Where are the main potentials in the knowledge transfer in the analyzed collaboration and which potential caused the biggest impact on knowledge transfer.
	Barriers and interferences in the knowledge transfer process (*noise*)	What causes barriers and interferences in the knowledge transfer?
	Short-run *learnings* on the individual level	What do people learn from and about the partner to increase their own work and possible ongoing collaboration with the same/other partners?
	Behavioral, process, and procedural *changes* on an individual level	What differences occur in the joint PD work compared to the original behavior, deployed processes, and PD procedures? Is the root cause the joint work with the partner?
Project-level	*Project success*	Measures indicating whether the project is, e.g., on time, within the budget, etc. Here the standard measures of PD success (e.g. Cooper 2000) are deployed as well as the individual goals set by the participating partners. Closely related to the standard PD project measure are the two following.
	Quality issues during / after the project	If knowledge is not properly transferred, it could cause problems in understanding or applying knowledge, resulting, e.g., in product quality issues. Product call-backs are a possible result.
	Intense of *re-work* during the project	In this research it is assumed that one consequence of improper knowledge transfer is re-work. Re-work might result from an incomplete understanding of certain aspects within the sender or improper transfer to the receiver. An ongoing application of this knowledge can cause re-work.
Collaboration-level	*Follow-up collaborations*	If the partners are both satisfied with the collaboration and the exchange of knowledge is valuable for both sides generating reciprocal benefits, the likelihood of follow-up collaborations increases.
Firm-level	Long-run *learnings* on the firm level	One partner or , in the best case both, learn from each other and can increase the overall firm performance when leveraging new expertise from the joint work in internal applications.
	Behavioral, process, and procedural changes	Process, technology, or procedural changes can be traced back to the influence of the collaborating partner.

4.2 Working propositions on DiC

I classify the knowledge sender's capabilities into two categories. First, I consider *initial disseminative capabilities*, which comprise activities contributing to the transfer of knowledge. For those, the individual characteristics and needs of the receiver are taken into account, whereas activities of the receiver are not yet required. Secondly, I con-

sider *reflected disseminative capabilities* to be those demanding partner-related interaction. The latter capabilities take activities and the behavior of the receiver into account. Table 4.02 highlights the two sets of capabilities that compose disseminative capabilities on the team project level and gives an overview on the contributing research streams. DiC are arranged in an inductive and chronological order, closing with an exception to this order, the moderating capability. I believe that the first two sets in combination with the moderating disseminative capability represent the dimensions of disseminative capabilities and play different, yet complementary, roles in explaining knowledge transfer success.

Table 4.02 - Disseminative capabilities and contributing theoretical streams

Category	*Knowledge sender capabilities*	**Knowledge Transfer theory**	**(Organizational) Teaching and Pedagogy theory**	**Communication theory**
Initial disseminative capabilities	*Ability to decontextualize knowledge*	Chini (2004); Carlile and Rebentisch (2003); Cummings and Teng (2003); Hinds *et al.* (2001); Szulanski (1996)	Lehner and Ziep (1997)	Shannon and Weaver (1949)
	Ability to encode knowledge	Minbaeva (2007); Chini (2004); Minbaeva and Michailova (2004); Carlile and Rebentisch (2003); Pedersen *et al.* (2003)		Jablin et al. (1994); Monge *et al.* (1981); Shannon and Weaver (1949);
	Ability to design an appropriate communication approach	Murray and Peyrefitte (2007); Kwan and Cheung (2006); Chini (2004); Pedersen *et al.* (2003); Ranft and Lord (2002); Gupta and Govindarajan (2000); Szulanski (2000); Leonard-Barton (1995); Galbraith (1990)		Keller (1994); Daft *et al.* (1987); Daft and Lengel (1986); Shannon and Weaver (1949)
	Ability to communicate effectively	Minbaeva (2007); Minbaeva and Michailova (2004); Reagans and McEvily (2003); Simonin (1999);	Euler and Hahn (2004)	Duran and Spitzberg (1995); Jablin *et al.* (1994); Parks (1994); Spitzberg and Cupach (1984); Monge *et al.* (1981)
Reflected disseminative capabilities	*Ability to build up and leverage relational capital*	Ammess and Cohent (2001); Kale *et al.* (2000); Dyer and Singh (1998); Lane and Lubatkin (1998)		
	Ability to select the relevant and required knowledge assets	Carlile and Rebentisch (2003); Martin and Salomon (2003); Ammess and Cohent (2001); von Krogh *et al*. (2000); Dyer and Singh (1998); Nelson and Winter (1993); Leonard-Barton (1988)	Mietzel (2001); Fiet (2000)	
	Ability to support the knowledge application	Lichtenthaler (2006); Martin and Salomon (2002; Martin *et al.* 2003); von Krogh *et al.* (2000); Szulanski (2000)	Heller (2002; Heller 2006); Mietzel (2001); Fiet (2000); Knowles (1981); Bluth (1975)	
Moderating capability	*Ability to consider and use feedback*		Euler and Hahn (2004); Mietzel (2001); Solomon and Rosenberg (1964)	Haas and Arnold (1995b); Dehees (1994); Jablin (1994); Sypher/Sypher (1981); Luft (1971)

4.2.1 Initial disseminative capabilities

In order to start the transfer process the sender has to de-contextualize (Shannon *et al.* 1949; Cummings *et al.* 2003) knowledge first. De-contextualization means detaching knowledge from its environment. Embeddedness is a key characteristic of knowledge (Granovetter 1985, 1992; Cummings *et al.* 2003), and the majority of knowledge is embedded in, e.g., people, tools, and routines (Argote *et al.* 2000) or, as Polanyi (1966) and Nonaka (1994) have termed it, tacit. Therefore, the value of knowledge is only proven in a specific context. Due to the embedded and context-bound nature of knowledge, it is difficult to transfer (Reed & DeFillippi 1990; Brown *et al.* 1992; Nonaka 1994).

To make knowledge transferable, i.e. to detach knowledge from one context, transfer it, and apply it in a different context successfully, the knowledge sender has to detach knowledge from its current environment, hence, abstract it (Carlile *et al.* 2003). Performing this abstraction can be difficult, especially because of the occurrence of causal ambiguity (Szulanski 1996). Causal ambiguity arises in situations where it is hard or even impossible to relate the consequences or effects of a phenomenon to its initial states or causes. This phenomenon is very common in strategy, where it is often impossible to determine whether the success of a company is due to solid strategic thinking or due to sheer luck (Lippman *et al.* 1982). Hence, by detaching knowledge from its original context, the value decreases with an increasing likelihood of causal ambiguity (Szulanski, 1996). In this case, adjacent contextual aspects have to be transferred as well. However, for practical as well as efficiency reasons, the number of adjacent factors that can be transferred is limited (Lehner & Fredersdorf 2003). This tendency peaks in the conflict of the goals of transferring as much contextual knowledge as possible for the purpose of enabling a complete understanding, the completion trap (Lehner *et al.* 1997), and resource limitation.

Furthermore, the level of understanding and expert knowledge impacts the ability to de-contextualize knowledge (Cummings *et al.* 2003; Joshi *et al.* 2007). Scholars argue that the knowledge sender has to be as expert and knowledgeable as possible in order to be a good sender (e.g. 2000; Venzin *et al.* 2000; Mietzel 2001). Nevertheless, the more expert the knowledge sender is, the more difficulties occur in explicating knowledge for integration purposes within the receiver (Hinds *et al.* 2001; Liebowitz 2003). Therefore, the knowledge sender has to solve or prevent the engineering paradox involving the trade-off between expert knowledge transfer and success in transferring knowledge to non-experts (Hinds 1999). Here the difficulties lie in the anticipation of existing knowledge within the receiver and the differences in the knowledge bases.

Experts tend to abstract know-how to a higher degree, for which reason they reduce the transfer of context-related knowledge. The knowledge engineering paradox increases with an increase in cognitive distance. By nature, inter-organizational collaboration features project team members with higher and with lower degrees of expert knowledge in different fields.
Overall, de-contextualization encompasses the activities of abstraction of relevant adjacent contextual factors. The more receiver-aligned the de-contextualized knowledge is, the easier the ongoing application within the new context is. Hence, I posit:

Proposition P^1 *The success of inter-organizational knowledge transfer is related to the ability of the knowledge sender to de-contextualize knowledge.*

Once it is clear what knowledge, including the adjacent factors, is going to be transferred, it has to be encoded (Scudder *et al.* 1989). Encoding refers to the articulation of knowledge and encompasses, e.g., the process of getting to the point or the clarity of given expressions (Monge *et al.* 1981). Among others, Monge *et al.* (1981) and Jablin *et al.* (1994) regard the process of (oral or written) encoding as an important aspect before knowledge transfer can take place. From a more engineering-oriented point of view, knowledge and information have to be encoded in transferable and receivable 'signals' for transfer in communication activities (Shannon *et al.* 1949). Often, the knowledge of partners with diverse backgrounds who collaborate in joint projects is highly specialized. The knowledge sender, as an expert from a particular field, has to master the challenge of converting knowledge from its specific terminology, nomenclature, etc. to make it understandable to outsiders, e.g., development partners. Experts not only tend to organize their knowledge differently, they also abstract knowledge to a higher degree than a novice and articulate it in a different way. In order to enable a later decoding within the receiver under the presence of cognitive distances the sender has to make the de-contextualized knowledge accessible for the receiver. The inability to present knowledge in an adequate way makes it impossible to receive and understand it, hence, to use it for problem solving (Carlile *et al.* 2003).

Proposition P^2 *The success of inter-organizational knowledge transfer is related to the ability of the knowledge sender to encode the knowledge to be transferred.*

Subsequently, after having selected, de-contextualized, and encoded the knowledge for transfer purposes, an adequate transfer approach needs to be designed. Firstly, the

sender selects the channels and media as well as the transfer mode for an effective transfer, and secondly, she utilizes the selected approach in the most efficient way.

In their widely-known communication model on elements of communication, Shannon and Weaver (1949) identified the communication channel as one limiting aspect of signals and message transfer. There is a wide variety of different channels which can be distinguished, e.g., according to their capacity for communication signal transportation. Short messaging service (SMS), email, telephone, or face-to-face conversations enable different levels of communication richness; nevertheless, all bear advantages and disadvantages in differing settings (Daft *et al.* 1986). Channels vary in speed and their capacity to transfer knowledge as well as in the resource efforts deploying them. Workshops, for example, are often the choice for highly complex tasks; simultaneously, workshops are related to higher resource efforts, especially in terms of time and manpower. If a given situation calls for knowledge to be utilized for a quick decision based on financial ratios, email is an appropriate way to transfer this know-how, considering the speed needed and the resources available. As these two examples illustrate, the individual setting has to be considered in selecting the transfer approach.

According to media richness theory, certain task situations require specific types (e.g., technical or intuitive) and amounts or forms (e.g., implicit or explicit; formulas or text) of knowledge to be transferred, and as related to the type of know-how, different types of transfer approaches (Daft *et al.* 1986, 1987; Keller 1994; Ranft *et al.* 2002). The knowledge sender is in charge of designing the transfer approach containing the channel and media as well as the transfer modes. For example, describing the owner's manual of a car via SMS is a good illustration of a channel overload and can be regarded as an inadequate selection for this intended purpose.

The act of designing the transfer approach does not necessarily pave the way to successful knowledge transfer. Instead, the way of actually utilizing and organizing the approach, e.g., by co-locating project members to increase face-to-face conversations, is important as well. Hence, the knowledge sender needs to be familiar with advantages and disadvantages of transfer approach dimensions.

Due to the strong influence of interaction patterns and the surrounding environment, the sociology of knowledge transfer has to be considered (Lucas *et al.* 2006). Besides the selection of the channel and media, other aspects have to be reflected on when designing the knowledge transfer approach, namely, creating corporate socialization procedures (Gupta *et al.* 2000), ensuring documentation quality, or training the involved people (Galbraith 1990). Taken together, all these elements are relevant drivers of transfer success. The bundle of elements has to be arranged according to the transfer

situation. All the different dimensions of a knowledge transfer approach underpin the impact of their composition on the success of knowledge transfer.

Proposition P^3 *The success of inter-organizational knowledge transfer is related to the ability of the knowledge sender to design an appropriate communication approach.*

To transfer knowledge to the other development partner successfully, capabilities to *communicate* appropriately and effectively are required (Simonin, 1999). Communication capabilities (Jablin et al., 1994; Monge et al., 1981; Parks, 1994; Spitzberg & Cupach, 1984) are a hybrid phenomenon due to their art- and social science-related character (Jablin et al., 1994). To the bundle of communication capabilities belongs the ability to display suitable communication behaviors in given situations such as instructing, advising, persuading, listening, providing feedback, interviewing, and motivating. Likewise, the communicator has to be skilled in perspective taking, e.g., being able to switch the point of view and see things through the project partner's eyes enables the knowledge sender to identify sources of misunderstanding or communication gaps. Based on this, she is able to enhance the communication process. Empirical evidence supports that these behaviors also show effects on communication process success (Jablin et al., 1994). Moreover, communication capabilities comprise a bundle of abilities used by the knowledge sender to overcome communication gaps (Jablin et al., 1994). When looking at the communication of knowledge between heterogeneous partners in cooperative settings, numerous gaps can be identified, e.g., language incompatibilities, conflicting coding schemes, or differing cultural conventions. Successfully bridging those gaps is challenging to the sender (Szulanski, 2000), and the stronger her ability to know and to follow the applicable rules and norms of communication, the more promising the success of knowledge transfer is.

Hence, I argue that the more the knowledge sender is able to cope with the varying facets of communication and with communication gaps and adapts her communication to the current situation, the more she is able to transfer knowledge in a successful way.

Proposition P^4 *The success of inter-organizational knowledge transfer is related to the ability of the knowledge sender to communicate effectively.*

4.2.2 Reflective disseminative capabilities

Mutual interactions and the activities of the knowledge sender in response to the receiver's specifics are as important as the initial activities to realize a successful knowledge transfer process. Mastering iteration loops ensures that the transferred knowledge is understood, will be integrated, and can be used for the joint project work. Knowledge transfer is successful if it is conducted in such a way that the receiver is able to use the new knowledge to enhance the project (Walter, Lechner, and Kellermann 2007).

In order to start the interaction in the transfer process, it is necessary, e.g., to know and find the right contact persons (Hansen 1999) and to have knowledge about the receiver's language (e.g., English, German) and lingo (e.g., the technical terms). This knowledge is known as partner-specific knowledge (Dyer *et al.* 1998). In this context further preconditions for actually transferring knowledge are mutual trust and respect (Granovetter 1985; Hansen 1999). Also, strong rather than weak ties to the partner (Lane *et al.* 1998), relative, partner-specific, and relative absorptive capacity (Dyer *et al.* 1998; Todorova & Durisin 2007) enable efficient knowledge transfer (Amesse *et al.* 2001) or the transfer of more complex knowledge. Similarly, human co-specialization, which describes how partners specialize in terms of tasks to be fulfilled and how they stabilize their roles, eases the exchange of knowledge as, e.g., it is clear who has and who needs what knowledge. These relation-specific assets (trust, strong ties, partner-specific absorptive capacity, etc.) along with the partner-specific knowledge are subsumed in the construct *relational capital* (Kale *et al.* 2000). In sociology literature, this construct is known as social capital (Coleman 1988). Both phenomena increase as partners work together. Moreover, based on empirical research, the findings by Dyer and Singh (1998) indicate that relational capital contributes to an increase of the outcome of collaborative work.

In particular, I argue that the more the knowledge sender is able to generate and leverage relational capital within the joint project work, the more likely it is that the knowledge transfer is successful. Within the conceptual framework the relational capital inhabits a central role compared to the other DiC. The nature of this DiC, in particular existing relational capital between the partners involved, holds the potential to enhance the other related DiC. For example, as the knowledge sender has exact knowledge of her partner’s existing knowledge base in a certain technical field, she is able to adjust the knowledge selection process based on this insight. Hence, I contend:

Proposition P[5] *The success of inter-organizational knowledge transfer is related to the ability of the knowledge sender to build up and leverage relational capital.*

In order to avoid a knowledge overload and to be truly efficient in transferring know-how, the sender needs to appraise the receiver's knowledge base, identify the strengths and what is lacking in the receiver's portfolio (Martin *et al.* 2002, 2003), and consequently, align transfer activities (von Krogh *et al.* 2000). An assessment of the receiver's knowledge portfolio to identify deficiencies with regard to the current project represents the first step in selecting transfer knowledge (Grant *et al.* 2004). The second step is to assess its relevance and value concerning the current task or problem and to evaluate whether it is worth transferring those assets (Carlile *et al.* 2003). In this regard, it is crucial to consider the receiver's (relative and partner-specific) absorptive capacity (Cohen *et al.* 1990; Dyer *et al.* 1998; Lane *et al.* 1998); however, it appears challenging to estimate it appropriately (Amesse *et al.* 2001; Mietzel 2001). The fact that cooperating partners always have different knowledge bases and experts seem to have difficulties anticipating non-experts' experience (Hinds 1999) heightens the challenge of this task for the sender. Good anticipation avoids a knowledge overload, thus increasing transfer efficiency and success. However, a trade-off emerges as the process of knowledge selection harbors the danger of limiting understanding by weeding out too much (Fiet 2000), e.g., basing the filtering process on wrong assumptions (Hinds *et al.* 2001).

As von Krogh *et al.* (2000) state: "…both sides of the (knowledge transfer) process can discuss the receiver's available knowledge…". Identifying and evaluating know-how to be transferred requires social interaction, as a mutual identification and evaluation process leads to accurate results. Based on the insights into the receiver's needs regarding know-how, the sender can purposefully adjust the content. This increases the efficiency of the transfer that follows for both partners. My arguments are in line with insights from Dyer and Singh (1998), who state that being able to identify and evaluate complementarities in the knowledge portfolio enhances the success of the joint work concerning the inter-linkage of knowledge assets.

Proposition P[6] *The success of inter-organizational knowledge transfer is related to the ability of the knowledge sender to select the relevant knowledge to be transferred.*

One objective of knowledge transfer is to induce behavioral changes within the receiver, to enable the receiver to solve problems or to purposefully pursue the development of a joint product. To reach this objective, appropriately transferring the relevant knowledge by the sender and perceiving it by the receiver are not sufficient. The knowledge transfer will only be successful once the knowledge is applied.

The application process can be assisted and supported by the knowledge sender (Knowles 1981; Heller 2002, 2006). Support is helpful, even necessary, as there are a number of barriers preventing the receiver from actually applying and utilizing the knowledge gained. Szulanski (1996; Szulanski 2000) indicates potential sources of internal stickiness such as causal ambiguity, misunderstandings, or trained personnel who prove unfit for their new roles. Additionally, a lack of or low retentive capacity (Szulanski 1996; Szulanski 2000; Lucas *et al.* 2006) on the part of the receiver would hamper the sustainability of transferred knowledge assets and thereby their integration into the joint project work, especially in the case of complex know-how (Galbraith 1990).

Activities to overcome knowledge transfer barriers by supporting the receiver are investigated by, e.g., Szulanski (2000). For instance, sufficiently transferring the operating procedures of a new process technology can involve on-site training in a production setting where the receiver actively applies the newly gained knowledge and can be corrected or can be given supplemental knowledge immediately (Carlile *et al.* 2003). Here, the sender is more like a coach, supporting the knowledge application and providing real-time feedback to increase transfer success (Bluth 1975; Mietzel 2001). Moreover, she could train her own people in pedagogical skills enabling the utilization of the newly gained know-how and to serve as helpers and facilitators (von Krogh *et al.* 2000).

I disagree with Szulanski (1996; Szulanski 2000) and Cool *et al.* (1997), who state that the influence of the knowledge sender along the transfer process diminishes. Instead, I contend that this assumption hinders a sustainable use of the new know-how. Especially in the later stages of the transfer process, the receiver requires support while transforming knowledge into capabilities (Carlile *et al.* 2003). Hence, knowledge transfer benefits from the ability of the sender to provide support when needed, even, and especially, in later stages of the transfer.

In cases of teaching, Fiet (2000) showed that the facilitator has to balance the extent of her support in order to achieve the most successful. The more the knowledge sender initiates the transfer, the fewer competencies the receiver will acquire due to the fact that the teacher and not the student is the most engaged. Too much teacher engage-

ment bores the students and reduces their motivation to acquire knowledge in an active way.

Thus, I state that the more the knowledge sender provides support pertaining to the application of the knowledge, the higher the success of genuine knowledge transfer will be.

Proposition P^7 *The success of inter-organizational knowledge transfer is related to the ability of the knowledge sender to support the receiver in the knowledge application.*

4.2.3 Moderating capability

The receiver constantly (consciously and unconsciously) evaluates the knowledge received, the effectiveness of the transfer approach as well as the transfer activities deployed. Based on his impressions and the visible results, he provides feedback by transmitting signals, e.g., by explicitly describing the knowledge elements missing or by signaling questions or doubts by gesture (Luft 1971; Dehees 1994). This feedback in turn initiates impulses for ongoing self-monitoring and self-reflection processes within the sender. According to findings by Sypher and Sypher (1981), these processes support the creation of an environment that nurtures the improvement of knowledge transfer. As such, feedback serves as an essential precondition and a rich source for a continuous improvement in knowledge transfer activities (Solomon *et al.* 1964; Dehees 1994; Jablin *et al.* 1994). Hence, feedback is a rich source for improving knowledge transfer, for which reason the ability of the knowledge sender to consider and use this source becomes crucial.

In particular, I postulate that considering and using feedback moderates the impact of disseminative capabilities on transfer success in two dimensions: content-specific and methodology-specific. In the content-specific dimension, feedback on the transferred knowledge itself aims to trigger a self-reflecting process on the depth, breadth, suitability, quality, validity, and reliability of transferred know-how. For example, knowledge selection turns out to be inappropriate for the level of expert knowledge the receiver has. Problems arising in understanding the newly received knowledge go back to the high level of abstraction. When the receiver transmits feedback on that, the sender can adjust her knowledge selection procedure according to the receiver's preferences. Purposeful monitoring and reflecting upon feedback provide a chance for the knowledge sender to take action. Consequently, self-reflection enhances - thus moderates - the positive effect of understanding the knowledge on the transfer process.

In the methodology-specific dimension, an inadequate process of transferring knowledge, e.g., an inappropriately designed transfer approach or insufficient integration support is as cumbersome as receiver-unaligned knowledge selection. The sender considers feedback and reflects upon, for example, how she can succeed in the process of de-contextualization by monitoring how she will actually be able to transfer the knowledge from her context to the receiver's. Based on this, she is able to adjust her manner of de-contextualizing know-how. Either she enhances her skills in abstraction or she aligns them by delivering more or less contextual aspects embedding the core know-how to be transferred (Carlile *et al.* 2003). Let us have a look at another example from the methodology-specific dimension and consider the encoding process. In the presence of feedback and self-reflection, the sender takes the opportunity to check whether, e.g., technical terms, abbreviations, the company-specific language, and the like (e.g. Carlile *et al.* 2003) have been understood, and possibly explains those utilizing different terms than before. Deploying the teacher-student analogy again, the capability to use feedback enriches the quality of the teaching process (Euler *et al.* 2004) because the teacher better understands the effectiveness of her teaching practices (e.g., the design of transfer approaches) and is now able to adjust them. Lastly, the knowledge sender monitors the way the interaction transpires and reflects upon her performance for the purpose of eliminating unsuccessful parts of the communication process. In doing so, the impact of communication capabilities on the success of knowledge transfer is multiplied by leveraging feedback (Duran *et al.* 1995).

Proposition P[8] *The impact of the knowledge sender's capabilities is different in the presence of the ability to utilize the receiver's feedback for transfer process improvement.*

4.3 Summary

In chapter 3, I introduced the construct of DiC as abilities of the knowledge sender that result in activities which impact the success of knowledge transfer. To recapitulate, I understand disseminative capabilities as a multidimensional construct. Following this definition, this chapter derived eight working propositions on DIC which constitute my ideas of the concept of disseminative capabilities.

(1) Ability to de-contextualize knowledge

(2) Ability to encode knowledge

The first two capabilities are chronologically ordered. In the process of de-contextualization, knowledge, thus far embedded in people, tasks, or routines within

the sender, is detached from its specific context. Before the physical transmission transpires, the encoding of de-contextualized knowledge takes place. For example, knowledge is written down or articulated in a presentation. Subsequently, an adequate

(3) communication approach has to be designed

by selecting and combining appropriate channels and media. Furthermore and along with this, the knowledge sender has to able to

(4) communicate effectively

Additionally, the knowledge sender needs experiences in

(5) building up and use relational capital.

Based on insights, a commonly developed knowledge base, and the recent tasks, the knowledge sender is required to

(6) select the relevant and required knowledge asset

to enable the advancement of the project. To finally reach the objective of applying the knowledge successfully, the sender's capability to

(7) support the knowledge application

is of importance. Lastly, the knowledge sender needs a capability to

(8) consider and use feedback

from the receiver. The more she is able to react to the feedback given in a proper way, the more effectively the knowledge transfer takes place. After deriving the working propositions, the dimensions of this construct become clearer and serve as the guideline for the following case study work, which is reflected in the structure (*see* Appendix A-5.1-A-5.2)

Chapter 5 -

Case study investigations

Chapter 5 presents the empirical investigations. After deriving the working propositions, I conducted case studies to test the outlined preliminary conceptual model as well as the underlying propositions. The aim of the empirical testing is to revise this model and the propositions and to base my results on a solid data base. Therefore, I give a brief outline of the case study design as it is deployed for this work, then provide a depiction of the selected collaborative projects, and briefly discuss the advantages and disadvantages of the selected setting (5.1). As the case study partners operate in the automotive industry, I provide an overview of industry-specific trends with special regard to the focus of this thesis. The major trends in the automotive industry driving companies to collaborate along and across the value chain are indicated (5.2). The chapter closes with a synopsis of the three companies and points out their interrelatedness as well as former cooperative projects (5.3).

5.1 Case study design

This chapter introduces three case studies on cooperative PD. Each one focuses on the collaboration between two participating companies[25]. Magna Steyr Fahrzeugtechnik AG & Co. KG (following, Magna Steyr) is the constant partner in all three cases, working either alternately with BMW AG (BMW) and Mercedes Benz Cars[26] (Mercedes Benz) or with the same partner on a different project (i.e., BMW X3 and BMW Z4). The case studies result from the empirical, in-depth investigation phase of this research. The overall goal is to identify the capabilities of the knowledge sender to impact knowledge transfer success in a cooperative PD setting. The outlined case study structure as shown in Figure 5.01 provides the empirical basis for within-case (1) as well as cross-case analysis (2)/(3) for ongoing theory building. This design is capable of a cross-analysis of one specific partner constellation over time (2) and between collaborations (3). In the investigations both partners maintain the role of the know-

[25] As long as not otherwise mentioned, the information provided in the case studies is based on the interviews with representatives from the participating companies as well as information that is taken from supplemental documents (presentations, organizational charts), the companies websites, and other public sources (publications, news etc.).

[26] On October 7th 2007 DaimlerChrysler AG was renamed Daimler AG after it had separated from Chrysler earlier in 2007, selling the Chrysler group. At the same time former Mercedes Car Group was renamed Mercedes Benz Cars. Facts and figures given in this work mostly go back to before October 7th.

ledge sender in different fields as knowledge transfer is considered to be a process involving role-switching. This dynamic character is reflected in the circular arrows, indicating the continuous switching between the sender and the receiver role. Subsequently, these insights provide the empirical basis for the managerial recommendations. Figure 5.01 displays the case study structure and the ways the data analysis takes place in this work.

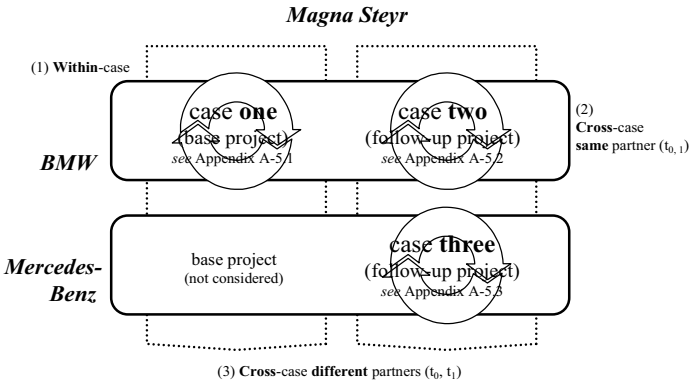


Figure 5.01 - Case study structure and deployed forms of data analysis

All case study partners are companies from the automotive industry. Cooperating in the field of product development is a steadily increasing strategic phenomenon in this industry and the selected companies in particular. Over the last several years automotive companies and especially OEMs have tended to give more and more responsibilities to 1st-tier suppliers such as development, production, or supplier management tasks[27]. This on the other end binds them closer together as they work more and more frequently in collaborative settings. In the selected case study setting, knowledge transfer for joint project work is subject to the same industry conditions. Although the participating firms are domiciled in two different countries (Germany and Austria), they are located and headquartered in German-speaking countries, a similar cultural area. One of the long lasting trends in the automotive industry is the development of new approaches in response to cost pressure (e.g. Just-in-time, Kanban, Toyota Production System etc.) in order to compete in such a highly competitive environment. As other industries adapt these strategies and face increasing cost pressure, the automotive

[27] For more details on trends in the automotive industry *see* chapter 5.2

industry is considered a “beacon” industry, introducing methods, tools, and procedures and setting new cross-industry trends.

As described in chapter 2, I selected case studies based on their potential as source for learning (Eisenhardt 1989). Therefore, I chose the projects due to their pioneering efforts in inter-organizational knowledge transfer and their work toward combining the partners’ knowledge assets in order to succeed in the project. The reasons for selecting these cases are multidimensional. All projects illustrate collaborative and inter-organizational PD between two partners. As already mentioned, collaborating in PD in the automotive industry has become an increasingly frequent phenomenon. I selected collaborations from the recent past to be able to see the outcomes of the project (quality issues, call-backs, etc.) and especially the rather long-term knowledge transfer results (learning impact, process changes, etc.). Additionally, and in line with Eisenhardt’s recommendations (1989), I consider companies with different business models and sizes. Magna Steyr, the constant case partner, is relatively small compared to BMW and Mercedes Benz. Table 5.01 provides an overview of the empirical data set. All featured cases describe cooperative PD projects which result in the achievement of a minimum level of success in launching a new product to the market.

At this point a remark on the reciprocal nature of knowledge transfer in the selected cases is necessary. In all three cases knowledge transfer from the OEM to Magna Steyr was necessary to enable the partner to realize the project goals and to develop a car for a ‘foreign’ company. This entailed fully understanding of the characteristics (e.g., vehicle performance, noise, harshness, vibration (NVH), etc.) of a BMW or a Mercedes. What kind of knowledge needs to be transferred in this direction is outlined later in the case studies. Does knowledge transfer necessarily take place in the opposite direction as well and does this mutuality verify the fit of the selected theories deployed for this work? Reciprocal knowledge transfer was confirmed in all three analyzed cases; whether it was anchored in the contract between the partners (e.g., the Mercedes Benz - Magna Steyr project) or the two sides accepted the exchange of knowledge in the joint work both consciously and unconsciously. That mutuality supports the applicability of the selected theoretical framework. However, the knowledge transfer differed in terms of the transferred content and of its intensity in certain phases of the project. As knowledge transfer is required if both partners have different knowledge bases concerning a relevant project task, it will never be a symmetric process with two equally skilled partners. Nevertheless, I integrated this mutuality of the transfer process by approaching it from two perspectives; both partners are the knowledge sender and both are the knowledge receiver in a certain field. They switch roles as they cannot be send-

er and receiver at the same time for the same knowledge asset. Of course, this represents only a slice of reality which must later be considered when analyzing and discussing the research findings and deriving the implications for theory and practice.

In the three cases one of the partners provided the facilities for the joint PD. However, resources from both partners were shipped into the project. As described in more detail (*see* case studies in appendices A-5.1 to A-5.3), all three development projects were executed in Graz, Austria, at the Magna Steyr facility. To have a BMW (X3 or Z4) and a Mercedes Benz (C-, E-, and S-class) developed by Magna Steyr, engineers at the Magna Steyr facilities required the transfer of knowledge. This was also confirmed by the project team members (for a critical examination of knowledge transfer in the selected cases, *see* 'Knowledge transfer - a real-world phenomenon' in chapter 2.2). The cases focused on the product development phase taking place at Magna Steyr's (development) facilities. Nevertheless, the projects had different objectives, as the X3 collaboration included ongoing production at Magna Steyr, the Z4 project involved production at the North American BMW facility in Spartanburg, SC, and the 4-matic collaboration with Mercedes Benz was somewhat in between. In the latter collaboration the E-class 4-matic remained for production purposes at the Magna Steyr plant, whereas the C-class (plant Bremen) and the S-class (plant Sindelfingen) production took place at Mercedes Benz facilities.

Different targets across the analyzed collaborations (development, serial development, and production) draw attention to two important issues to be discussed before entering the case investigation. Firstly, differing collaboration objectives require different types of knowledge to be transferred, especially during the product development stage. For example, the development and ongoing production of a vehicle at the Magna Steyr facility did not require transferring and building in the partner's production-specific needs. Secondly, and related to the first point, the intensity and proximity of the partner teams' work and knowledge exchange varied because of the different objectives. A 'relocation' of the developed vehicle from Magna Steyr for the production phase required closer interaction, e.g., training on the product or coaching sessions during the development process, for a smooth hand-over (Mercedes C- and S-class, and BMW Z4). Deploying the selected case studies therefore requires keeping these different objectives and contents of the collaborations in mind when analyzing the knowledge transfer activities and processes in the PD phase. Thus, the different kinds of knowledge necessary to be transferred and the approaches applied are of special interest.

In order to provide consistent case studies and to avoid confusing repetition, the case study structure prioritizes the project as well as the partners with special regard to DiC.

For the sake of developing a good case study, one which reflects the multi-dimensionality of knowledge transfer, I consciously included the other success factor context domains, namely the receiver, the relationship, the interaction, and the knowledge type, to avoid neglecting important aspects. This in turn prevented me from a too narrow exploration in terms of understanding the whole picture and the underlying mechanism (Hedström & Swedberg 1998) from the sender's perspective.

5.2 Automotive industry trends

To reiterate, the automotive industry was chosen as a representative industry for two reasons. Firstly, it is an industry in which rapid pace is critical. Secondly, the automotive industry accounts for 15% of jobs worldwide and will keep growing in the coming years. This indicates the role and the impact of this industry as well as its representativeness in terms of generalizability for a broad variety of projects. The quickly evolving scientific and competitive base contributes to the dynamic nature of the industry, for which reason it is and has been in a permanent state of evolution and constant change, especially in the last two decades. Overall, one can identify five main trends within the automotive industry relevant from the perspective of this research work (Dannenberg & Kleinhaus 2007):

- A shortening of product life cycles and
- An increase in the number of derivates and launches, demonstrating the tendency toward broader arrays of products. In total, production volume is predicted to increase by approximately 35% (76 million units per year) within the next 8-10 years.

Both trends imply that the resource companies and especially OEMs have to spend on the design, development, engineering, and production of new cars and derivates will dramatically increase.

- Relocation of value creation activities along the value chain from the OEM to 1st-, 2nd-tier, and other suppliers (about 80% in 2015) is a long-term trend that will still continue. This includes the urgent need to develop activities as well as closer collaboration at the value chain interfaces. The relocation of tasks further requires a capability transfer or at least the teaching and development of the supplier into new fields (e.g., purchasing responsibility requires supplier management capabilities). OEMs concentrate more and more on tasks closely related to the car brand itself, such as conceptualization and design, marketing, and sales.

- Increasing competition arising from the East. China-based car manufacturers are increasingly establishing themselves as global players in the automotive market. Supported by a huge home market (app. 1.3 billion inhabitants and just recently about 80 million able to buy a car) Chinese car manufacturers are expanding into firmly settled markets like the US or Europe, siphoning off the market shares from other players. This means that local OEMs have to identify and deploy new ways to stay competitive and use available resources more efficiently.
- Rising innovation pressure, as is the case in other industries. Developments in software, electrical systems, and electronics are opening the way for new technological applications (brake- and steer-by-wire, run flat technology for tires, adaptive safety systems, communication and entertainment systems, etc). Innovations are not limited to the development of software and related hardware; design innovations and new niche car concepts (roadster, SUV, SAV, convertible hard tops, etc.) characterize today's automotive industry. This in turn has a huge impact on the R&D expenditures that companies have to lay out for new innovations.

One possible strategy to challenge these issues is to collaborate along as well as across the value chain and here especially in the PD phase. In this way, the automotive industry is following the general trend toward R&D alliances, as outlined in chapter 1. For example, the total number of existing alliances between the 20 largest Japanese, European, and US auto assemblers increased dramatically in the latter half of the 1980s, from 36 in 1985 to 102 in 1990, and then remained at that elevated level (Heller, Mercer, and Fujimoto 2006).

5.3 Case studies participants

As already mentioned, the case study partners are Magna Steyr, located in Graz (part of the Magna International Corporation), BMW, headquartered in Munich (part of the BMW Group), and Mercedes Benz, headquartered in Stuttgart (part of Daimler AG). Table 5.01 outlines the main characteristics of the three companies.

Table 5.01 - Companies selected for in-depth case studies

Company	Industry	Firm size*	Headquarter	Products and Services	Collaborations…	Business model
Magna Steyr Fahrzeugtechnik AG & Co KG	▪ Automotive industry ▪ Aviation industry	**Magna Steyr Fahrzeugtechnik AG & Co KG** ▪ 11991 employees ▪ 17 locations worldwide ▪ Wholly owned company by Magna Steyr Group **Magna International Inc.** ▪ 17.16 billion €** in sales - 3 billion €** from Complete Vehicle Assembly / 1.44 billion. €** from tooling, engineering, and other ▪ Net income of 375 million €** ▪ 83,300 employees ▪ 235 production sites, 62 product development and engineering center	Oberwaltersdorf, Austria	▪ Cars and Systems ▪ Engineering, Vehicle Assembly, Fuel Systems, Space technologies, and Services related to the other products ▪ (Consulting) Service provider ▪ Production planning, metrology, accredited material testing, homologation, product life cycle management, and risk management	▪ …with OEM's: Audi, BMW, Mini, Chrysler, IVECO, Jeep, Mercedes Benz, Saab, Smart, Stewart & Stevenson, Aston Martin, Rolls-Royce, Bugatti, Bentley, Ferrari, Maserati, Maruti, Tata, SAIC, FAW, Chery, Geely, AvtoVaz, GAZ	▪ 0.5-tier supplier ▪ Capable of designing, developing, and producing own cars (MILA concept car), nevertheless lacking sales and distribution networks ▪ Service provider for OEMs and other suppliers for design, development and engineering and production ▪ Consulting is offered additionally
BMW AG	▪ Automotive industry	**BMW AG** – 76,000 employees ▪ 42 billion € in sales, ▪ 485 million € net income, (1.18 million produced cars) ▪ R&D spending 2.97 billion €, 7.0% R&D quota **BMW Group** (Rolls-Royce, MINI, BMW) ▪ 49 billion € in sales ▪ Net income 2.87 billion € ▪ 1.37 million cars sold ▪ 107,000 employees ▪ 23 production sites, 9 R&D facilities, 9,400 employees ▪ R&D spending 3,208 billion €, 6.5% R&D quota	Munich, Germany	▪ Cars, motor bikes, and bicycles ▪ Financial services ▪ Consulting services ▪ Engine development and production for external customers (Opel, Land Rover, Magirus, Kaeble, Rosenbauer, Morgan Motor Company, and Wiesmann)	▪ …between **BMW AG** and Magna Steyr: BMW X3, X5, Z4, 3series ▪ …between **BMW Group** and Magna Steyr: Mini Cooper, Rolls-Royse	▪ Classical OEM ▪ Strengths in innovation and design ▪ Engine development and design as core competencies

Company	Industry	Firm size*	Headquarter	Products and Services	Collaborations…	Business model
Mercedes Benz Cars	▪ Auto-motive industry	**Mercedes Benz Cars** (Mercedes Benz, Mercedes Benz AMG, Mercedes Benz McLaren. Maybach, and Smart) ▪ 54 billion € in sales ▪ Net income 2,415 billion € (1.25 million cars sold) ▪ 99,343 employees ▪ R&D spending 2,176 billion €, 4.0% R&D quota **Daimler AG** ▪ 151 billion € in sales ▪ Net income 3.23 billion € ▪ 4.75 million cars sold ▪ 271,486 employees (June 2007) ▪ R&D spending 5.3 billion €, 3.5% R&D quota	Stuttgart, Germany	▪ Cars, Trucks, Vans ▪ Financial Services ▪ Consulting Services	▪ ...between **Mercedes Benz Cars** and Magna Steyr: A-, B-, C-, E-, G-, M-, and S-class, Freightliner P-class ▪ …between **Daimler AG** and Magna Steyr: Chrysler Voyager, Chrysler 300, Jeep Grand Cherokee, Jeep Commander, Dodge Caliber	▪ Classical OEM, high-price segment ▪ Technological leader (statement in the annual report)

* Figures based on the 2006 annual reports; except the figures for Daimler AG. Due to the changes in the company these figures are adjusted based on corporate and public sources.
** Figures given in US$ are converted to € with the currency ratio of 1 US$ equals 0.70908 € (http://www.oanda.com/convert/classic - accessed on October 9th 2007).

5.3.1 Magna Steyr Fahrzeugtechnik AG & Co. KG

Magna Steyr Fahrzeugtechnik AG & Co. KG, as part of the Magna International group, is a 0.5-tier supplier[28]. The company exclusively develops and assembles vehicles for and in collaboration with car manufacturers such as BMW, Mercedes Benz, Saab, and Chrysler (for a complete list *see* table. 5.01). Furthermore, the product and service range also includes, e.g., the design and production of fuel systems, the design and development of convertible hard-tops and roofs, and the application of space technologies to the automotive industry. Magna Steyr provides an all around-package from the development to the assembly of cars. Mostly, these cars are niche products (e.g., convertibles, roadsters) and expected to be low-volume projects. OEMs give such projects to Magna Steyr as they are well known in the market for their special capabilities in developing and producing vehicles in small numbers effectively and efficiently. Nevertheless, Magna Steyr is capable of realizing high-volume projects as well, e.g., the BMW X3, which is the topic of one of the following three case studies (Appendix A-5.1). Actually, this project has been relocated to BMW facilities due to, e.g. its enormous market success and the opportunity to full use the existing capacities at the BMW facility.

Being able to design, develop, and of course, to assemble complete vehicles corresponds exactly to the portfolio of an OEM. Introducing the concept car MILA in 2005 seemed to be Magna Steyr's last required step in positioning itself as an OEM. Why then is Magna Steyr not selling its own cars and taking the step toward transforming itself into an OEM? Mainly two reasons seem plausible when looking at the company. First, growing out of Steyr-Daimler-Puch and Magna Europe, Magna Steyr started its business operations in 2001 as a 1st-tier supplier. Building up a strong network of clients, supplier capabilities, and market reputation took a long time as well as enormous resource effort. Magna Steyr's business model has been growing exponentially over the last decade as production capacity has increased by 500% to almost 250,000 units per year. Furthermore, from a strategic point of view, transforming a company into an OEM implies becoming a competitor to its current customers. In consequence, Magna Steyr would have to expend a great deal of effort building up the missing 'OEM' capabilities, and coincidentally, the revenues for running the business as before would disappear. In the second quarter of 2007 Magna International almost acquired the Chrysler unit from DaimlerChrysler AG. Although the Chrysler deal failed at the

[28] For an explanation of this term *see* case study in Appendix A-5.1 – A-5.3.

very last second (Chrysler went to Cerberus), it fit Magna in its position as 0.5-tier perfectly. Being positioned between a classical OEM and a 1st-tier supplier gave rise to the term 0.5-tier supplier.

Along with Magna Steyr Fahrzeugtechnik (vehicle engineering and assembly), the following belong to Magna International: Cosma International (metal body and structural system), Intier Automotive Seating (seating systems), Magna Donnelly (interior and exterior vision systems, window systems, and automotive mirrors), Magna Powertrain (Powertrain), Magna Closures (closures), Decoma International (exterior), Intier Automotive Interiors (interiors), Magna Electronics (electronics), and the Magna Car Top Systems (roof systems). The company therefore covers every aspect necessary to design, develop, and assemble a complete car. This accumulation of different fields of expertise in Magna International has grown over many years. Founded in 1894 and 1899, the three original companies (Josef und Franz Werndl & Comp., Johann Puch - Erste Steiermärkische Fahrrad-Fabriks-Aktiengesellschaft, and Österreichische Daimler-Motoren-Gesellschaft Bierenz, Fischer & Co) provided the foundation for Steyr-Daimler-Puch AG (1934). Taken over by the Canadian auto part giant Magna International in 1998, the company was named Magna Steyr Fahrzeugtechnik in 2001. Today, Magna Steyr employs about 12,000 people in 17 locations throughout the world.

5.3.2 Bayrische Motorenwerke (BMW) AG

BMW is a classic OEM, designing, developing, producing, and selling vehicles (BMW, Mini, Rolls-Roys) and motor bikes. Additionally, the company builds bicycles as well as engines for external customers like Opel, Land Rover, Morgan Motor Company, Wiesmann, among others. Even in the aviation industry, BMW engines are used (Rosenbauer uses BMW engines for the FOX model). In the automotive market, BMW stands for extravagance in design and outstanding engine development. Within the premium car segment, the BMW Group is the market leader in technology and innovations based on externally offered prices in these categories.

The foundation of BMW AG is a story of establishing two independent and still existing players in the automotive industry. Rapp Motorenwerke GmbH, established in 1913, was renamed BMW AG in 1918 after newly named BMW (1917) became a joint stock company. At that time BMW only developed and produced engines for the aviation industry. After the First World War no German-based company was allowed to build airplane engines for a period of five years. Camillio Castiglionim, the main share holder at that time, left BMW and took with him the rights to the name. He then

joined the Bayrische Flugzeugwerke (BFW), founded by Gustav Otto son of the Otto engine inventor Nikolaus Otto[29]. At the moment when Castiglioni joined BFW, BMW AG was officially founded for a second time[30]. This in turn required that the other company known as BMW AG be renamed. First, the company was called Südbremse and later on renamed Knorr-Bremse. Knorr-Bremse is still a successful and globally operating automotive supplier company. Although the corporation known as BMW AG was founded in 1916 or 1922 (depending on the reference), the production of vehicles did not start until 1928, when BMW bought the Fahrzeugfabrik Eisenach. The first BMW car rolled off the production line in 1929 (BMW 3 model).

Today the BMW Group is the third most efficient car manufacturer worldwide, trailing only Porsche (Germany) and Toyota (Japan), with about 6.3% in return on sales (ROS) in 2006. The BMW Group is positioned in the high-class segment of the car market. A continual rise in the number of cars sold over the last five years led to a total of 1.37 million units sold in 2006; BMW AG provided about 1.2 million on its own. Strong growth in sales figures in turn led to capacity restrictions, which opened the opportunity and the need to collaborate with external partners. In fact, both analyzed collaborations between Magna Steyr and BMW were initiated based on internal capacity restrictions. Besides those projects, BMW and Magna Steyr are working together on the 3 series, the Mini, and the Rolls-Royce.

5.3.3 Mercedes Benz Cars

Mercedes Benz is a German car brand belonging to Mercedes Benz Cars (Mercedes Benz, Mercedes Benz AMG, Mercedes Benz McLaren, Maybach, and Smart) of Daimler AG. Besides Mercedes Benz Car, Daimler AG includes Daimler Trucks and the financial service business unit. Founded in 1926, Mercedes Benz resulted from a merger between the Daimler-Motoren-Gesellschaft, founded by Gottfried Daimler, and Benz & Cie, founded by Carl Benz. The new company was named Daimler-Benz AG[31]. Mercedes Benz is well known and the market leader in the high-end (+50% increase in sales compared to 2005) and luxury car segment worldwide.

Having sold about 4.75 million cars in 2006, Daimler AG is one of the biggest car manufacturers throughout the world. Today, 10.6% (about 355,000 units in total) of all

[29] In the BMW symbol one can see the company's origin in the aviation industry. The circle with the alternating white and blue panels stands for two rotator blades (white) in the blue sky.

[30] The time when BFW was founded by Gustav Otto (March 16, 1916) is now BMW's official founding year.

new registrations in the German home market are Mercedes Benz cars. Based on sales figures, Daimler AG was the 6th biggest company in the world in 2005 and number one in Germany at the same time, out-earning second- or lower-ranked companies by more than 42 billion € (Allianz Group in 2nd). Over the last several years, Daimler AG and other OEMs have faced a dramatic increase in product launches. Within the last decade the company has enriched its product range with completely new models and derivates such as the introduction of the A-, B-, C-, M-, and R-class, the McLaren SLR, and the new SL. In the US market, for example, representative of the other developed industry markets, Daimler AG launched three new cars in 2002, 30 in 2005, and in 2007 this number is expected to rise to 41 new product launches. Like BMW, Mercedes Benz faces resource and capacity shortages. One possible way to overcome these barriers in order to keep up with the increase in product launches as well as the growth of the car market itself is to collaborate with external partners.

Besides having the same roots (Gottfried-Daimler-Motorengesellschaft), Mercedes Benz and Magna Steyr have a historical relationship that goes back to 1979, when Daimler-Benz launched production of the G-class, which has been manufactured in Graz for almost 30 years now[32]. Another milestone in this relationship was the acquisition of the Eurostar plant from Mercedes Benz by Magna Steyr in 2002. Nowadays, both companies are working together on a number of different projects in different fields such as development (C-, E-, and S-class 4-matic, and the Smart MCC), complete vehicle production (E-, G-, and M-class), as well as module and component production (e.g., E- and S-class, steel fuel systems).

5.4 Summary

Choosing the outlined case study design provides the opportunity to learn about knowledge transfer and especially knowledge sender capabilities in a detailed way. Analyzing collaborations from the automotive industry in German-speaking regions and between partners with a history of working together, offers the potential to identify and analyze knowledge transfer mechanisms and the underlying sender capabilities in a clear way. Both OEM partners from the cases have had similar experiences in working with Magna Steyr on a joint project, although the relationship between Magna Steyr and Mercedes Benz is stronger in a formal manner due to historical relationships. In all

[32] By the time of this collaboration Mercedes Benz and the Mercedes Benz Car Group was part of the Daimler-Chrysler company. Within this company other collaborations should be mentioned, namely Chrysler Voyager, Chrysler 3000, Jeep Grand Cherokee, Jeep Commander, and Dodge Caliber

three collaborations the two partners work together on joint product development. Nevertheless, the projects differ in terms of the overall setting as one case project envisions development and ongoing production (E-83) as the focal point of the collaboration, while another focuses solely on the product development phase (E-86).

The topic which comes under scrutiny in the case studies is whether inter-relatedness and the similar project settings provide comparable or varying results in the knowledge transfer outcomes. For learning purposes (Eisenhardt 1989), the best case scenario is when the analyzed projects vary in terms of project and knowledge transfer outcomes. Then the subsequent cross-case analysis can reveal the different knowledge transfer mechanisms and the DiC of the partners resulting in different transfer outcomes.

Chapter 6 -

Cross-case analysis and theory building

This chapter aggregates the commonalities and differences among the presented disseminative capabilities from the analyzed case studies and refines the working propositions outlined in chapter 4. In the following section, I challenge the ideas underlying the working propositions and investigate their value for explaining the empirical observations (6.1). This leads to the derivation of the concluding hypothesis of this thesis. Furthermore, based on these findings, I present the final definition of disseminative capabilities as it emerges from the data analysis. As the case studies (*see* Appendix A-5.1-A-5.3) are structured according to the working propositions, this chapter follows the newly designed research model as presented in Figure 6.09 (6.2.). The research findings and hypothesis also serve as the basis for further discussions, including the extension of the existing and addressed theory and the derivation of managerial recommendations in chapter 7.

Table 6.01 summarizes the main characteristics of the case study settings and highlights important aspects from the research perspective.

Table 6.01 - Characteristics of the analyzed case study PD collaborations

	Magna Steyr/ BMW (BMW X3)	**Magna Steyr/ BMW (BMW *Z4* coupé)**	**Magna Steyr/ Mercedes Benz (E-class 4-matic)**
Collaboration	▪ Magna Steyr contractor ▪ First collaboration for a complete car development and ongoing production ▪ Long-term relationship	▪ Magna Steyr contractor ▪ Second complete development, first time Magna Steyr managed supplier and purchasing processes ▪ Long-term relationship	▪ Magna Steyr contractor ▪ Second complete vehicle development project with partial, ongoing production ▪ Long-term relationship (since the Steyr-Daimler-Puch times)
Phase of the collaboration in the development cycle	▪ Serial development and ongoing production	▪ Partly conceptual phase, and serial development	▪ Serial development and divided production (E-class Magna Steyr (Graz), C-class Mercedes Benz (Bremen), and S-class Mercedes Benz (Stuttgart)
Exchanged knowledge	▪ System-specific ▪ Process-specific ▪ Product specific ▪ Organization-specific ▪ Business metrics	▪ Process-specific ▪ Product-specific ▪ Production-specific ▪ Organization-specific ▪ Business metrics	▪ Process-specific ▪ Product-specific ▪ Production-specific ▪ Business metrics

	Magna Steyr/ BMW (BMW X3)	Magna Steyr/ BMW (BMW Z4 coupé)	Magna Steyr/ Mercedes Benz (E-class 4-matic)
Priority of knowledge transfer* (Magna Steyr's view/ view of the partner OEM)	▪ Very high/Very high	▪ High/Very high	▪ High/Medium or Low

All three companies conclude that the success of collaborative PD was influenced by the knowledge transfer performance. Both OEMs recognized the necessity to provide Magna Steyr knowledge to develop a car. In particular, they had to ensure the provision of all required know-how (system, product, process knowledge etc.) and support to turn the project into a success. The pressure to succeed was high since BMW as well as Mercedes Benz have direct market access, and the reputation of a collaboratively developed and produced car would rest only with the OEM. Nevertheless, both companies followed different approaches to realizing a knowledge transfer process in order to enable Magna Steyr to develop and produce cars in collaboration with them. The different approaches are clearly reflected in the priority OEMs give to knowledge transfer.

The case studies indicate that the knowledge sender deploys different approaches in different settings. This in turn leads to different degrees of knowledge transfer success, enabling one to draw conclusions from those performance differences. As the knowledge sender and her transfer capabilities are the object of interest in this study, the following section (cross-) analyzes the differences and commonalities among the capabilities in the three different cases. The goal is to identify the set of capabilities impacting the knowledge transfer from the sender's perspective and thereby to shape the profile of the successful knowledge sender. This profile consists of hypotheses derived after the cross-case discussion and represents the emerging theory of disseminative capabilities. For each relevant factor the following questions are answered and simultaneously serve as the structure for this chapter:

- What is the *relationship between* disseminative capabilities and knowledge transfer success?
- What underlies and shapes the *disseminative capability*?
- Does the empirical data support the working propositions? *Hypotheses* for the DiC and their relation to the transfer process are shaped.

6.1 The set of knowledge sender capabilities

The capabilities and the concluding hypotheses are structured according to the designed research framework at the end of this chapter (*see* Figure 6.09). Derived hypotheses represent the basis for the newly emerging theory of disseminative capabilities.
The objective of this chapter is to challenge the empirical research findings and the working propositions derived in chapter 4. In chapter 4 working propositions were grouped into initial DiC (knowledge de-contextualization, encoding, communication approach design, and effective communicating), reflective DiC (build up and utilize relational capital, select relevant knowledge, and support the knowledge application), and the moderating capability (consider and utilize feedback). Along the case study investigations it became clear that this grouping was no longer stable and the dimensions of DiC were not complete, e.g., initial DiC already required the interaction of both partners, the chronological order of the working propositions and the DiC was not found in practice, relational capital played a more central role in practice than was assumed in the working propositions, being a valuable knowledge source turned out to be an essential DiC, and considering and utilizing feedback did not prove its moderating character for all other capabilities. Taking this into account the new grouping order now features the following disseminative capabilities and simultaneously serves as the guideline through chapter 6:

- The valuable knowledge sender (*see* chapter 6.1.1).
- Selecting knowledge (*see* chapter 6.1.2).
- De-contextualizing knowledge (*see* chapter 6.1.3).
- Encoding knowledge (*see* chapter 6.1.4).
- Designing the transfer approach (*see* chapter 6.1.5).
- The knowledge application support (*see* chapter 6.1.6).
- Relational capital (*see* chapter 6.1.7).
- Considering and utilizing feedback (*see* chapter 6.1.8).

6.1.1 The valuable knowledge sender

In the case study investigations, participants outlined the impact of the trustworthiness and reliability of the knowledge sender on the knowledge transfer success. This was indicated in the case studies in the section introducing the partners' knowledge bases. Although this knowledge sender property was not included in a single working proposition, the case studies revealed that proactive knowledge interpenetration and frequent

knowledge utilization impacted development into a trustworthy and reliable knowledge sender. Therefore, the activities and the underlying capabilities supporting the trustworthiness and reliability effect are of interest and included to launch knowledge transfer activities.

Impact on transfer success

Looking at the foundation of all three collaborations, one can see that the search for a suitable partner motivated OEMs to work with Magna Steyr on joint PD. Independent from the reasons for establishing the joint development with Magna Steyr, the company was chosen based on its capabilities in fields relevant to the project's success. For example, Mercedes Benz chose Magna Steyr because they sought to have the best available 4-matic technology integrated into their latest S-, E-, and C-class to continue the success story of the second 4-matic generation. BMW founded the Z4 coupé collaboration due to internal capacity restrictions. They searched for a company well-known for lean and flexible niche car production in order to realize an incredibly tight time line and to turn an internal idea into a project and market success.
In other words, OEMs look for a partner able to provide knowledge assets that they lack themselves and who is capable of fulfilling the high expectations engendered by the project. Therefore, being considered a valuable partner, i.e., knowledgeable and reliable concerning the ongoing project tasks was a success driver for becoming the collaborating partner. This is perfectly in line with scholars who have shown the importance of trustworthiness and reliability as characteristics of the successful knowledge sender (Szulanski 1996; 2000; Wasko *et al.* 2000; Cabrera 2003; Szulanski *et al.* 2004). In all three cases, trustworthiness and reliability are strongly related to the understanding of knowledge. The knowledgeable sender who understands knowledge is probably better at performing the transfer of her knowledge. Furthermore, a better and deeper understanding increases the quality of the transferred knowledge and hence the quality and the success of knowledge transfer (Mietzel 2001).
A better understanding of transfer knowledge within the sender served as the starting point to impact transfer success in different ways. A deeper understanding, for example, helped the sender to react upon call-backs, to solve problems in understanding, or simply to provide the partner high-quality knowledge in terms of comprehensibility and content. Working on the BMW Z4 convertible gave BMW an edge in knowledge concerning all aspects of that product. This depth and breadth of knowledge helped Magna Steyr to understand the know-how transferred from BMW more easily. Facing

changes of 15% in the entire vehicle opened up the possibility of applying the knowledge and experience already gained to a great extent.

The transfer of knowledge related to the virtual development technique from Magna Steyr to BMW worked out in the opposite manner. The field was relatively new to Magna Steyr in the Z4 coupé project. The transfer in this field was accompanied by difficulties in understanding or even providing additional continuative knowledge. The transfer to BMW and the enabling of understanding turned out to be very resource-intensive. It cost Magna Steyr enormous effort, e.g., giving intense presentations, to build up BMW's confidence in their reliability concerning this expertise. Over time they successfully deployed the virtual development technique in the project work, indicating that internal learning had given them the ability to transfer knowledge more easily.

In consequence, a deep understanding impacted the perceived credibility of the knowledge source, one of the main decision parameters for selecting the collaborating partner, as the knowledge sender supplied proven knowledge to her receiver (Davenport *et al.* 1998; Fiet 2000). This is in line with findings by von Krogh *et al.* (2000) indicating that the successful facilitator of knowledge is technically well-versed, i.e., being knowledgeable in the given field in order to be able to provide assistance and in-depth knowledge on technical details, shift scales, or to be able to take a generalist's view on that particle knowledge. A more credible sender is considered to have greater impact on the receiver and his behavior.

Being able to provide the receiver know-how that is fully understood and proven helps to focus the transfer because the sender is already aware of potential dangers and pitfalls and knows what knowledge is necessary to understand it. Referring to the BMW Z4 coupé project collaboration, BMW already knew which problems would occur and adjusted the knowledge transfer by deploying insights from the Z4 convertible projects. That helped Magna Steyr to prevent certain mistakes and re-work issues from arising.

It appears that gaining the reputation and status of a valuable sender follows a distinctive process. Starting from a complete understanding based on a full interpenetration of transfer knowledge, the sender is able to improve her own knowledge-sending process and thereby the success of the receiver's knowledge application. Application success indeed helped to build up reputation as a valuable knowledge source first within the receiver's organization. As a result, the sender built up a market reputation that reflected the positive experiences of receiving partners. Apparently, the key to success in the analyzed collaborations was the intensity as well as variety of applications and

the resulting degree of transfer knowledge interpenetration. High market reputation itself enabled more frequent knowledge application, which led to a deeper interpenetration of this know-how and additional development of related expertise. An intensive application, as in the case of BMW's PD process or Magna Steyr's expertise in the all-wheel drive technology over the last decades, helped to increase internal understanding and success in transferring this know-how to the partner in a demonstrable way.

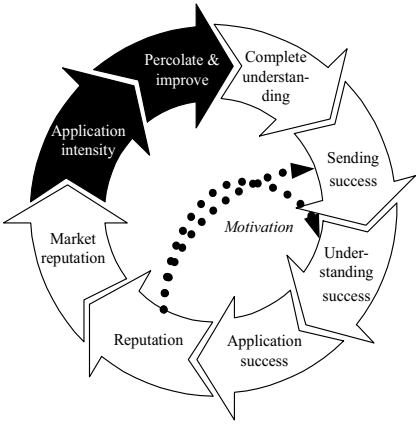


Figure 6.01 - Becoming a trustworthy and reliable knowledge sender - empowering cycle

Project team members from BMW, Mercedes Benz, and Magna Steyr confirmed the development steps in the process toward a valuable knowledge sender as outlined in Figure 6.01. This self-empowering circle can explain a positive empowering result as well as possible negative outcomes. A lack of complete understanding of transfer knowledge encumbers understanding within the knowledge receiver, as Mercedes Benz acknowledged from the E-class 4-matic series project. In that project, Mercedes Benz traced a lack of understanding of the transferred knowledge from Magna Steyr back to the incomplete understanding on the partner's side. Following the circle, the knowledge application success was insufficient, and Mercedes Benz, the knowledge receiver, perceived the partner's level of trustworthiness and reliability as a knowledge sender to be unsatisfactory. Referring to another example from this collaboration, the self-empowering circle also explains why the process of problem solving was not satisfactory. Magna Steyr, discovering problems during the development phase, did not interpenetrate occurring problems before monitoring them. Therefore, Mercedes Benz was not able to understand the core of the problem, hence not able to explain it, and

the problem-solving process that followed became inefficient and resource intensive. Magna Steyr struggled in terms of interpenetrating problems before sending them to the partner with respect to identifying the cause-solution relation underlying the problems.

The self-empowering circle also features an internal loop called motivation. As the case studies conducted revealed, the motivation of the knowledge receiver impacted the transfer of knowledge as well. Related to the not-invented-here syndrome (Allen 1977), especially the operating departments of BMW and Mercedes Benz reacted with skepticism to applying knowledge from an external partner, in this case Magna Steyr. In the course of the joint work, the operating departments became convinced of the quality of Magna Steyr's know-how from application successes they had experienced up to that point. The growth in reputation as a trustworthy and reliable knowledge sender increased the partner's willingness and motivation to apply the sender's knowledge, thereby strengthening the success of sending as well as understanding know-how.

This was observable within the cases as BMW's operating departments were skeptical of the partner's know-how in terms of the virtual development technique and the exponential reduction in development time for the Z4 coupé project. Towards the end of this project, BMW sent employees to learn exactly those approaches, methods, and tools from Magna Steyr. In between the two analyzed BMW - Magna Steyr collaborations, confidence in the partner's knowledge base and reliability as well as the acceptance of transferred knowledge increased. For the BMW X3 project Magna Steyr had to convince BMW in intense presentations and documentations of their ability to realize the project. In the Z4 coupé project collaboration that level of effort was much lower. Referring to the analyzed Mercedes Benz collaboration, one can clearly identify the same tendencies. Both the experiences Mercedes Benz had in the first generation 4-matic project on its own and the success of the collaborative second generation 4-matic project in collaboration with Magna Steyr convinced Mercedes Benz of Magna Steyr's value as a PD partner and knowledgeable expert in the 4-wheel drive technology. Based on that confidence level, they established the analyzed collaboration with Magna Steyr to continue the success story of the 4-matic family.

With a sound reputation earned over a large number of collaborative and non-collaborative projects, Magna Steyr, BMW, and Mercedes Benz, developed their market reputations in specific capabilities, e.g., 4-wheel drive technology for Magna Steyr. Especially in Magna Steyr's case, reputation helped them to enter into even more collaborative projects to leverage these capabilities and thereby to work on and deepen

underlying know-how. It appeared to be the same case for the OEMs, as they constantly deepen their expertise in core business fields.

Disseminative capability

The case study investigations show that a valuable knowledge sender increases the success of the knowledge transfer. However, this relationship was already the topic of numerous studies showing the same results (Szulanski 1996; 2000; Wasko *et al.* 2000; Cabrera 2003; Szulanski *et al.* 2004). Marked in black in Figure 6.01, the linchpin for the knowledge sender is knowledge application (Teece 1977; Szulanski *et al.* 2004) and an ongoing interpenetration of transfer knowledge (Zander & Kogut 1994; von Krogh *et al.* 2000).

A closer look at the knowledge application revealed three influencing factors impacting deeper understanding and the development toward a valuable knowledge sender in a specific field. How deeply knowledge is understood depends on the intensity of its former use and the spectrum of applications the sender has made in the past (Teece 1977). Frequency and variation of knowledge utilization in the past increase the depth of understanding (Szulanski *et al.* 2004) in the presence of a capacity for self-reflection. Referring to variety, Magna Steyr deployed their 4-wheel technology capabilities in off-road vehicles as well as luxury cars and thereby discovered constraints and advantages in deploying this technology in changing settings. The frequency of knowledge application helped Magna Steyr to interpenetrate the technology over and over again. Starting with the first generation of the G-class, Magna Steyr applied the technology in various projects including the Audi all-road Quattro, Golf country, or Mercedes Benz 4-matic. This allowed them to constantly use their know-how and to further deepen their expertise in this field.

Additionally, along with the constant application and the broad spectrum of projects, Magna Steyr developed their knowledge further. By reflecting on the knowledge assets, they identified weaknesses and room for improvement over the previous 30 years, and the company experienced continuous improvement of their technology and thereby a deepening of the underlying knowledge. To refer to another example, BMW's PD process has developed generically over the last several decades. Staying with their individual approach and applying it over and over again helped BMW to interpenetrate it completely, to improve it continuously, and to document it in a detailed way. Over the years such intense process application has built BMW's (market) reputation for executing one of the best documented and integrated PD process throughout the automotive industry.

Being a valuable knowledge sender and being considered as one appear to be two different things. Latter requires convincing the partner by repeatedly providing high-quality knowledge that has been proven over and over again. One approach deployed by Magna Steyr was to outline process approaches, methods or tools for the PD phase in intense presentations or by organizing workshops which brought together the employees involved. The case was different for the OEMs. In general, they did not face the need to prove their knowledge. Notwithstanding its role as the OEM in the BMW X3 and the Z4 coupé project collaborations, BMW itself initiated workshops and seminars to make its know-how and existing expertise clear to Magna Steyr. Mercedes Benz project team members, especially the operating departments, invoked their elevated status as the OEM, which to them implied no need to prove their expertise. Knowledge transfer performance suffered from that attitude.
Starting from the self-empowering circle, two disseminative capabilities enabling development towards a valuable knowledge sender can be derived, as outlined in Figure 6.02.

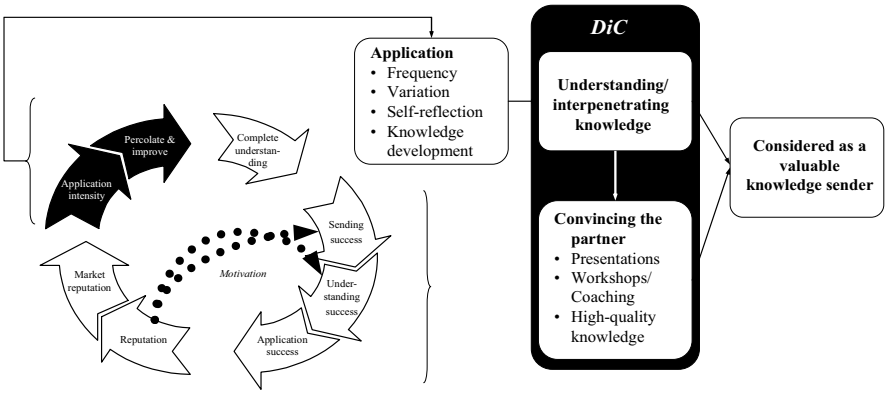


Figure 6.02 - Disseminative capabilities to become a valuable knowledge sender

Upfront presentations and outlining knowledge, as seen in the analyzed BMW and Magna Steyr collaborations, helped to shape a picture of the knowledge bases. Nevertheless, the knowledge sender proved her status as a valuable sender by repeatedly providing only relevant, high-quality know-how. Magna Steyr did not want to limit its efforts for the initiation phases and the kick-off meeting in particular. Instead, the company introduced some internal rules for knowledge transfer as seen in all analyzed case studies. Before transferring knowledge to a partner, they interpenetrated it again

to identify lacks or weaknesses in understanding, thereby initiating a process of reflection on internal knowledge. This helped Magna Steyr to maintain its reputation and the confidence of its partners. Based on that process, Magna Steyr launched a second knowledge transfer guideline. They tried to exclude knowledge not fully understood from transfer until internal saturation was completed. Furthermore, excluding such knowledge from transfer helped to cut down transfer failures in all analyzed projects. Additionally, it gave the knowledge sender the chance to interpenetrate it without causing confusion or problems in understanding within the receiver.
BMW deployed another interesting approach that underlined the impact of a reliable and trustworthy knowledge sender by introducing the technical networker in the BMW Z4 coupé and the X3 project. This concept was launched in the X3 project and became an integral part of the organizational setting in collaborative projects from then on. Mercedes Benz abolished the integration of such an approach. The guiding idea about this organizational function was to provide a deep technical understanding from its training and working background and to bring together knowledge carriers and potential receivers. In the BMW Z4 coupé project the technical networker had in-depth knowledge about the Z4 roadster production and knew the product from the inside-out. The long years of experience from the technical side (being a technician by training) as well as from the product side (involved in the Z4 roadster team) made clear that the value of a knowledge source comes from experience in related fields, the degree of understanding, and the ability to convince the partner of being knowledgeable.

Shaping the hypothesis

To gain a deep understanding of the transfer knowledge, the sender increases the intensity and the variation of knowledge applications. A fully understanding of the transfer knowledge positively impacts the success of the knowledge transfer. Evidences from the analyzed cases shows that overall there are various levers that impact the understanding of knowledge. Furthermore, it turned out that fully understanding knowledge before sending it is just as important as the continuous development towards a valuable knowledge source. This capability was not included within the set of the working propositions. Nevertheless, it turned out that being considered a valuable knowledge sender has a high impact on the knowledge transfer performance. Therefore, the capability to become this perceived valuable knowledge sender is added to the dimensions of disseminative capabilities. This adds another important perspective to the concept of disseminative capabilities by adding the need to convince the partner

of one's status as a valuable knowledge sender. Utilizing these two aspects, I derive the first hypothesis:

Hypothesis H[1] *Being considered a valuable knowledge sender positively impacts on inter-organizational knowledge transfer success.*

Researchers outline the process of knowledge transfer differently (e.g. Szulanski 1996; Hansen 1999; Szulanski 2000; Kwan *et al.* 2006) as they divide it into more or less distinctive phases. Additionally, they label phases individually containing similar or even congruent activities. This is especially the case for the early knowledge transfer process phases, where knowledge selection, knowledge de-contextualizing, and knowledge encoding takes place. Figure 6.03 delineates and separates these three phases as it they are applied for this research study.

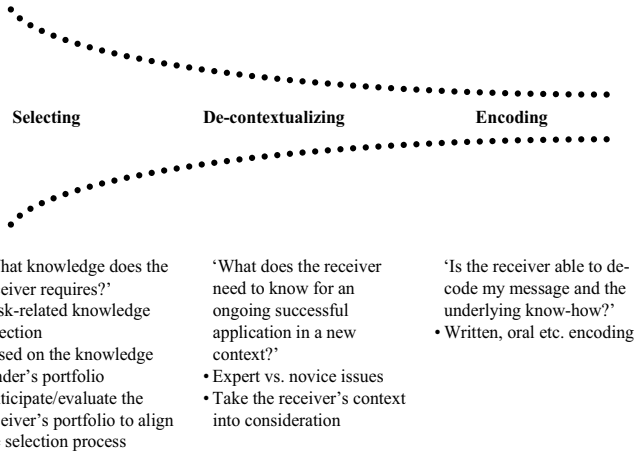


Figure 6.03 - Selecting - de-contextualizing - encoding from the sender's perspective

Within the set of working propositions the selection process was included in the reflective disseminative capabilities group. As mentioned before, this grouping found no support in empirical observations and turned out to represent the first task the knowledge sender performs when initiating the transfer process.

6.1.2 Knowledge selection

As delineated in Figure 6.03, one can see that the knowledge transfer process begins with the selection of transfer knowledge. This step sets the basis for ongoing de-contextualization, where the issue of detaching knowledge from its embeddedness arises. To start from the beginning, before launching any other activities, the knowledge sender has to select the knowledge assets relevant for current or ongoing tasks along the project as outlined in working proposition P^6.

Impact on transfer success

In order to avoid a knowledge overload or unconscious knowledge limitations potentially resulting in comprehension problems, the knowledge sender is in charge of selecting transfer knowledge. Good knowledge selection therefore takes the current task, the project setting, the partners involved, among other factors, into consideration to adjust the knowledge to be transferred (von Krogh *et al.* 2000). Moreover, adequate knowledge selection addresses the efficiency as well as the effectiveness of the transfer process. Efficiency considerations focus on the effort the sender expends to enable knowledge application within the receiver. The case of Mercedes Benz and Magna Steyr collaborating on the 4-matic series project underlined that one has to take into account that a reduction in individual transfer effort is contra-productive for an overall efficient know-how transfer. Instead of reducing the transfer effort for the project, i.e. increasing the transfer efficiency for both partners, Mercedes Benz increased its efficiency, which accounted for Magna Steyr's effort to understand and apply transferred knowledge. They did so by limiting the transfer activities to basically providing Magna Steyr access to data bases. When problems arose, they supported the partner, even though the effort Magna Steyr had already expended up to the point of support was pointless.

Although the analyzed collaborations were not established with the aim to transfer knowledge, all three projects required the combination of partners' capabilities to achieve the goals set. To enable this combination of capabilities, e.g., deploying the 4-wheel drive technology in a luxury car, as was the case in the Mercedes Benz – Magna Steyr 4-matic series collaboration, partners clearly had to display their strengths and the project requirements. Based on such a picturing approach, project tasks could be compartmentalized, as seen in the BMW X3 project. This in turn enabled the project partners to leverage the best of both 'worlds' and realize the best possible results. However, the OEMs under study tended to rely on their own approaches, methods, and

tools. This resulted in an unrealized potential to improve knowledge transfer as well as to advance the project itself. Power and strategic issues prevented an optimal combination of strengths based on the current project tasks. Nevertheless, in fields where these issues did not infer a task-related combination, knowledge selection relying on an accurate picture of the partner's knowledge bases enabled a more focused transfer. Required assets then were able to be transferred according to identified gaps in the partner's knowledge base. That in turn reduced the effort required from both sides and allowed a fitted application within the receiver's portfolio. For example, Mercedes Benz had already launched two generations of 4-matic vehicles (the first generation on their own, and the second generation jointly with Magna Steyr) and had a decent understanding of the technology as well as a sense of where problems might reside. Anticipating that existing knowledge, Magna Steyr easily transferred missing aspects, thereby enabling understanding.
Additionally, for the knowledge transfer to succeed the sender ensured that she addressed the right people with the right knowledge for a specific task at a given time and in the most appropriate form.

Disseminative capability

To select knowledge as effectively as possible, the sender needs to appraise the receiver's knowledge base, identify the strengths and the gaps in the receiver's portfolio, evaluate the value of the transfer knowledge for the receiver (Martin *et al.* 2002, 2003), and consequently, align transfer activities (von Krogh *et al.* 2000). Thus, the question for the collaborating partners is how to execute the presentation of the knowledge portfolios and the project tasks, especially from the sender.
In all three collaborations the idea of combining knowledge bases according to existing capabilities was present. Nevertheless, the approaches deployed differed between the partner constellations. Magna Steyr and BMW started the BMW X3 project with a kick-off meeting outlining strengths and weaknesses in the capabilities according to the given tasks in the project. Failing to see the benefits of such an approach, Mercedes Benz rejected that procedure. In the BMW X3 project this strengths-and-weakness evaluation had started even earlier, namely, during the offering phase, when Magna Steyr submitted its project proposal to BMW. Based on that, partners established a basic concept of a portfolio outlining strengths and weaknesses. With that approach, project teams enabled their counterpart to picture gaps in the knowledge base, which in turn allowed the sender to focus on knowledge transfer activities according to missing assets. Observations in the two BMW - Magna Steyr cases are in line with

Grant and Baden-Fuller (2004), who identified an evaluation of the receiver's portfolio as one of the two steps for transferring knowledge. Joint problem-oriented work, milestone meetings, and simple discussions served as instruments to evaluate the partner's base as well. In the second step, knowledge assets were investigated as to whether they were worth transferring with regard to the current project task (Martin *et al.* 2002; Carlile *et al.* 2003; Martin *et al.* 2003).

Excursion - the knowledge portfolio idea

According to Grant and Baden-Fuller (2004) and as outlined in Figure 6.04, every company has knowledge assets that are fully deployed in organizational products or processes. These core capabilities are (1) for example, for Mercedes Benz, the building of luxury cars, for BMW, the designing of sport vehicles, and Magna Steyr's 4-wheel drive technology. As capabilities develop and change or new technologies emerge, a mismatch between the exiting knowledge base and that required for certain products, processes, or technologies arises. In these cases companies can choose either to develop missing capabilities internally or collaborate with external partners to close the existing knowledge gaps (2): For example, knowledge Mercedes Benz lacked regarding 4-wheel drive technology or that Magna Steyr was able to develop fuel engines but nevertheless had problems developing a diesel particle filter engine. On the other hand, changes in technology and products leave knowledge assets within the company undeployed (3). In these cases the question is either to unlearn or to leverage these assets outside the company in collaborations, by engaging in out-licensing, or by selling patents. Both fields (un-deployed and missing knowledge assets) represent areas for collaboration. Another important insight from the portfolio idea utilized in the case studies was the display of strengths and weaknesses in the organizational knowledge portfolio.

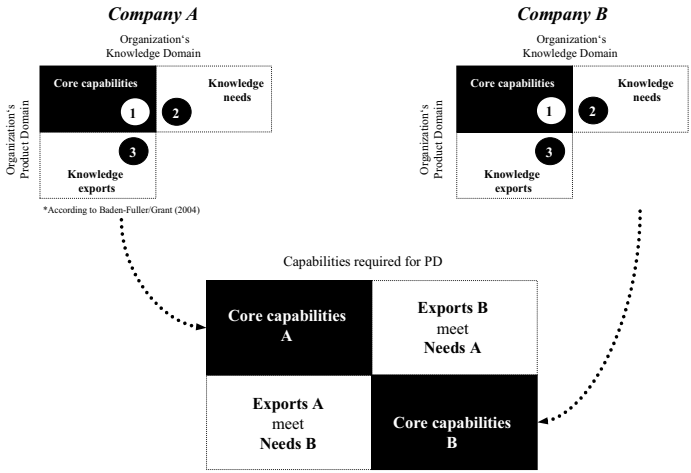


Figure 6.04 - Combination of two companies' knowledge portfolios

In the analyzed projects, there were tendencies toward partners combining their portfolios in the sense that the missing knowledge assets of one partner were provided by the partner. However, partners maintained their core capabilities. In fields where one of the partners had more knowledge than his collaboration partner and capabilities needed to be combined for the joint PD, the required knowledge was provided and needs were met.

Referring again to the BMW - Magna Steyr collaborations, we see two other approaches to evaluating the partner's knowledge base and to aligning transfer activities. First, in the BMW X3 project, the knowledge portfolio idea developed into a formal document ('Leistungsschnittstellenvereinbarungen' (LSV)) portraying knowledge assets, their carriers, and the project plan, including all tasks along the project timeline. This approach was derived from a project plan in the course of the proposal and kick-off phase of the project. Afterwards, the document was extended by adding the knowledge transfer perspective regarding what knowledge was required, who could provide it, and when the receiver needed it. Subsequently, BMW experts revised the documents before deploying them in the project work. The LSV allowed BMW and Magna Steyr to see which expertise was required during the different project phases to realize the given tasks and where that knowledge resides within the partner. Based on the picture derived, knowledge transfer was more focused. Within the BMW Z4 coupé

project this instrument helped to increase the structure of knowledge transfer and was a critical element in this outstanding project's success.

The second approach deployed to relate both portfolios and to combine the knowledge bases of Magna Steyr and BMW was the technical facilitator, as seen in the X3 as well as the Z4 coupé project. Actually, Mercedes Benz intended to introduce such a position; however, the company later rejected it for efficiency reasons. This organizational role had a technical background to provide knowledge itself and to relate knowledge carriers and receivers within both partner companies.

Although the knowledge portfolio idea was a step toward an efficient and effective knowledge transfer, this approach showed serious limitations. First, creating this picture of the internal knowledge bases for the knowledge portfolio approach represented effort. Mercedes Benz did not see any benefit related to this idea and thus never displayed its own portfolio. Additionally, they were not able to picture what knowledge resided within the organization. Moreover, an evaluation of the partner's knowledge base relied mainly on the partner's own description. Inaccurate self-evaluation or simply wrong statements caused inefficiencies. Wrongly adjusted transfer knowledge impeded understanding within the receiver due to parts missing from his own portfolio. The effort saved by conducting an exact adjustment of transfer knowledge to the receiver's knowledge base resulted in additional effort to resolve the arising problems in understanding due to missing or left out know-how.

For example, in the 4-matic project Magna Steyr was supposed to develop and assemble a particle filter diesel engine version but did not have the required capabilities. When concretizing engine requirements and narrowing down the specifications for this derivate, Magna Steyr did not understand the know-how. Based on Magna Steyr's own judgment that it was capable of developing and producing the derivate, Mercedes Benz transferred the knowledge required to develop the engine. Due to a high level of detail of transfer knowledge and a lack of knowledge in that field, Magna Steyr team members experienced difficulty in understanding the transferred knowledge. Hence, Mercedes Benz re-integrated this part of the project. Inaccurate statements about the company's own portfolio had a negative impact on the knowledge transfer, as did mistaken portfolio expectations. In the same collaboration Mercedes Benz anticipated existing knowledge within Magna Steyr based on the previous 4-matic collaboration. Adjusted knowledge transfer then resulted in similar trouble, as employees had changed positions or simply lost know-how. To make matters worse, at some point, all three case study partners discovered a problem with basing their transfer adjustments on their own knowledge portfolios. This caused results similar to those arising from adjusting

knowledge transfer to mistaken expectations or inaccurate self-estimations about the actual knowledge base.

Shaping the hypothesis

From the outlined case studies and the impact of a good knowledge selection process on knowledge transfer success, there arose several issues the knowledge sender has to take care of. First of all, expending effort on the knowledge selection process helps to increase success for both partners. Striving for a one-partner effort optimization results in a decrease in transfer success for the whole collaboration, as seen in the analyzed Mercedes Benz - Magna Steyr collaboration. Such effort might involve evaluating one's own knowledge portfolio to identify strengths and weaknesses as well as to enable the partner to utilize the information for knowledge transfer selection. In the projects under consideration, this resulted in a beneficial situation for both sides and an increase in transfer success; this was particularly evident in the two BMW - Magna Steyr collaborations. The internal portfolio evaluation was the sufficient condition to increase knowledge transfer efficiency and effectiveness. Nevertheless, the sender's sphere of responsibility also includes the picturing of the partner's knowledge base concerning knowledge requirements that emerge. Knowledge transfer performance is positively impacted by the anticipation of the partner's existing and related know-how based on the knowledge portfolio concept combined with the deconstruction of imminent project tasks from a knowledge demand perspective. These findings are in line with working proposition P^6 and findings by Martin and Salomon (2002; Martin *et al.* 2003), and von Krogh et al. (2000) underlining the need to evaluate the partner's portfolio and to adjust transfer activities accordingly.

Nevertheless, at this point and based on the case study insights, the proposition of *selecting the relevant transfer knowledge* needs to be adjusted. Overall, the knowledge selection process appears as an orchestration of knowledge needs, existing knowledge bases and capabilities, the deconstructed project tasks, and the project time line. Therefore, I state:

Hypothesis H^2 *The success of inter-organizational knowledge transfer is positively related to the knowledge selection, that is, the ability of the knowledge sender to relate knowledge requirements and the receiver's existing capabilities.*

6.1.3 Knowledge de-contextualization

As knowledge arises and develops in changing settings, it has, on the one hand, to be detached from its contextual background for transfer purposes. On the other hand, the receiver desires contextual knowledge in order to understand the transferred knowledge fully and comprehend the boundary conditions of the ongoing knowledge application. Addressing this issue of detaching knowledge, working proposition P^1 related the ability of the sender to de-contextualize knowledge to a more successful inter-organizational knowledge transfer.

Impact on transfer success

Knowledge is of a context-bound nature and highly embedded (Granovetter 1985, 1992; Cummings *et al.* 2003) in, e.g., organizational structures, routines, processes, etc. Its value lies in the combination of both. Lacking the knowledge context is almost like lacking the application manual for putting the know-how to work. For transfer purposes knowledge needs to be de-contextualized, in other words, detached from its environment. Non-de-contextualizing would equal the transfer of the whole organization, including the personal experiences of all team members and other employees involved (e.g., operating departments), which would increase the transfer efforts to an unaffordable level. To enable understanding as complete as the knowledge sender's, both parties have to experience the same knowledge applications along the knowledge development path. As that is an impossible as well as unnecessary step and in order to realize the combination of both partners' capabilities, the knowledge sender is in charge of de-contextualizing knowledge for transfer reasons (Shannon *et al.* 1949; Cummings *et al.* 2003). Most contextual knowledge is of a tacit nature and therefore difficult to transfer.

What happened in the analyzed cases when contextual knowledge was not present in the transfer, i.e. the sender detached the transfer knowledge to an inappropriate degree for the receiver - whether abstracting too much or too little for a proper ongoing application understanding? Based on the contract underlying the analyzed Mercedes Benz - Magna Steyr 4-matic project, Magna Steyr agreed to develop a diesel particle filter engine derivate. They entered the collaboration without existing knowledge in that field. Based on the stipulated task of specifying the engine at a certain project milestone, Mercedes Benz transferred topical knowledge, reducing the contextual knowledge to a degree which they thought Magna Steyr would be able to handle. A lack of contextual knowledge for an ongoing application of Mercedes Benz's transfer know-

how caused problems in understanding for Magna Steyr. A discrepancy arose between the contextual understanding related to developing an engine and the knowledge Mercedes Benz transferred for developing the diesel engine. Offering another example, the transfer of business metrics-related knowledge from Magna Steyr without the provision of measurement models and methods for data analysis lacked this contextual component as well. Mercedes Benz was not able to understand the transferred knowledge, and the transferred know-how was worthless.

The decrease in contextual knowledge included in the transfer process also showed another, even worse, tendency. Providing less contextual knowledge increased the likelihood of uncertainty and casual ambiguity regarding how to apply the knowledge within the receiver. Due to a lack of understanding of framework conditions and the development path of certain knowledge assets, the results of applying the knowledge often differed from the expectations. Referring to the diesel particle filter engine development, Magna Steyr tried to interpret the transferred know-how internally before starting to utilize it. Trying to apply contextual knowledge on engine and diesel engine development in this case was limited. Their lack of understanding of the particle engine derivate meant the need for greater insight than Magna Steyr had at that time and than Mercedes Benz had provided in the transfer. The interpretations and specifications Magna Steyr provided for review reasons did not fulfill the expectations of the partner, and that part of the project was re-integrated into Mercedes Benz. The phenomenon described is perfectly in line with Szulanski's (1996) concept of causal ambiguity, which arises in situations where it is hard or even impossible to relate the consequences or effects of a phenomenon to its initial states or causes.

All cited examples focus on the case of less contextual knowledge. As the transfer of contextual knowledge equals effort (e.g., project hours), partners strove to reduce their efforts for efficiency reasons, as seen above. The strict timelines of all three analyzed projects made it impossible to invest a great deal of effort in the transfer, i.e., extended transfer of contextual knowledge. However, partners experienced situations in the collaborative work where they already knew about the related context. In these situations, they denied the transfer of further contextual knowledge for efficiency reasons. Along with this, Magna Steyr observed that BMW project team members (at times) declined to receive further knowledge. Anticipating that they already understood the transfer knowledge completely, they refused to receive further contextual expertise, which often resulted in an inability to understand transferred knowledge due to an early interruption.

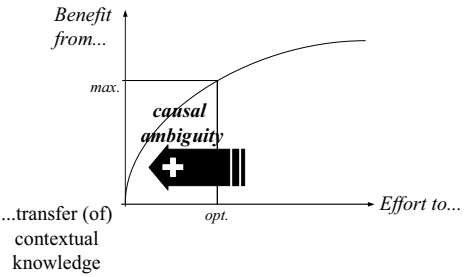


Figure 6.05 - Finding the optimal degree of de-contextualizing transfer knowledge

The outlined relationship between efforts and benefits from the transfer of contextual knowledge and the impact on causal ambiguity is illustrated in Figure 6.05. In the case studies contextual aspects had to be transferred in order to allow an understanding within and an application by the receiver. However, for practical as well as efficiency reasons, the number of adjacent factors that could have been transferred is limited (Lehner *et al.* 2003). Additionally, too much effort resulted in a decreasing benefit from transferring contextual knowledge due to already existing know-how within the receiver. The latter tendency is reflected in the decreasing incline of the outlined curve, indicating that too much effort in the transfer of contextual knowledge is self-regulated through the knowledge receiver (abandoning, refusing further input) and the project timeline (no resources, tight timeline), resulting in a lowering of the benefits gained from the effort spent to transfer the next knowledge 'unit'. This relationship peaks in the goal conflict between transferring as much contextual knowledge as possible to enable complete understanding, the so called completion trap (Lehner *et al.* 1997) and resource limitation. The black central arrow in Figure 6.05 indicates that reducing the effort to transfer contextual knowledge results in an increase in casual ambiguity as it.

Disseminative capability

As outlined, the question is not whether knowledge de-contextualization was necessary or not. Rather, the knowledge sender is in charge of finding an appropriate degree of de-contextualizing and an adequate balance between efforts and benefits of de-contextualizing transfer knowledge. The questions therefore are how to avoid a lack of contextual knowledge, how to find the optimum degree of de-contextualization (*see* Figure 6.05) for every single knowledge transfer activity, and which approaches were

successful in the analyzed collaborations. Especially, the degree of existing contextual knowledge and the capability of the knowledge sender to find the optimum under this condition became crucial.

As we can derive from the case studies and as is illustrated in Figure 6.05, the knowledge sender has to identify the optimum/maximum point. To solve this conflict of goals the level of expertise of the knowledge sender played an important role. For example, when BMW transferred product-specific knowledge about engine design specifications to Magna Steyr, the problem did not revolve around the understanding of these issues in general. However, the more detailed the knowledge was, the less complete Magna Steyr's understanding of that knowledge was. Project team members from the analyzed collaborations explored situations where the difference in the existing knowledge bases hindered a good transfer and ongoing understanding. This is completely in line with scholars from knowledge transfer theory analyzing the level of expertise in the knowledge sender and methods of de-contextualizing (Cummings *et al.* 2003; Joshi *et al.* 2007). A closer look at that issue reveals the closely related trade-off between being knowledgeable in a certain field and being able to transfer that knowledge to less expert partners (Hinds *et al.* 2001; Liebowitz 2003). Findings did not support the teaching theory perspective where the expert teacher is supposed to be the successful transmitter of knowledge (Cochrane *et al.* 1993). It was particularly Magna Steyr's experience that when it came to the transfer of details on technical specification, the understanding and therefore application potential decreased.

BMW was aware of the limitations and the conflict of goals in the case of the PD process, methods deployed, and tools that Magna Steyr uses to make their PD lean. To avoid a lack of contextual knowledge, they sent engineers to observe the application of methods and work on the contextual base while observing the partner's engineers during the BMW X3 collaboration. Magna Steyr tried to supply an optimum in contextual knowledge by extending its effort. Extensive presentations and documentation, on-site work, and joint problem solving were applied to enable contextual knowledge to flow intensively. That was one way of trying to prevent a lack of contextual insights into the side of the knowledge receiver.

With respect to the knowledge sender, cases showed different approaches to finding the individual optimum. Magna Steyr, for example, discovered that the order of knowledge transferred was of relevance when that optimum was not known. Basic knowledge, for example, was presented and exchanged during the BMW X3 project in a more formal way at first. Based on that, meetings or on-site visits were set up to outline needs for more contextual input. Bringing together the experts or the task-relevant

sender and receiver within the partners was then one approach to realize this. Contextual knowledge transfer was often realized in interaction-rich processes. Furthermore, Magna Steyr tried to understand the partner's perspective first before transferring knowledge. Full interpenetration and ongoing perspective taking turned out to be successful to the extent that neither BMW nor Mercedes Benz experienced any problems in understanding. Magna Steyr mentioned in this case that the anticipation of the task, the individual setting for the ongoing knowledge application, and the 'insights' into the partner's knowledge portfolio (*see* 6.1.2) were of importance. Magna Steyr itself saw room for improvement on this issue, as they determined that providing expert and ongoing application knowledge was a major source of potential. To that end, they worked and are working on their capabilities in training their experts. Unlike BMW and Magna Steyr, both of which took pains to find the optimal degree of de-contextualization, Mercedes Benz did not care about a partner-individual adjustment as they mostly relied on the provision of knowledge via IT tools and systems.

Shaping the hypothesis

We have seen that knowledge de-contextualization is a critical task in knowledge transfer. This is in line with prior work (e.g. Carlile *et al.* 2003; e.g. Cummings *et al.* 2003). When knowledge is transferred, de-contextualizing has to take place. Working proposition P^1 addresses this topic, aiming at the de-contextualization capabilities of the knowledge sender. Based on case study insights, this general capability turned out to be still valid; however, it has to be concretized from the case analysis. The question concerning the underlying de-contextualization capability is not whether the knowledge sender is capable of performing de-contextualization, but rather, how to prevent the occurrence of casual ambiguity (Szulanski 1996) while maintaining an efficient knowledge transfer processes. It is not possible to withhold contextual knowledge and simultaneously support an ongoing knowledge application within the receiver, just as it is likely not possible to transfer all adjacent contextual aspects. The case study investigations revealed different strategies ranging from not providing contextual knowledge to the receiver to taking the perspective of the knowledge receiver to detach knowledge according to his existing and the required contextual understanding. Overall, the success of knowledge transfer in the cases where the knowledge sender has taken care of de-contextualizing knowledge turns out to be higher than if she has not given it any attention. Hence, I posit:

Hypotheses H^3 *The ability of the knowledge sender to realize the optimal degree of knowledge de-contextualizing is positively related to the success of inter-organizational knowledge transfer.*

6.1.4 Knowledge encoding

After detaching knowledge from its individual embedding, it still resides within the sender. As far as knowledge de-contextualization is concerned, the selected know-how is not ready for the physical transfer yet. To move forward and turn knowledge into a physically transferable asset, it has to be transformed into a material good which can be read, listened to, or observed when applied. Therefore, working proposition P^2 addressed the sender ability to encode knowledge for transfer reasons.

Impact on transfer success

Any kinds of knowledge from deployed capabilities which were combined in the three cases with exchanged business metrics had to be transformed into a transferable form (Monge *et al.* 1981; Scudder *et al.* 1989; Jablin *et al.* 1994). Encoding activities were originally investigated in communication engineering science and focused on the process of formulating a message for the transfer of the encoded knowledge (Shannon *et al.* 1949). Without this transformation in either written or oral form, the knowledge transfer could not take place. An exception might be seen in the observation BMW carried out to gain insights into Magna Steyr's PD approaches and tools. In that case Magna Steyr employees did not have to put their knowledge into a certain form to transfer it. Nevertheless, observations were just one part of the knowledge transfer 'campaign' BMW ran during the X3 collaboration, when the whole PD process was documented in written form. During those observations, the interaction between BMW and the Magna Steyr employees was very intense as well. Based on this information, one can conclude that the minimal condition to enable a knowledge transfer was then the encoding step itself. The ongoing question was then whether there were differences in the encoding performance or not. Were there any trends if certain kinds of encoded know-how were easier to understand? And what was the knowledge sender's approach towards that?

Disseminative capability

In the course of the case study projects all team members deployed different oral as well as written ways of encoding knowledge for transfer purposes. The form of knowledge encoding (oral, written, or action-embedded) did not have a strong impact. However, these decisions were rather interesting in the sense that they were closely interwoven with the selection of an adequate transfer approach, as outlined later in chapter 6.1.5.

Encoding was more an issue about the difference between the knowledge bases of sender and receiver, the organizational individuality employees experienced, or the region they came from. Magna Steyr and Mercedes Benz discovered in their collaboration that the level of expertise played an essential role in the encoding process. When it came to the development of the diesel engine derivate, an increase in the level of detail of exchanged knowledge was accompanied by problems in understanding. Team members reported technical terms they had never heard of, company-wide expressions and abbreviations which were unknown to outside people, or even technical terms given in a foreign language. Latter aspect especially occurred the case in the BMW Z4 coupé project, when production-specific knowledge was transferred from the Spartanburg plant in the US to the development team in Graz. Even over the relatively limited physical distance between Magna Steyr and BMW as well as Mercedes Benz, dialect differences surfaced, which caused minor, nevertheless real, lingo and language problems, particularly in early collaboration phases.

Besides experts using different technical terms, company-specific expressions, or even different languages, another phenomenon could be seen across all the cases. Experts tended to be incapable of encoding knowledge in a form that was decodable afterwards within the receiver's coding system. This issue emerged because experts organize their knowledge differently, i.e., they abstract knowledge to a higher degree than non-experts; hence, they articulate it in a different way. Especially Magna Steyr identified enormous potential in their project teams to increase the effectiveness of the encoding process. Employees within Magna Steyr were trained prior to the collaborative work in different relevant fields including communication and joint work-related issues. Using less specific terminology, employing fewer abbreviations and nomenclatures, getting straight to the point, and using unambiguous expressions, for example, were targeted goals of these training and coaching sessions held in collaboration with psychoanalysts. After the first time and resource-intensive collaboration between BMW and Magna Steyr in the X3 project, the training program was planned to be extended by including topics such as taking the perspective of the partner when putting knowledge

into words, oral expressions, or action. Magna Steyr designated this approach for the purpose of increasing the satisfaction of the OEM partners and the success of transferring knowledge. The latter issue was of particularly high priority as the OEM partners expected that success and regarded it as a special advantage in working with Magna Steyr.

Shaping the hypothesis

As already seen, knowledge encoding is an act of externalizing knowledge for transfer purposes. Underlying knowledge sender activities aim to provide knowledge and messages containing relevant information in a form the knowledge receiver can decode later on. In the three cases conducted, the inability to present knowledge in an adequate way rendered both its reception and comprehension; hence, it was unusable for problem solving or project advancement. (Carlile *et al.* 2003). In order to enable a later decoding within the receiver in the presence of cognitive distance, the sender decontextualized knowledge accessible for the receiver. Since the aim of encoding knowledge is to realize the decoding within the receiving partner, working proposition P^2 needs to be extended by adding the partner focus determine the coding scheme, which reflects the objective of the encoding step precisely. Thus, the knowledge sender has to take care to encode her knowledge in a partner-adequate manner, i.e., in accordance with his level of expertise or his origin (with respect to company, region, personal development pathway, etc.). Therefore, I state:

Hypothesis H^4 *The ability of the knowledge sender to encode transfer knowledge according to the receiving partner's coding system is positively related to the success of inter-organizational knowledge transfer*

6.1.5 Designing and utilizing an adequate knowledge transfer approach

Subsequently, after the selection, de-contextualization, and encoding of knowledge for transfer purposes, an adequate transfer approach needs to be designed and executed. According to the case studies conducted, the transfer approach contains a combination of transfer channels and media for transmitting signal- and message-embedded knowledge. In this understanding, the knowledge transfer approach is the physical bridge between the sender and the receiver. This bridge can be embodied in various forms and combinations of transfer channels and media. Firstly, the sender selects the channels and media for the knowledge transfer, and secondly, she utilizes the selected ap-

proach. As working proposition P^3 and P^4 jointly address the procedure of designing and executing a communication approach, I now integrate these two discrete steps.

Impact on transfer success

Along the three analyzed projects, team members deployed a spectrum of different transfer media and channels. In employing email and written, hard-copy documents as well as inter-active work on the product; the employees involved initially mentioned basing their transfer approach selection on a gut decision rather than following a structured procedure. Deploying dedicated lines to provide knowledge to the receiver appeared to be of limited adequacy for the purpose of transferring context-rich know-how. Magna Steyr found fault with Mercedes Benz's deployment of this approach because it did not transfer ongoing and supplementary know-how. This channel and the related media to access Mercedes Benz's data were adequate for information and data only. Once problems with applying the accessed know-how occurred, this channel became insufficient. Looking at the example of BMW and Magna Steyr in the Z4 coupé project revealed that a complex problem required the exchange of a vast amount of know-how. BMW and Magna Steyr brought the object of interest to a production line and analyzed causes for an existing problem by de-constructing it. In the course of this work, the experts involved exchanged knowledge in real time and very frequently. These two examples indicate a different adequacy of transfer channels and media. Given this, the project team members seemed to follow mechanisms and loosely-structured procedures when selecting and deploying transfer approaches instead of relying on a gut decision. Analyzing the structures and mechanisms underlying these two and further observed examples of selecting the transfer channels and media revealed eight factors impacting the determination of the approach design (complexity, content, background, experience, efficiency, breadth, project phase, corporate setting).
The above-outlined examples clearly indicate the impact of knowledge *complexity* and its *content* while composing an adequate approach. The higher the complexity of know-how was the more project teams deployed interactive transfer channels. Meeting notes were exchanged via email, whereas critical project milestones were discussed interactively in review meetings accompanied by an earlier exchange of relevant information. The decision regarding which transfer media to deploy is discussed in the media richness theory (Daft *et al.* 1986, 1987). BMW and Magna Steyr recognized the value of interactive work, especially at the beginning of a project. Investing more time in the early *phase* to get to know each other and exchange content-related as well as collaboration-related know-how required richer and therefore interactive transfer ap-

proaches, such as face-to-face meetings. In later phases the collaborations showed a tendency to deploy fewer interactive procedures. In addition, the *breadth* of knowledge impacted the choice of the transfer approach. Handling an enormous amount of knowledge required richer transfer approaches, as was the case in early project phases, for example, when BMW trained Magna Steyr employees working in their IT environment during the X3 collaboration. As different transfer channels and media have varying transfer capacity due to physical reasons (Shannon *et al.* 1949), BMW and Magna Steyr tended to deploy high-capacity approaches to reduce transfer time and increase transfer efficiency.

Cooperative settings as deployed in all three projects lacked a co-location of teams for the rich and interactive transfer of knowledge. Flying back and forth between Graz (Magna Steyr) and Stuttgart/Bremen (Mercedes Benz) or Munich (BMW) to discuss the specification of a screw or the minutes from the latest review meeting was senseless. Instead, project partners tried to travel only as often as necessary to keep the resource allocation *efficient*. Another important factor was the personal *background* as people developed their own way of maintaining knowledge transfer. Furthermore, the individual background and training level influenced the channel and media choice as well. Technical *experts* tended to use written asynchrony transfer or interactive problem-solving work. The more hybrid forms such as meetings or videoconferencing were not preferred by this group.

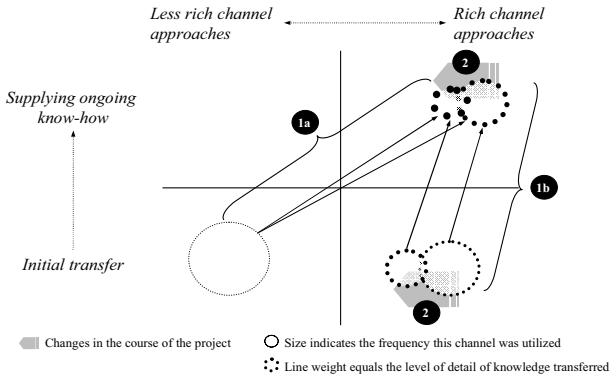


Figure 6.06 - Deployed knowledge transfer approaches in collaborative inter-organizational settings

Wrapping up the impact of the given factors, one can assume certain tendencies in the transfer approach design as outlined in Figure 6.06 and in accordance with Daft and

Lengel (Daft *et al.* 1986, 1987). First, partners tended to deploy a multi-step transfer process utilizing a combination of transfer channels (1a & 1b). In Figure 6.06 this is outlined as a simplified two-step approach. As observed in the cases, project team members chose to prepare the knowledge transfer by exchanging written documents, data, and information in the first step. As in both projects between BMW and Magna Steyr, presentation slides along with other documents were transferred between the partners prior to personal meetings. Based on those, the review meetings served as a basis for focusing on areas where understanding had not emerged from the transferred know-how up to that point, indicating an increase in the level of detail in the transfer knowledge (1a). Both steps support the media richness theory (Daft *et al.* 1986, 1987), as the combination of transfer channels and media turned out to be the critical success factor. However, the initial knowledge transfer was not necessarily limited to less rich channels. Team members also deployed richer transfer channels in the first step (1b) as seen in the early collaboration phases in the BMW X3 and the Z4 coupé projects. In the course of the project, transfer channels changed in such a way that team members deployed more of the less rich approaches (2). One reason for that was the already existent joint knowledge base, which included organizational, inter-company know-how, and other things related to the joint work procedure. The transfer focused more and more on specific topics connected to the PD procedure itself.

Especially the richer transfer channels approach the richness and breadth of human language. Video-conferencing, interactive work, and face-to-face meetings can be narrowed down to the underlying communication. As the design of the transfer approach appeared challenging, execution as well was critical to success. Originating from different geographical regions, different companies, and within the collaborations, from different phases in the value chain, project team members in all three analyzed cases were different. Additionally, the joint work was not limited to the project team itself. Related operating departments were involved in the projects analyzed and acted differently compared to the project team members. Apparently, the project teams followed, for example, other goals than the operating departments of BMW and Mercedes Benz. Even within participating companies these interface problems occurred, as we saw in the BMW X3 project, when the operating departments limited the knowledge transfer due to fear of losing know-how to 'others'. Within all three projects, there was huge potential for improving communication as a means to bridge those gaps and differences and realize an efficient knowledge transfer.

Disseminative capability

Among the impacts outlined concerning the knowledge transfer approach, two dimensions emerged to be of significance. In the first step, the transfer approach is outlined. In the second step, these transfer channels and media are executed. With that framework, especially communication-based transfer approaches received special attention.
As the knowledge sender is in charge of designing the transfer approach, she has to consider all impacting factors. Furthermore, experiences in collaborating impact on the approach design. Magna Steyr's business model heavily relies on joint project work with external partners and they are experienced in setting things up and operating the exchange of relevant knowledge. This is reflected in the different approaches the case study organizations involved applied. Both BMW and Mercedes Benz rejected Magna Steyr's process of setting-up and maintaining especially the early collaboration phases. Over the three years prior to the referenced collaborations, Magna Steyr had already used extensive kick-off meetings or an intensive early phase deploying rich knowledge transfer approaches when setting up collaborative projects. Upon reviewing the project performance, both OEM partners identified this as an unrealized and important potential. As the project continued, the knowledge sender needed to identify the changes in the transfer process as well and she selected adequate transfer approaches. Failure to consider the impacting factors adequately resulted in poor transfer performance, as was observable in the Magna Steyr - Mercedes Benz case. Mercedes Benz optimized their effort to transfer knowledge by mainly deploying less rich media approaches, which in turn resulted in a weak transfer performance. Orchestrating the available and adequate transfer channels and media while considering the above-mentioned impact factors in order to meet the requirement of the given transfer setting was therefore an issue for the knowledge sender (Ranft *et al.* 2002).
Once the transfer approach is set-up, a consequent execution is required in order to leverage the design approach. Team members did not identify problems with executing less rich approaches. Richer transfer approaches mainly suffered because of the communication dimension. Magna Steyr identified internal problems in this field. In tendency, technical experts were not prepared to work together. Similar observations were made for BMW's operating departments, especially in the BMW X3 collaboration. Fear of losing knowledge and a lack of acceptance of external knowledge prevented these employees from establishing an efficient knowledge exchange. In general, the above-mentioned differences between the partners involved represented enormous challenges for the knowledge sender. BMW deployed the technical facilitator in the X3 as well as the Z4 coupé project as Magna Steyr integrated collaboration prepa-

ration training sessions to overcome communication gaps, to give voice to the people involved, and to be able to take the receiver's perspective (Galbraith 1990). Magna Steyr additionally intended to extend those training sessions by involving psychologists to prepare project team members for such work. A failure to adapt a different perspective, for example, was a serious issue in the 4-matic project, as Mercedes Benz did not make any effort to adopt Magna Steyr's point of view. Rather, they executed their method of knowledge transfer in an un-reflected manner. Therefore, the knowledge sender is in charge overcoming the aforementioned differences between the partners and the issues resulting from these differences. This is in line with work by communication scholars (Jablin *et al.* 1994; Jablin *et al.* 2001) analyzing communication competencies.

Shaping the hypothesis

Working propositions P^3 and P^4 address the issues of designing an appropriate communication approach and communicating effectively. Both propositions combined address the two steps (designing and executing through efficient communication) section 6.1.5 investigated. The case studies show the strong interrelationship between the two steps. Therefore, merging these topics makes sense from a perspective that regards the design and the execution of knowledge transfer as interwoven tasks. Doing so allows covering the execution focus in this hypothesis as well as including the execution of other kinds of knowledge transfer approaches. Furthermore, the communication focus of these working propositions is to some extent misleading concerning the term 'communication'. The transfer of knowledge occurred in various ways and happened over different channels and media. As already seen, for example, dedicated lines at no point served the communication between the sender and the receiver. Although most insights revealed from the case study investigations are supported by communication theory, the communication act itself represents only this special part. Additionally, this is supported by the fact that only the richer transfer channels and media required communication processes, as communication theory understands them. In order to follow the deployed theoretical stream of knowledge transfer, communication science, and teaching theory, I re-name the term knowledge transfer approach.

We saw the two interwoven steps the knowledge sender maintained in order to transmit her knowledge to the receiver. First, she orchestrated the different transfer channels and media. Secondly, for those channels and media that required communication processes, she executed effective communication. Recognizing this, I state:

Hypothesis H[5] *The ability of the knowledge sender to execute an adequately designed transfer approach is positively related to the success of inter-organizational knowledge transfer.*

6.1.6 Supporting the knowledge application

After the transfer knowledge has physically 'left' the knowledge sender in spoken form, written in documents, or embodied in performed actions, the receiver takes over the process lead for further steps, namely, receiving the knowledge as evidenced by recognizing the technical stimulus of the transmitted knowledge (e.g., hearing, reading, observing), decoding knowledge that is applicable with the coding system of the receiver and the company, and applying knowledge by contextualizing it into the new setting. In other words, the transfer knowledge takes a path similar (although reversed) to the one it originally took from the sender. Nevertheless, the steps outlined take place within the receiver, for which reason the knowledge sender's impact seems to diminish. Contrary to Szulanski (1995) and Cool *et al.* (1997), who follow exactly this interpretation, I observed a high impact of the knowledge sender throughout the process part, even after the transmission of knowledge. Therefore, I contend that this assumption hinders a sustainable use of knowledge. Especially in the later stages of the transfer process, the receiver requires support while transforming knowledge into capabilities (Carlile *et al.* 2003). Working proposition P[7] addresses exactly this aspect of the knowledge transfer when highlighting the positive relationship between the knowledge application support and the increase in knowledge transfer performance.

One objective of knowledge transfer is to enable behavioral changes within the receiver, to enable the receiver to solve problems, or to pursue the purposeful development of a joint product. To achieve this objective, appropriately transferring the relevant knowledge by the sender and physically perceiving it by the receiver are not sufficient. The knowledge transfer is only successful once the knowledge is applied. Referring to the application-oriented definition the thesis at hand follows, the transfer process includes the application as well. The tasks of the knowledge sender change at this point and she now is the supporter and facilitator who guides the receiver through the ongoing process steps (von Krogh *et al.* 2000). Neither BMW nor Mercedes Benz collaborated with Magna Steyr only for knowledge transfer reasons, although it was an essential contractual issue in the 4-matic series project between Magna Steyr and Mercedes Benz. The intention was to work together on the development of a product, which in turn required an extensive knowledge exchange. Without an ongoing application of

transferred knowledge, none of the three projects would have generated a product ready for market launch. This underlines the importance of knowledge application, and due to efficiency reasons, the knowledge sender accompanies the application in order to support it. Otherwise, knowledge transfer endeavors of all types related to the project up to that point would have been made in the belief that the receiver could apply the knowledge himself.

Impact on transfer success

What kind of barriers and limitations occurred during the application phase and what did the knowledge sender do to overcome those barriers? Four aspects emerged indicating the main application-related problems, namely a lack of understanding, missing application or contextual knowledge, casual ambiguity, and little retentive capacity on the receiver's side. All four aspects simultaneously indicate the main areas for potential knowledge sender support. Wit respect to the collaboration between Magna Steyr and Mercedes Benz, latter partner had experience in the field of designing, developing, and producing a 4-matic derivate on its own and from the collaboration with Magna Steyr in the second generation 4-matic derivates. Nevertheless, the company demanded extensive knowledge transfer in this field, even fixing this in the collaboration contract. Therefore, *understanding* the 4-matic technology to the full extent became a critical objective for Mercedes Benz. Magna Steyr did expend great effort in support of that objective. For example, bringing a 4-wheel drive gearbox already assembled in a car to the Mercedes Benz production line and then deconstructing it was a successful way to enable understanding. Afterwards, when Mercedes Benz started the production of the C- and S-class 4-matic version, they were able to apply this knowledge on their own. Prior to that, Magna Steyr had sent know-how concerning the technology via documents, presentations, or in joint work with the Mercedes Benz project team members. As outlined in section 6.1.3, the transfer of plain information or knowledge was not sufficient to enable understanding. Contextual knowledge entailed supplemental know-how about the development, the application setting within the sender, and therefore represented great potential for the receiver.

Often, problems in the knowledge *application* work could be traced back to a lack of understanding of how to put transferred knowledge into action. Citing again the Magna Steyr-Mercedes Benz collaboration, the production and assembly of the C- and S-class went back to the Mercedes Benz production plants after the development of the prototype. In turn, this required providing Magna Steyr with production-specific knowledge in order to ensure producibility afterwards. At the beginning of the cooper-

ation, they did so by handing over manuals as well as documents about production-specific requirements. Nevertheless, as this was a critical issue during the project, Mercedes Benz and Magna Steyr both agreed to work interactively in order to deepen that type of knowledge. Therefore, they brought prototypes to the Mercedes Benz production plants to test run production tasks. Magna Steyr team members worked together with Mercedes Benz engineers on various production-specific topics and problems and traced them back to their root causes in the development-related work. In doing so, Magna Steyr's already existing concept of the production process and built-in producibility requirements became concretized in interactive work and through hands-on experience with the applications. BMW in their collaboration with Magna Steyr as well discovered the importance of supplemental and application knowledge therefore introduced the technical networker concept.

Another example indicating the importance of supportive activities was the execution of the newly designed PD process Magna Steyr and BMW deployed in both of the analyzed projects. First, Magna Steyr outlined the new process and involved BMW engineers as closely and as early as possible in the PD work. Additionally, BMW sent a team to observe the PD process with all its methods and tools. This helped BMW to understand procedures by actively experiencing the new process. Magna Steyr team members provided support when BMW applied parts of this process for internal process improvements later on.

Furthermore, and closely related to the discussion in section 6.1.3, there arose the problem of *causal ambiguity* (Lippman *et al.* 1982). In that situation, the knowledge sender did not obtain enough knowledge to eliminate a discrepancy between the intended and actual knowledge application outcomes. Similar to the understanding and the application aspects outlined before, the knowledge receiver required further context, application, and other types of knowledge in order to lower the risk of causal ambiguity to occur. For example, Mercedes Benz's interest in knowledge about the 4-wheel drive technology was high; thus, they chose to collaborate with Magna Steyr for the second consecutive time in this field. Team members mentioned that Magna Steyr's expertise was valuable; Mercedes Benz's existing knowledge base in that field after the first 4-matic project collaboration with Magna Steyr as well as their failure to develop a 4-matic derivate on their own was not sufficient. Interestingly, the latest version of the Mercedes Benz 4-matic derivate was completely developed and produced by Mercedes Benz. How did Mercedes Benz succeed in learning from those two collaborations and the 4-matic project from earlier days and even more importantly, how was knowledge successfully maintained? Repetitive application and the development

of the 4-wheel drive technology on its own helped Mercedes Benz to fully interpenetrate this technical know-how. Being able to do so indicate that Mercedes Benz had gained a broader 4-wheel drive knowledge base and that knowledge was kept internally. However, Magna Steyr provided support in order to deepen the know-how base and overcome the problem of too little *retentive capacity* (Szulanski 1996; Szulanski 2000; Lucas *et al.* 2006). This potential lack seemed to be the reason for Mercedes choosing a collaboration partner in the analyzed case study on the 4-matic series rather than carrying it out on their own.

A lack of support resulted in problems in applying transfer knowledge. Besides solving capacity restrictions, an important side-effect of working with Magna Steyr was the desire for, e.g., new PD approaches, methods, and tools. One approach used to gain those insights as well as new ideas involved both OEMs waiting for Magna Steyr to provide new solutions to existing problems, regardless of whether there already existed a solution or whether the problem was not solvable at all. This approach resulted in double- and re-work for Magna Steyr; with a different approach, problems could have been solved more easily and with far less effort.

Disseminative capability

Based on the identified aspects critical to a successful application of knowledge, the sender's areas for support became clearer. In all three collaborations supportive activities took place to enable knowledge application. Coaching, training, on-the-product work, and the technical networker were a few of the instruments deployed to deepen knowledge in an interactive way.

Based on an existing knowledge advantage, the sender was able to adjust her transfer activities to her experiences in that specific field (potential problems, ways to avoid shortcomings in the knowledge application, etc.) and/or to provide application support. Application support therefore was provided due to its anticipation or based on problems. The latter possibility required reflecting capabilities of the knowledge sender in order to understand the application problem and to provide adequate support (right knowledge and right timing), such as sending further knowledge. As outlined in Figure 6.06, for a two-step knowledge transfer the application support followed similar rules. Application support mostly contained interactive methods which were much more focused on specific issues and details. Across the analyzed projects the sender was more a coach supporting a knowledge application to increase the transfer success, which is in line with findings from various scholars (e.g. Bluth 1975; Mietzel 2001). Magna Steyr trained employees selected for the project team prior to the collaborations to

prepare them for the joint working situation. Along with other topics, training included how to support the partner in case of problems in understanding Magna Steyr's approaches. This was critical to success, as they were in charge of enabling understanding and ongoing application.

Shaping the hypothesis

The findings from the analyzed projects support working proposition P^7 on the importance of application support. The knowledge sender assisted and supported the knowledge application process (Knowles 1981; Heller 2002, 2006). Support was helpful, even necessary, as there were a number of barriers (lack of understanding, missing application or contextual knowledge, casual ambiguity, and too little retentive capacity) preventing the receiver from applying the knowledge gained. Not clearly observable was the teaching aspect within this capability on avoiding repetition in knowledge transfer and the effect on understanding and application. This can be traced back to the timeline of industrial projects, which is critical and temporally limits repetitive and excessive knowledge transfer. Furthermore, all of the collaborations were based on a contract that stipulated Magna Steyr as the provider of the completely developed vehicle. Both OEMs tried to limit supportive activities because they had 'bought' a full package. Nevertheless, the impact of knowledge application support is clearly indicated; thus, I state:

Hypothesis H^6 *The ability of the knowledge sender to support knowledge application is positively related to the success of inter-organizational knowledge transfer.*

6.1.7 Building up and utilizing relational capital

Besides transfer activities like encoding, de-contextualizing, or the design of the transfer approach directly impacting knowledge transfer success, other aspects showed impact as well. In section 6.1.1 the existence of the knowledge base concept was introduced. Both partners deployed their bases for the joint project work by transferring know-how to the partner, which was used to advance the project. In addition to the partner-individual knowledge bases, a third knowledge base appeared. First, when analyzing the knowledge transfer adjustment to the existing knowledge base, the three project partners underlined that they additionally considered existing knowledge bases from former joint work relations. Secondly, for the design of the knowledge transfer approach project team members tended to deploy less rich channels and media in later

collaboration phases. Getting to know each other in recent work or earlier collaborations helped the companies to set up a joint knowledge base containing organizational knowledge as well as knowledge related to technologies and processes (*see* chapter 6.1.5) and to reduce the transfer activities due to already existing knowledge. Addressing this phenomenon, working proposition P^5 aimed to indicate the positive relationship between the building-up and leveraging of relational capital and the success of inter-organizational knowledge transfer.
I follow the concept of relational capital, given by Kale *et al.* (2000), which addresses mutual trust between the individual members of collaborating partners. In addition to that individual level construct, I include the underlying ideas of relation-specific assets (Dyer *et al.* 1998). For example, inter-personal ties, partner-specific absorptive capacity, or a joint knowledge base were observable in the analyzed case studies.

Impact on transfer success

During the case study investigations partners regularly referred to an existing joint knowledge base or knowledge about the partner, which demonstrated an impact on the work results. As the BMW X3 project was the first collaboration of its type between Magna Steyr and BMW, partners invested heavily in the development of relational capital, e.g., training Magna Steyr project team members in the BMW system environment after investing about 25 million € in customizing their systems for collaborative work (e.g., accessibility from external sites, user rights, etc.). Based on this relational capital, the second collaboration project (BMW Z4 coupé) plan could be met. Team members knew each other already from the BMW X3 project, had insights into decision processes, or working procedures. Building the BMW Z4 coupé within 18 months was possible because of the existing knowledge about the partner and work-related know-how within BMW as well as Magna Steyr. Additionally, both project teams tried to staff the BMW Z4 coupé project similarly to the BMW X3 project. Team members knew each other, which promoted easier joint work. Responsibilities, level of expertise, contact dates, individual language and lingo of the partner's project team members, among other things, were already known.
Despite the advantages mentioned and the impact emerging from deploying knowledge about the partner and the existing knowledge base, benefits from leveraging this know-how showed limitations. As seen earlier, joint work improved both the joint- and the individual knowledge bases due to success in knowledge transfer as well as related learning effects. Benefits from a broader knowledge base resulted from their leveraging, as seen in the examples given. On the other hand, this leveraging harbored the

danger of over-estimating the existing knowledge bases and the relational capital. In such a case, adjusted knowledge transfer was predicted to fail. The case of the Mercedes Benz-Magna Steyr collaboration indicated that the adjustment of transferred knowledge was based on an incorrect estimation of existing relational capital, particularly the knowledge gained from the first 4-matic series that the partners developed jointly. Magna Steyr rotated people within the project team, and it was not possible to have the same people in this project, as in the first collaborative project. Team members were not able to understand and apply transferred knowledge as Mercedes Benz had anticipated more relational capital within the receiver.

Apparently, relational capital had an impact on knowledge transfer success. Nevertheless, this impact differed from that of the other DiC introduced so far. Relational capital enabled the project team members of Magna Steyr as well as BMW and Mercedes Benz, e.g., to locate the right people within the partner organization, to be able to adjust the transfer knowledge to the knowledge portfolio of the receiving partner, and thereby to have an idea of the partner's level of absorptive capacity (Cohen *et al.* 1990). These findings are perfectly in line with existing work on partner-specific knowledge (e.g. Granovetter 1985; e.g. Dyer *et al.* 1998; Hansen 1999; Todorova *et al.* 2007) Relational capital showed no direct impact on the success of knowledge transfer; nevertheless, it influenced related DiC, as outlined in Table 6.02.

Table 6.02 - Influence of relational capital on DiC

Disseminative capability (DiC)	**Impact of relational capital**
Valuable knowledge **sender** (chapter 6.1.1)	▪ *No impact on this disseminative capability.*
Transfer **knowledge selection** (chapter 6.1.2)	▪ Based on insights into the receiver's knowledge portfolio, the transfer was able to be adjusted in terms of transfer extent, etc. This in turn helped to design a lean knowledge transfer process. ▪ Knowledge transfer was easier to focus on, e.g., the right team members within the receiver, actual missing know-how, and already existing expertise. ▪ Negative impacts emerged as the sender adjusted her transfer knowledge based on incorrect estimations of the partner's knowledge base.
De-contextualizing knowledge (chapter 6.1.3)	▪ Knowledge about the receiver enabled the knowledge sender to adjust her degree of de-contextualization to the existing knowledge base of the receiver. Knowing the receiver better and better therefore supported to find the optimum between a higher degree of abstraction and transfer effort. ▪ Again, an incorrect anticipation of the existing relational capital, especially the joint as well as the receiver's knowledge base, worsened the knowledge transfer instead of increasing its success.
Encoding knowledge (chapter 6.1.4)	▪ Knowledge about the receiver and especially his language and lingo made it possible to adjust the encoding process. Subsequent decoding in the knowledge receiver's coding scheme was easier. Project team members learned about the preferences and individual coding systems of the partner and increased the efficiency of the decoding process.

Disseminative capability (DiC)	Impact of relational capital
Design and leverage and **transfer approach** (chapter 6.1.5)	▪ As people prefer to communicate differently, the design and the use of the transfer approach became more individualized and thereby better in terms of transfer success.
Support the knowledge receiver (chapter 6.1.6)	▪ Know-how about the partner's weaknesses in the knowledge portfolio enabled an individualization of the knowledge transfer. Technical experts for example preferred to solve problems in understanding directly and in product-related work.

Disseminative capabilities

As relational capital had an impact on five out of six of the so far introduced DiCs, mainly increasing their impact on the knowledge transfer success, the question is how to promote this enabler. Before looking at capabilities in this field, one has to consider that benefits from relational capital only arose when it was leveraged, e.g., the knowledge sender adjusted her way of encoding the transfer knowledge to the coding system of the knowledge receiver. In order to leverage relational capital, the knowledge sender needed to invest in its build-up, as for example BMW did when training Magna Steyr project team members to work in their systems in the X3 collaboration or deploying primarily interactive work at the beginning of the X3 and the Z4 coupé collaborations. Besides the building-up and the leveraging step itself, the process of leveraging the existing relational capital base featured two additional steps, namely, intra-organizational diffusion and the evaluation of the actual relational capital base. The diffusion of relational capital is necessary as project team members might change organizational roles over time or between the projects or as they unlearn certain skills. Especially, the issues of unlearning and role changing underline the necessity to evaluate the actual existing relational capital base before adjusting transfer activities. The resulting 4-step approach to leveraging relational capital is outlined in Figure 6.07.

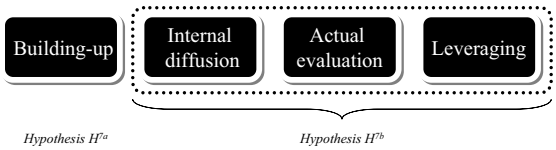


Figure 6.07 - Process to utilize relational capital

Figure 6.07 indicates that the process of utilizing relational capital is divided into two parts according to the following hypotheses H^{7a} and H^{7b}. The latter part cluster contains three steps. Instead of splitting this cluster and deploying three hypotheses, I

combine them. In doing so, the internal diffusion and the actual evaluation of the existing relational capital base prior to the leveraging of this know-how are regarded as preconditions and enabling steps for the purpose of adjusting the knowledge transfer process to the partner.

Building up relational capital was observable in two different ways, reflecting the two 'dimensions' of relational capital. The relation-specific aspects (e.g., getting to know the people within the receiver, building up mutual trust) were built up in inter-personal contacts and activities. Especially, kick-off meetings and face-to-face work in the earlier project phases helped to address the right team members within the receiver team. Unfortunately, Magna Steyr's approach, the building-up of relational capital in the early project phase, was rejected by the OEMs. Throughout this phase, Magna Steyr normally invested great effort in connecting people with each other and setting the basis for rapid relational capital growth. Afterwards, OEM project team members mentioned that they regretted having failed to take advantage of that potential.

One aspect of the relational capital was the joint knowledge base the project team members had developed together in former projects (BMW X3 with BMW, first generation 4-matic series with Mercedes Benz, etc.) or in the course of the recent collaboration. BMW deployed training sessions and coaching, as in the case of the IT systems in the BMW X3 project, in order to develop Magna Steyr's understanding and knowledge in this field. In general, all kinds of interactive and collaborative work impacted the broadening of the joint knowledge base and similarly affected both partners' individual bases in turn.

When it came to leveraging existing relational capital in order to e.g., design a partner-adequate transfer approach or to de-contextualize the transfer knowledge to a partner-optimized degree, problems arose. Building up the relational capital was considered to be an investment, which especially BMW and Mercedes Benz tried to leverage within subsequent collaborations. Issues arose when expectations about the existing relational capital within the project team differed from the actual base. Therefore, one important aspect of realizing benefits from leveraging relational capital was the evaluation of the recently available knowledge base rather than expecting a base containing all of the knowledge the two companies had ever exchanged. A continuous evaluation enabled a depiction of the existing knowledge assets. If done properly, the transfer process could have been adjusted in a way to increase transfer success. The analyzed cases reveal approaches to depicting knowledge bases such as the 'Leistungsschnittstellenvereinbarungen' introduced by BMW. Regardless of the fact that this was a static instrument displaying the knowledge bases at the very beginning of the collaborative project

work, it indicated a possible way to proceed. Besides the obligation to send knowledge founded on an existing knowledge base, the knowledge sender herself needed to provide a picture of her portfolio as well. Being the receiver and sender from time to time underlined the need for all the partners involved to display their relational capital and diffuse it internally.

Shaping the hypothesis

The above-outlined findings over the three analyzed case studies indicate that gaining benefits from leveraging relational capital required investment in this asset, diffusion throughout the organization, and an evaluation of the actual relational capital base beforehand. Collaborating companies in the three projects underlined that the method and time of leveraging knowledge became a critical issue with respect to benefiting from relational capital. The distinction between the two-process parts (building-up and leveraging relational capital - diffusion, actual evaluation, leveraging) when combining both aspects in the working proposition was clearer than assumed in chapter 4.
Project team members were urged to build up relational capital beginning in the very early collaboration stages and to extend it by working together or investing in both the knowledge base of the partner and the joint knowledge base. Interactive work and face-to-face transfer channels appeared to be adequate instruments for and ways of supporting a faster ramp-up of relational capital, as the media and channel richness was a the success-critical determinant. Without an existing level of relational capital, any effort to leverage this asset to enhance the impact of the other DiC would fail. Therefore, I state

Hypothesis H^{7a} *The ability of the knowledge sender to build up relational capital is positively related to the potential impact on the related disseminative capabilities and thereby inter-organizational knowledge transfer success.*

The analyzed cases revealed that leveraging relational capital required close interaction between the sender and the receiver as the existence of partner-specific, relation-specific, and extent of the joint knowledge base was not easily predictable. For example, project team members left the project as in the BMW - Magna Steyr collaboration projects or even the company, knowledge was lost and forgotten, or relational capital was not diffused within the partner organization to the point of use. Incorrect predictions, on the other hand, had a negative impact on the other DiC, as was the case when

Mercedes Benz adjusted its knowledge transfer selection based on assumptions regarding Magna Steyr's knowledge base.

In the analyzed cases, we can see that the positive impact of relational capital increases the impact of other DiC as outlined in Table 6.02. Knowledge transfer became more efficient, as, e.g., the transfer was more focused on the right people and on the necessary content. Therefore, leveraging this asset required providing a picture of the actual relational capital base and to deploying those insights when adjusting the knowledge transfer process to the partner. Besides the build-up of relational capital, leveraging this asset in the right way was essential for benefiting from the potential relational capital holds; thus, I state

Hypothesis H^{7b} *The ability of the knowledge sender to leverage relational capital to increase the impact of related disseminative capabilities is positively related to the success of inter-organizational knowledge transfer.*

Within the conceptual framework (*see* Figure 6.09) relational capital inhabits a central role compared to the other DiC. The nature of this DiC, in particular existing relational capital between the partners involved, held the potential to enhance the other related and DiC introduced thus far (except the valuable knowledge sender dimension).

6.1.8 Considering and using feedback

According to my understanding of the nature of knowledge transfer, the knowledge sender and the receiver constantly interact in an interactive process. Up to this point, the knowledge receiver's way of influencing transfer success has not been considered, as this seems not to be in the direct focus of this thesis. However, there are activities the receiver initiates to impact transfer success which affect the knowledge sender's activities. The knowledge sender in turn needs capabilities to recognize these activities and deploy underlying insights to improve the knowledge transfer process. Feedback to increase various aspects of the transfer process has thus far not been taken into consideration; however, it represents a rich source for the knowledge sender to improve her sending process. Working proposition P^8 therefore highlights the relationship between the consideration and utilization of feedback from the knowledge receiver on the disseminative capabilities and thereby the transfer success performance.

Impact on transfer success

The constant interaction between the sender and the receiver led to certain outcomes in terms of either successful or unsuccessful transfer activities. In the best case the knowledge receiver transmitted signals, messages, or more directly described the knowledge transfer results to the knowledge sender. Three different types of feedback occurred during the joint work in the analyzed case studies. *Firstly*, the knowledge receiver gave feedback to the sender on her methods of transferring knowledge. As seen in the collaborative project between Mercedes Benz and Magna Steyr, in which knowledge transfer was limited to the IT system, Magna Steyr gave feedback to the partner via various ways/approaches, e.g., direct conversation or reporting of problems occurring from a lack of understanding. Referring to Magna Steyr's experience in the BMW projects, the deployment of the feedback given helped the knowledge transfer approach to become more and more aligned to the receiver's preferences. In the course of the partnership, BMW and Magna Steyr established certain procedures for working together and exchanging knowledge in turn. For example, on a project level team members agreed on the positive effects of regular meetings to structure constant interaction and give more freedom to personal interaction in between those meetings. Both partners experienced those kinds of partner-individualization processes in the knowledge transfer process.

Secondly, feedback activities concerning the transferred knowledge and its quality took place in the interactive knowledge transfer process. For example, the knowledge receiver had trouble in understanding the received knowledge, as was the case with Magna Steyr receiving knowledge about the diesel particle filter engine technology. Knowledge transferred from Mercedes Benz was highly abstracted and could not be put into Magna Steyr's portfolio due to missing knowledge. This absent knowledge caused a lack of understanding. Therefore, Magna Steyr provided feedback concerning the content of the transferred knowledge and missing aspects from Mercedes Benz.

Thirdly, there was inadequate, or even no, feedback. This case is very important as it represented a worst-case scenario for the knowledge sender. As mentioned in the introduction of this section, project team members involved in the three case projects underlined the value of feedback for improving collaborative work. In some areas, Magna Steyr did not receive any kind of feedback from its collaborating partners. Especially in these areas, Magna Steyr was disappointed about the lost opportunity to improve their content and their approaches to transfer knowledge. Indirect feedback was given when identifying methods, tools, and procedures within the partner's organization afterwards. However, this could not be traced back 100% to the source of the

observable changes. The approaches used to give consolidated feedback were review meetings or lessons-learned meetings after the project. Some kind of similar impact was observable when feedback was given on a high level of abstraction. Especially, the two OEMs tended to proceed in this way as they gave unspecified feedback such as *knowledge was not understood* or *there occurred a problem with a specific solution to this and that problem*. This level of abstraction meant doing all of the work again, explaining everything in detail, and running another extensive knowledge transfer instead of improving the existing process by eliminating unsuccessful elements. This in turn hindered the transfer process from becoming more efficient.

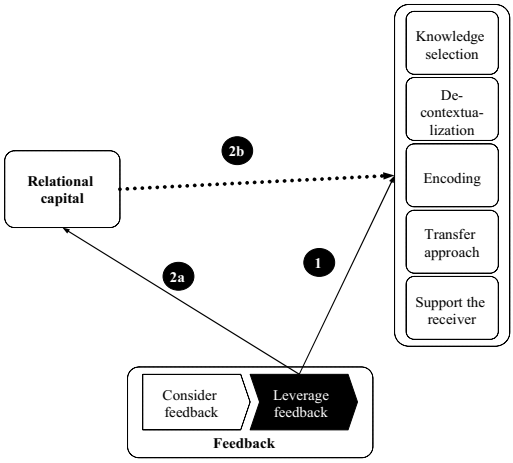


Figure 6.08 - Impact of feedback on knowledge transfer success

Similarly to the impact of relational capital on knowledge transfer success, feedback did not indicate a direct impact either. Rather, it showed two different outcomes, including the impact on the relational capital base and the potential for improving the knowledge transfer process. As outlined in Figure 6.08, feedback affected the DiC of knowledge selection, de-contextualization, encoding, designing the knowledge transfer approach, and supporting the knowledge receiver. This tended to be the short-term impact (1). In the long run, feedback was a valuable resource for broadening the relational capital base. Feedback from the knowledge receiver on the knowledge transfer process also helped in learning about the partner's preferences and his individual requirements to make the transfer even more successful. These small bits and pieces arising from gestures, remarks, direct talks, or review meetings formed a picture of

how and where to improve the transfer process (2a). The extended relational capital base concerning the partner's preferences then helped to individualize the transfer process, which impacted the transfer performance, as outlined in chapters 6.1.2-6.1.6 (2b). Confirming this tendency, Magna Steyr outlined the process transformation toward partner- and even team member individual knowledge transfer procedures.

Disseminative capabilities

In reference to the case studies conducted, benefits from feedback follow a process similar to relational capital. First, the knowledge sender needs to consider feedback if any was given by the receiving partner. Secondly, feedback and its potential to improve knowledge transfer needs to be unleashed by leveraging the information and hints embedded in the feedback. If feedback is that important for the knowledge sender to impact on the transfer success, how can she optimize the process of considering and leveraging it?

Considering feedback occurred in a manner quite similar to the receiving process of knowledge itself; however, most of the deployed feedback was given via interpersonal and rich transfer approaches such as face-to-face talks or at least directly over the phone. Regarding feedback as knowledge, this additionally underlines the alternating character of the sender and receiver roles of both partners. The knowledge receiver provided feedback by transmitting signals, e.g., explicitly by describing the knowledge elements missing or by signaling questions or doubts through gesture (Luft 1971; Dehees 1994). Subsequently, the knowledge sender acknowledged the feedback and, as happened in most of the cases, took action in preparing activities to use this source for improvement. Feedback on transferred knowledge itself aimed to trigger a process of self-reflection regarding the depth, breadth, suitability, quality, validity, and reliability of transferred knowledge. A good illustration of these internal processes was observable in the case of Magna Steyr transferring knowledge about problems as they arose. When the analysis of problems was called for, the OEMs mostly gave the lead back to Magna Steyr. Magna Steyr tended to spend great effort on understanding and solving problems on their own before considering help. One reason for that was the collaboration setting, featuring Magna Steyr as the partner being paid for delivering ideas and solving problems. Before submitting a problem, therefore, project team members tried to find its causes and effects, structure it, and based on that, initiate the interaction with the partner. As one essential outcome, the problem was at least structured and better interpenetrated than it would have been without doing so, and Magna Steyr was quickly able to come up with ideas to solve the problem. Contrary to that, Mercedes Benz

received feedback from Magna Steyr in the 4-matic series collaboration on the adequacy of the knowledge transfer approach they deployed but did not use that feedback for transfer process improvement.

Once the feedback from the knowledge receiver was absorbed, the knowledge sender decided whether to take action or not, as seen in the above-mentioned examples. If she decided to take action and to leverage this source for transfer process improvements, potential causes for the feedback were analyzed first. Ongoing activities to solve the root causes of the feedback were planned, and the knowledge transfer changed with respect to the dimensions already known (content, transfer process). Throughout the three cases, the knowledge transfer process improved once the feedback was considered and the ongoing transfer action leveraged this rich source of improvement. After the knowledge sender leveraged the received feedback, she could smooth out problems of misunderstanding, missing knowledge, or disadvantages of the deployed knowledge transfer process.

To refer to a methodology-specific example, an inadequate process of transferring knowledge, e.g., an inappropriate encoding process or insufficient integration support was as cumbersome as an unaligned knowledge selection that disregarded the receiver's needs and demands. Team members from all three partners were speaking the same language, came from a similar cultural region, and the same industry. However, differing technical terms, abbreviations, the company-specific language, and the like (e.g. Carlile *et al.* 2003) caused some problems in understanding. Team members' specific feedback addressing those issues helped the sender to follow up with further explanations or to use more general terms the next time.

Shaping the hypothesis

The working proposition on utilizing the receiver's feedback only addressed the second part of the feedback process, which underlines the deployment of feedback to increase the knowledge transfer process. However, the consideration of feedback as seen in the analyzed case studies was simply a function of motivation. The reason why BMW and Mercedes Benz did not react to feedback from Magna Steyr was mainly that they wanted Magna Steyr to solve problems itself. Therefore, considering feedback was only the precondition and set the stage for its later use. When it came to leveraging this source of improvement, the knowledge sender utilized self-reflection and self-monitoring capabilities in order to increase the knowledge transfer process in the two outlined ways (*see* Figure 6.08). Therefore, I basically stay with working proposition P^8 as capabilities are addressed in the thesis at hand. The case studies analyzed

reveal that the mechanisms for leveraging feedback increased knowledge transfer success; thus, this was another DiC indirectly impacting transfer success. Considering the two different ways of impacting knowledge transfer success, I present two hypotheses, each of which concretizes a particular working mechanism. Thus, I state:

Hypothesis H^{8a} *The knowledge sender's capabilities to leverage feedback from the receiver by improving knowledge transfer activities is positively related to inter-organizational knowledge transfer success.*

Hypothesis H^{8b} *The knowledge sender's capabilities to leverage feedback from the receiver by broadening the relational capital base is positively related to inter-organizational knowledge transfer success.*

6.2 Summary

Table 6.03 summarizes the development pathway from the (working) propositions to hypotheses based on the findings from the empirical investigations. The table follows the same idea as the hypothesis section (6.1.1-6.1.8). Starting from the findings, the related working proposition was examined and the final hypothesis was shaped. The order follows the order of the final hypothesis, and besides the working proposition and the hypotheses, it also displays empirical findings and the weaknesses identified in the working propositions.

Table 6.03 - Development pathway from the working propositions to the hypotheses

No.	Working proposition (chapter 4)	Empirical findings (wrap-up) (chapter 5 & 6)	Weaknesses of the working proposition	No.	Hypothesis (chapter 6)
		▪ Reliability and trustworthiness do have an impact on the value of the knowledge source and the transfer success. ▪ The understanding of knowledge and the value increased through intense transfer knowledge applications in the past. ▪ Self-empowering circle to become a valuable knowledge source works in positive and negative directions ▪ Understanding the transfer knowledge and convincing the partner was important.	▪ Being a knowledgeable and trustworthy knowledge source is not a capability and was therefore not included in the working propositions. ▪ Nevertheless, developing towards a valuable knowledge sender is one of the most essential processes for the knowledge sender to go through. ▪ The impact of being a valuable knowledge source is considered to be big.	**H^1**	Being considered as a *valuable knowledge sender* positively impacts on the inter-organizational knowledge transfer success.
P^6	The success of inter-organizational knowledge transfer is related to the ability of the knowledge sender to *select* the knowledge *relevant* to be transferred.	▪ Knowledge selection was the initial step in the transfer. ▪ The evaluation of the partner's knowledge base was important. ▪ Knowledge portfolio concept arose.	▪ Capability is important before the first transfer activity can be launched. ▪ It is not only about the selection of relevant transfer. It is more like relating the knowledge needs and exiting knowledge sources to enable an optimal knowledge base combination.	**H^2**	The success of inter-organizational knowledge transfer is positively related to the *knowledge selection*, that is, the ability of the knowledge sender to relate knowledge requirements and the receiver's existing capabilities.

No.	Working proposition (chapter 4)	Empirical findings (wrap-up) (chapter 5 & 6)	Weaknesses of the working proposition	No.	Hypothesis (chapter 6)
P^1	The success of inter-organizational knowledge transfer is related to the ability of the knowledge sender to *de-contextualize* the knowledge to be transferred.	▪ De-contextualization is the trade-off between effort and benefit. ▪ Knowledge sender in search of the optimal de-contextualizing degree. ▪ Contextual knowledge indispensable for understanding and ongoing application.	▪ De-contextualizing implies a trade-off between effort and benefit which was not considered in the working proposition. ▪ A high degree of de-contextualization required less effort however the likelihood of the transfer to fail (understanding problems within the receiver) increases. ▪ The knowledge sender has to find the optimal degree of knowledge de-contextualization according to the individual transfer setting.	H^3	The capability of the knowledge sender to realize the optimal degree of *knowledge de-contextualizing* is positively related to the success of inter-organizational knowledge transfer.
P^2	The success of inter-organizational knowledge transfer is related to the ability of the knowledge sender to *encode* the knowledge to be transferred.	▪ Without encoding knowledge transfer is not possible at all. ▪ Important issues are different expert level, taking the perspective of the receiver, and enable the decoding within the sender.	▪ The ability to encode knowledge in a way, that the knowledge receiver can decode this knowledge afterwards in his coding system is success-critical.	H^4	The ability of the knowledge sender to *encode transfer knowledge* according to the receiving partner's coding system is positively related to the success of inter-organizational knowledge transfer
P^3	The success of inter-organizational knowledge transfer is related to the ability of the knowledge sender to *design an appropriate communication approach.*	▪ Knowledge transmission is a two-step procedure containing transfer approach design and its execution. ▪ The approach design addresses the combination of adequate channels and media according to the given transfer setting. ▪ Some channels and media require communication processes, for which reason the knowledge sender needs communication competencies as well to execute the transfer approach.	▪ The whole process is about transferring knowledge and not about communication. ▪ Richer channels deploy more interactive communication. ▪ Effective communication is therefore part of the general execution process which is required for all transfer approaches.	H^5	The ability of the knowledge sender to execute an adequately designed *transfer approach* is positively related to the success of inter-organizational knowledge transfer.
P^4	The success of inter-organizational knowledge transfer is related to the ability of the knowledge sender to *communicate effectively.*				

No.	Working proposition (chapter 4)	Empirical findings (wrap-up) (chapter 5 & 6)	Weaknesses of the working proposition	No.	Hypothesis (chapter 6)
P^7	The success of inter-organizational knowledge transfer is related to the ability of the knowledge sender to *support the receiver* in the knowledge application.	▪ Knowledge application is the process step when the transfer realizes benefits. ▪ Trade-off between support to realize a successful product and additional effort (in addition to the contractual payment) occurred.	▪ *Empirical findings support working proposition.*	**H^6**	The ability of the knowledge sender to *support* knowledge *application* is positively related to the success of inter-organizational knowledge transfer.
P^5	The success of inter-organizational knowledge transfer is related to the ability of the knowledge sender to *build up* and *leverage relational capital.*	▪ The benefits from this important source of successful transfer relied on two equally important steps, namely building-up relational capital as fast as possible and utilizing it adequately. ▪ Relational capital contains partner-specific, relationship-specific knowledge and insights into the receiver's knowledge portfolio.	▪ The two steps equally impact the knowledge transfer success. To find the relationship therefore both steps have to be analyzed independently to get a reliable result.	**H^{7a}**	The ability of the knowledge sender to *build up relational capital* is positively related to the potential impact on the related disseminative capabilities and thereby inter-organizational knowledge transfer success.
				H^{7b}	The ability of the knowledge sender to *leverage relational capital* to increase the impact of related disseminative capabilities is positively related to the success of inter-organizational knowledge transfer.
P^8	The impact of the knowledge sender's capabilities is different in the presence of the ability to utilize the receiver's *feedback* for transfer process improvement.	▪ Feedback is a valuable source to improve the knowledge transfer process. ▪ Impact occurs in two different indirect ways, (1) improvement of the core process DiC (except the valuable knowledge source dimension) and (2) the broadening of the relational capital base.	▪ Working proposition lacks the dimensions and mechanisms to benefit from feedback. ▪ Two step process needs to be split into its core and distinctive parts and considered separately.	**H^{8a}**	The knowledge sender's capabilities to *leverage feedback* from the receiver by improving knowledge transfer activities is positively related to inter-organizational knowledge transfer success.

No.	Working proposition (chapter 4)	Empirical findings (wrap-up) (chapter 5 & 6)	Weaknesses of the working proposition	No.	Hypothesis (chapter 6)
		▪ Feedback's full potential is revealed when leveraging included information in deploying them in process improvements (content or transfer process).		**H^{8b}**	The knowledge sender's capabilities to *leverage feedback* from the receiver by broadening the relational capital base is positively related to inter-organizational knowledge transfer success

6.3 Revised model of DiC

The revised model on disseminative capabilities shows some important changes compared to its preliminary the initial design given in chapter 4. First of all, the capability to develop into a valuable knowledge source was very important for knowledge transfer success, and this capability is featured in the revised framework on DiC. The center of the revised model features the steps of selecting knowledge, de-contextualizing it, encoding it, designing a transfer approach, and supporting the knowledge application within the receiver. One new disseminative capability (valuable knowledge source) is added due to its impact on the transfer success. Additionally, feedback and relational capital have been assigned new positions within the model. Now, these DiC are positioned within the model to reflect their impact functions, i.e., relational capital impacting related capabilities and feedback as empowering the impact of related disseminative capabilities as well, as outlined in Figure 6.09.

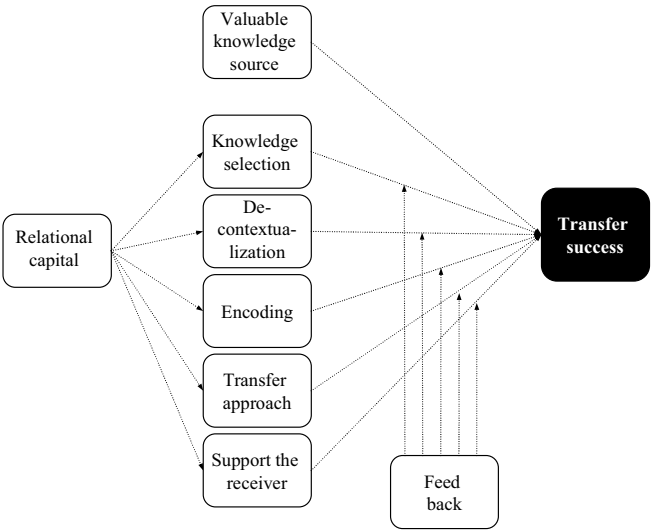


Figure 6.09 - Revised model of disseminative capabilities

In chapter 3, I introduce the construct of DiC as the abilities of the knowledge sender resulting in activities which impact the success of knowledge transfer. I understand

disseminative capabilities as a multidimensional construct. Starting from this definition derived from the literature review and initial fieldwork, I entered the in-depth case study work based on the preliminary conceptual model and eight working propositions. After the case study and the cross case study analysis, I determined eight capabilities constituting the concept of disseminative capabilities. In the case study work it turned out that being considered as a

(1) Valuable knowledge sender

is a necessary precondition for successful knowledge transfer. The knowledge sender herself creates this profile. Once the collaboration is founded, partners launch the transfer process, including

(2) Knowledge selection

(3) Knowledge de-contextualization

(4) Knowledge encoding

The first three capabilities are in chronological order. If it is clear what knowledge it takes to realize a certain project step, the relevant know-how can be selected. Selecting knowledge initiates the process of de-contextualizing, where knowledge, thus far embedded in people, tasks, or routines within the sender, has to be detached from its specific context. Before the physical transfer occurs, the encoding of selected and de-contextualized knowledge takes place. For example, knowledge is written down or articulated in a presentation. Subsequently, an adequate

(5) Knowledge transfer approach has to be designed

by selecting and combining appropriate channels, media, and a mode for an effective transfer. To finally reach the objective of successfully applying the knowledge, the senders' capability to

(6) Support the knowledge application

is of importance. Furthermore, the knowledge sender has to

(7) Build up and utilize relational capital,

e.g., in order to find the right contact persons within the receiver’s organization, speaking the receiver’s language, etc. Relational capital leverages the positive effect of the previously listed capabilities. Lastly, the knowledge sender needs to

(8) Consider and use feedback

from the receiver. The more she is able to react in a proper way upon the feedback given, the more successfully the knowledge transfer is conducted.

Chapter 7 -

Discussion and implications of results

Chapter 7 - the last leg of this thesis - presents the end of my research journey and concludes with a consideration of the research findings from a management (7.1) and theoretical perspective (7.2). In chapter 1, I introduced the objectives of my work, which now serve as benchmarks when reflecting upon research findings from the practical and the theoretical perspective. In the following section, the actual research achievements and the objectives outlined for this work are challenged (7.3). During my research, I made use of a number of assumptions and definitions to focus the work as much as possible in order analyze the addressed problem. Based on these decisions and definitions regarding the research methodology, the framework and the unit of analysis have to be challenged and reflected upon in terms of the generalizability and limitations of the findings. Furthermore, as this work represents the final milestone of my doctoral studies the dissertation pathway is critically reflected (7.4). Since my work focuses on a very specific topic, the research conducted here on the context domains of transfer literature opens the door to follow-up questions, which can serve as the starting point for further research (7.5).

It turned out that research on knowledge sender capabilities is of high practical and theoretical importance and the impact of disseminative capabilities on inter-organizational knowledge transfer success is shown. The latter finding addresses the overall research question **Q** - Do disseminative capabilities enhance the success of knowledge transfer in inter-organizational PD projects? - guiding this work.
In the analysis of the three case studies conducted, which focus on inter-organizational PD projects, reveals that knowledge transfer from the sender's side represents more than the result of spill-over effects, as Cohen and Levinthal (1990) described the source's duties. The sender plays the role of the valuable knowledge source in selecting, de-contextualizing and encoding knowledge, designing the transfer approach, and supporting the knowledge application in the knowledge transfer process. Furthermore, she deploys relational capital and feedback to impact the previously mentioned process steps. The bundle of disseminative capabilities represents the dimensions of this introduced construct and thereby aims to answer sub-research question $\mathbf{q}^{\mathbf{one}}$ - what are the main dimensions of disseminative capabilities? Furthermore, the variations in the knowledge sending activities and differences in performing these activities observed in

the case study work help to confirm that disseminative capabilities have an impact on knowledge transfer performance. These capabilities help to explain varying performances of knowledge transfer between the analyzed projects. Therefore, this work also answered research question $\mathbf{q^{two}}$ - do disseminative capabilities explain why knowledge transfer success varies across inter-organizational projects? Both collaboration partners rely on the success of the knowledge transfer, as in the case of the analyzed collaborative projects. The success of knowledge sending becomes as important as knowledge receiving; hence, companies have to develop capabilities to succeed at both ends (sending and receiving) of partner-oriented knowledge transfer. In the case study investigations and the cross-case analysis, we saw more or less successful methods, tools, and approaches for knowledge transfer. To derive the managerial implications I follow the structure of the final research model outlined in Figure 6.09. Simultaneously, I indicate the ways to develop disseminative capabilities. Addressing sub-research question $\mathbf{q^{three}}$ - can disseminative capabilities be developed, and if so, how?

7.1 Management Implications

At the beginning of the work, I outlined the practical relevance of collaborative PD work in the automotive industry today. This in turn indicated that knowledge transfer has become an important management task and organizations have to establish processes and methods to manage knowledge exchange when working jointly with a partner company. Without knowledge transfer, none of the analyzed collaborations would have been successful in terms of creating a product ready to be launched to the market. As knowledge transfer consists of the sending and the receiving process, managers face the challenge to succeed in both activities in order to perform collaborative product development. Knowledge sending and the capabilities of the sender were in the focus of this research study and revealed various fields of action to improve the process of knowledge transfer from the sender's side. In the following sections, these fields are outlined, pointing out the managerial implications derived along the set of identified disseminative capabilities.

7.1.1 Valuable knowledge sender

The positive relationship between the degree to which a knowledge sender is considered valuable and knowledge transfer success is indicated in hypothesis H^1. This relation implies that companies face the need to establish procedures to develop into a

trustworthy and knowledgeable source. The frequency of and variations in knowledge application and the knowledge base development through the application process were drivers for becoming a knowledgeable sender. Furthermore, the hypothesis - being considered a *valuable knowledge sender* positively impacts on the inter-organizational knowledge transfer success - determined that being knowledgeable is not sufficient for a successful transfer of knowledge to the partner. To the same extent, the knowledge sender is obliged to convince the partner of her value as a knowledge sender. Facing these two influential steps, the knowledge sender must develop her capabilities in both fields.

Providing time to develop knowledge internally and to develop the understanding within the company that knowledge is of high importance to organizational success helps a company on the way to becoming a knowledgeable sender. Frequent and varying knowledge application supports the interpenetration of one's own knowledge base, to identify possible lacks in understanding and work on their elimination so that the organization's knowledge base can be broadened and deepened. Establishing and maintaining close relationships with universities, research institutes, and other companies to get access to new technological know-how represents another possible way for organizations to become more knowledgeable. As being knowledgeable represents the half-way point to successful knowledge transfer, the sender has to develop 'sales' capabilities in terms of convincing the partner that she is a valuable knowledge source. Presentation skills and providing high-quality knowledge are enablers for achieving the status of a valuable knowledge source. Limiting knowledge transfer to know-how which is completely understood by the sender, for example, resulted in being regarded as a valuable knowledge source.

7.1.2 Knowledge selection

Before the knowledge sender starts the transfer of knowledge, she selects the knowledge for transfer purposes. Impacting parameters for this selection process are the collaborative setting, the ongoing tasks, or the partner's strengths and weaknesses concerning required knowledge assets. Hypothesis H^2 - The success of inter-organizational knowledge transfer is positively related to the *knowledge selection*, that is, the ability of the knowledge sender to relate knowledge requirements and the receiver's existing capabilities - implies two different impacts of a good selection on knowledge transfer. First, it limits the sending effort due to more focused transfer ac-

tivities, and secondly, the receiver is able to apply this knowledge more easily when deploying it in his knowledge base.

The knowledge sender has to follow certain rules in order to successfully deploy a knowledge portfolio approach. When using the portfolio concept, the sender needs to win the approval of the receiving partner regarding the evaluated picture. This requires the receiver in turn to present a picture of his portfolio and to correct the sender if she makes wrong assumptions. In practice different practices and methods to realize the portfolio approach emerge, e.g., LSV's as a formal instrument depicting required knowledge assets and potential sources along the project time line, or the technical networker, an individual who evaluates strengths and weaknesses in the partners' portfolios and relate knowledge sources and potential receivers. As is the case for the early collaboration phase, partners submit offers based on given project requirements, give pitch presentations, and have negotiation meetings. This also indicates a kind of knowledge portfolio displaying strengths and the weaknesses. As the portfolio approach enables a more efficient combination of strengths, the knowledge sender needs the receiver to depict his portfolio. One key to success is the design of one's own knowledge portfolio to provide the partner a good picture for her knowledge selection process and the support of the receiver on picturing the knowledge portfolio (evaluation in interpersonal contact, establish rules to proceed the portfolio, etc.). An important rule to follow when deploying the portfolio concept for knowledge selection procedures is to rely on a portfolio picture that has actually been evaluated and not to make assumptions regarding the partner's knowledge base. Often partners deployed the portfolio approach based on an old portfolio picture from former collaborations.

7.1.3 Knowledge de-contextualizing

The cases reveal that the de-contextualizing of knowledge plays an important role in transfer success. In order to benefit from knowledge transfer, the receiver applies transferred know-how. To be able to deploy transferred knowledge in the given project setting, he needs to understand the context the transferred knowledge originally emerged from. Hypothesis H^3 - The capability of the knowledge sender to realize the optimal degree of *knowledge de-contextualizing* is positively related to the success of inter-organizational knowledge transfer - puts the knowledge sender in charge of finding this customized degree. The thesis at hand reveals that tending more toward a lower level of de-contextualizing represents the more successful strategy. Furthermore, the de-contextualization is closely related to the concept of the knowledge portfolio and

the transfer knowledge selection. Insights into the partner's portfolio facilitate a more precise estimation of what contextual knowledge is still needed and how much supplementing know-how already exists.
One way to develop this de-contextualizing capability is to prepare project team members for tasks such as considering the partner's knowledge, his background, and more generally, to take the receiver's perspective. Such internal training sessions should be heavily recommended to technical experts. Especially this group shows tendencies toward abstracting too much, i.e. choosing a very high degree of de-contextualizing while disregarding the level of existing contextual understanding within the receiver. With special coaching, project team members are trained to take the partner's perspective.

7.1.4 Knowledge encoding

After the knowledge sender has selected and de-contextualized the transfer knowledge, she chooses a way to encode her thus far tacit knowledge in a signal form to transmit it to the receiver. Various types of encoding approaches such as oral communication or written documents occur in practice. During this process step, the knowledge sender is in charge of selecting a coding scheme which allows the receiver to utilize his own decoding approach to decipher the message and extract the knowledge within. Hypothesis H^4 - The ability of the knowledge sender to *encode transfer knowledge* according to the receiving partner's coding system is positively related to the success of inter-organizational knowledge transfer - addresses this relationship by underlining the necessity to deploy an appropriate coding scheme. Otherwise, the transfer fails. Therefore, to solve comprehension problems, the knowledge sender is charged with deploying understandable terms and refraining from company-individual knowledge, thereby enabling decoding within the receiver's coding system.
Knowledge encoding addresses more the technical aspects of communication topics, and in general knowledge senders do not devote much attention to this process. Nevertheless, as firms recognize the value of a complete understanding of the transmitted signals, the employees involved should be trained in this disseminative capability prior to the collaborative work. A special issue for this training is the emphasis on considering the language and the terms the receiver understands, e.g., keeping explanations in an understandable form, and they should be addressed at least to technician. The encoding capability seems to be less easy to develop compared to the other DiC. Again, experts tend to deploy their own coding scheme, as they assume that non-experts have

the same coding scheme and are therefore able to understand transferred knowledge and to decode it. The latter issue in particular indicates room for improvement and represents a starting point for internal training and coaching to increase the effectiveness of the sender's role in this important dimension.

7.1.5 Designing the transfer approach

Hypothesis H^5 - The ability of the knowledge sender to execute an adequately designed *transfer approach* is positively related to the success of inter-organizational knowledge transfer - implies the need for the knowledge sender to be familiar with different transfer channels und media and to be able to design the transfer approach according to the collaborative situation. Various impacting factors explain why certain approaches are preferred over others. The question here is whether and how the knowledge sender can learn which approaches to deploy in which situation. The more the knowledge sender was capable of reading the complex setting in which the transfer took place, the better the designed transfer approach fulfilled expectations of the knowledge transfer.

Deploying different knowledge transfer approaches helped the sender to initiate a learning loop and to benefit from her expertise in the next transfer activity. On the other hand, as there is not that much room for experimentation and failure, the organization should provide a framework for collaborations containing basic rules and procedures for interaction, such as review meeting schedules. In between, the employees have the freedom to figure out and thereby develop a feeling for the adequacy of different knowledge transfer approaches. Deploying rich transfer channels supports the transfer of required knowledge especially in the early collaboration phases and helps employees to decide where to maintain these approaches and where to deploy less rich ones based on efficiency considerations. As the selection of an adequate transfer approach is based on experiences, organizations should involve employees in as much projects as possible to gain such knowledge, e.g., in intra-organizational or cross-business unit collaboration projects requiring similar transfer procedures.

When considering the execution of the knowledge transfer approach designed, interpersonal communication is in the focus. Especially communication skills are a field for training and coaching initiatives. In this way, employees learn how to communicate in different situations and with different people. Technical experts in particular tend to avoid inter-personal communication; hence, communication coaching generates important benefits as they are the carriers of highly important knowledge. For example,

involving psychologists and communication experts in these training sessions would improve inter-personal communication skills. Another way of training these people might be to involve them in presentation and communication situations more often.

7.1.6 Supporting the knowledge application

This work follows the idea that the knowledge application determines the success of the overall knowledge transfer. Hypothesis H^6 - The ability of the knowledge sender to *support* the knowledge *application* is positively related to the success of inter-organizational knowledge transfer - takes it even further and underlines that the support from the knowledge sender is critical to knowledge transfer success. Without ongoing support, the transfer process harbors potentially grave problems in applying transferred knowledge. For the application support the sender supports the receiver, e.g., providing missing knowledge, sending experts to work on problems, or establishing an organizational role like the technical facilitator to provide faster support. Application support is necessary to overcome problems, e.g., lacks in understanding, missing application knowledge, casual ambiguity, or too little retentive capacity.
The capability to support the knowledge receiver in applying the transferred knowledge is a function of motivation and the priority given to the particular project. Observed activities undertaken to enable a knowledge application were routines and based on the experiences within the knowledge sender. Often differences in knowledge transfer performance can be traced back to the mindset toward the partnership, the assumed role of the receiver, or the idea of knowledge transfer. Here the management can be a good example by treating the partner as a valuable part in the collaboration and providing support wherever necessary. Aiming at the long-term goal to establish further collaborations in order to leveraging partner-specific investments underlines the motivation to ensure that the knowledge receiver fully understands the transferred knowledge. Another lever the management can utilize is to give high-priority to a certain collaborative project, which helps to get the necessary resources to be able to ensure adequate application support.
In order to develop this DiC, the partners have to work on their mindset toward their collaborative work and reciprocate knowledge transfer to improve transfer performance. Executing support activities, especially during the application of knowledge, did not differ from the transfer activities mentioned before. The sender identified lacks in understanding and provided ongoing support based on the receiver's feedback. Accompanying the application process additionally helped the receiver to integrate the

know-how into the existing knowledge base. Therefore, supporting the receiver to understand the transfer knowledge, applying it, keeping it internally, and avoiding casual ambiguity from occurring are related to the attitude and the mindset of the knowledge sender.
As the support of the knowledge application is often tied to high-interactive transfer approaches, both partners can co-locate the project teams. This helps to increase the total number of contacts as well as the opportunity to receive instant support in the case of problems.

7.1.7 Relational capital

Knowing the project partner, having an idea of his knowledge bases, and insights into working procedures or decision processes help collaborating partners to focus on transfer activities and in turn to shorten development times. Before leveraging this asset, partners invested in building up a relational capital base. These two separate steps are reflected in hypotheses H^{7a} - focusing the building up of relational capital - and H^{7b} – focusing on the leverage of relational capital to impact on related DiCs to increase the inter-organizational knowledge transfer success. In order to benefit from this asset organizations have to diffuse relational capital internally; otherwise, unlearning and employee rotation hinder the knowledge sender from unleashing its full potential.
Along the outlined 4-step approach (*see* Figure 6.07) to gain benefits from utilizing relational capital, the possibilities for the knowledge sender to develop her DiC become clear. Building up the relational capital base mainly requires interactive processes between the participating project team members. Management needs to set up a standard procedure to bring together project team members and, even more importantly, execute this approach as an integrated part during collaboration initialization. In the second step, the existing relational capital has to be diffused within the sender organization. This diffusion process requires intra-organizational knowledge transfer procedures and the establishment of tools and methods supporting the diffusion. Job rotation within the organization, mentoring programs, project databases, and intra-net solutions providing insights into the existing knowledge carriers, or procedures for project staffing are just some of the instruments supporting this diffusion process. The last of the listed methods, for example, can help to keep a certain core team, which knows the partner already and can spread this expertise among new team members.

One of the downsides of the approach utilizing relational capital is its often observable anticipation; wrong expectations worsened the knowledge transfer success due to poor knowledge transfer adjustments. Therefore, anticipation of relational capital must be avoided. Instead, the actual relational capital base has to be evaluated before relational capital is leveraged – here, the management is in charge of ensuring this process through, e.g., regulations, process rules, etc.

7.1.8 Feedback

Feedback indirectly impacts knowledge transfer success via improving related DiCs by individualizing the activities according to the partner's preferences, which is addressed by hypothesis H^{8a} - The knowledge sender's capabilities to *leverage feedback* from the receiver by improving knowledge transfer activities is positively related to the inter-organizational knowledge transfer success. These preferences become clear through feedback provided on the transfer performances. Furthermore, leveraging feedback supports the build-up of relational capital by recognizing the receiver's preferences and 'storing' them, which is reflected in the hypothesis H^{8b} - The knowledge sender's capabilities to *leverage feedback* from the receiver by broadening the relational capital base is positively related to inter-organizational knowledge transfer success. Prior to leveraging feedback, the knowledge sender receives these signals and then decides whether or not to consider this source of process improvements.

As with the support activities for knowledge application, considering feedback is a matter of the motivation and mindset of the knowledge sender. Again the management plays an important role in guiding this collaborative work and creates an environment which encourages the consideration of feedback as an important source for transfer improvement. Furthermore, changes in the mindset in this respect help to increase collaborative work performance and the inter-organizational knowledge transfer success.

The leveraging of feedback impacted knowledge transfer success in the ways already outlined. The knowledge sender has to identify the value of the feedback provided and improve the transfer activities according to the receiver's preferences, e.g., changing the deployed transfer media, providing more background information, or application support. Additionally, the leveraging, and especially the consideration, of feedback have important potential. Feedback inherently entails a request for and expectation of help and improvement in the transfer activities in question. Disregarding feedback sends negative signals to the knowledge receiver, and his motivation to provide further feedback in the future will decrease until this valuable resource for knowledge transfer

improvement finally disappears. The knowledge sender can turn this tendency in the other direction by asking pro-actively for feedback, thereby gaining the benefits outlined. Organizations more and more are deploying lessons learned and closing meetings as an integrated project task to gather feedback to improve their way of collaboration. This can be adapted to the knowledge transfer process as well. Management needs to make these steps part of the collaborative project in order to benefit from this valuable source for improvement.

Collaborative PD is an increasing phenomenon, as is knowledge transfer, to turn these collaborations into successful ones. As the knowledge sender impacts on this transfer, disseminative capabilities play an important role in this relationship. Faced with the reality of the importance of DiC, managers need to consider activities to develop disseminative capabilities. Table 7.01 gives a summary of the possibilities for the knowledge sender to develop DiC. The degree and extent of development opportunity differ between the capabilities; nevertheless, the table indicates that there are a lot of potential and areas to develop competitive edges in knowledge sending. The table and the derivation of the recommendations for management given in chapter 7.1 provide a recipe for improving knowledge transfer from the sender. Following the approaches given should help companies to gain insight into fostering valuable knowledge exchange and to create a practical guideline (Levin *et al.* 2004; Murray *et al.* 2007).

Table 7.01 - Impact and development strategies for DiC

Capability	Impact on transfer success	Development of these capabilities
Valuable knowledge sender	The more the sender is considered a valuable, the more successful the transfer of knowledge is.	▪ *Knowledgeable* sender – frequent application of knowledge, variations in knowledge applications, internal development of this know-how, self-reflection upon the knowledge assets/gap in understanding. ▪ Being *considered* a valuable knowledge source – develop presentation skills of project team members, transfer only fully understood knowledge.
Selecting knowledge	A partner-adequate knowledge selection according to the project setting, the ongoing project tasks, and the partner's knowledge base increase the success of the transfer process.	▪ Evaluate the partner strengths and weaknesses; and do not assume the existing base. ▪ Involve the partner in the evaluation process and get his agreement upon the outlined picture. ▪ Provide an actual picture of one's own portfolio to the receiver as roles are permanently alternating. ▪ Integrate the portfolio idea in already existing project management tools, e.g., LSV's or the technical networker.
De-contextualizing	The right degree of de-contextualizing increases the success of knowledge transfer.	▪ In coaching and training sessions project team members are prepared to detach knowledge according to the receiver's know-how base. ▪ Learn how to find the optimal degree of de-contextualization. ▪ Train especially technical staff.

Capability	Impact on transfer success	Development of these capabilities
Encoding	Knowledge transfer is successful if the sender encodes the transfer knowledge in a form the receiver is able to decode in his own coding scheme.	▪ Deploying terms and language the receiver is able to decode in his own coding scheme. ▪ Train experts to deploy more general explanations instead of high-technical terms or an expert coding scheme. ▪ Train technical experts to speak the language of less expert people.
Design and utilize the transfer approach	An adequate transfer approach enables a successful knowledge transfer. Nevertheless, the project team members need to execute this approach in a proper way in order to unleash its full potential.	▪ Involve people in collaborative work to experience the advantages and disadvantages of certain approaches in different collaborative settings. ▪ Train people in executing the transfer approach, especially those featuring inter-personal communication. ▪ Increase the communication skills in coaching and training workshops. ▪ Train people in intra-organizational and cross-business unit projects. ▪ Provide a framework for knowledge transfer activities on the organizational level. Leave room for experimentation for the individuals to find their way of designing and executing knowledge transfer approaches.
Application support	Ongoing support activities help the knowledge receiver to understand transferred knowledge, apply this transferred know-how successfully, overcome causal ambiguity, and to ensure the storage of received knowledge.	▪ The mindset and the motivation of the sender determine whether she provides the necessary support activities or not. This mindset and motivation can be increased by opening minds (collaboration as opportunity not as danger). ▪ Management has to pay the necessary level of attention to collaborations to provide the necessary resources. ▪ Product-related work bringing the employees involved together to work on problems or other issues. ▪ Accompany the receiver through the whole application process, providing all the necessary support and further required knowledge.
Relational capital	The leveraging of relational capital enhances the impact of the core process DiC and thereby impacts indirectly on the transfer success.	▪ Gaining the benefits from utilizing relational capital is the result of a 4-step process containing the building-up, diffusing, evaluating of the actual relational capital base, and leveraging phase. ▪ *Building up* - bringing together the people involved as early in the project as possible; visualize knowledge carriers and responsibilities. ▪ *Diffusing* - establish methods, tools, and procedures for intra-organizational knowledge transfer (e.g. job rotation, mentoring program, knowledge-related databases). ▪ *Actual evaluation* - never rely on assumptions of the relational capital base; evaluate it instead similarly to the portfolio evaluation prior to the knowledge selection process. ▪ *Leveraging* - adjust related DiC to the partner in order to optimize the transfer process.

Capability	Impact on transfer success	Development of these capabilities
Feedback	Considered and leveraged feedback indirectly impacts the knowledge transfer success by increasing the relational capital base and the improvement of the core process DiC.	▪ Considering feedback is related to the motivation and the mindset of the knowledge sender. ▪ Management has to work on these issues by providing motivation and changing the mindset. 'Feedback is the biggest source for improvement'. ▪ Pro-actively asking for feedback, lessons learned and project review meeting to gain feedback from the receiver. ▪ Leveraging knowledge requires the identification of the value of this resource and reacting to the information included. Utilize underlying knowledge to improve transfer activities.

7.2 Theoretical contributions

One of the main contributions of this research work to theory is that it develops the construct of disseminative capabilities, provides an empirical foundation for the concept, and therefore serves as a solid base from which to start further research initiatives on the knowledge sender's capabilities (*see* section 7.5 for details). In the empirical investigations, I found support in two dimensions. Firstly, the research approach deployed ensured the reliability and validity of the construct itself. Secondly, in the course of the research, and especially in the case study work, I found evidence for my initial assumption that disseminative capabilities enable organizations to transfer knowledge more successfully and to gain benefits from process improvements on a project level. The findings contribute to the extension of theory in knowledge transfer (7.2.1) and to the inter-relatedness of knowledge transfer in general, communication science, and teaching theory (7.2.2). Finally, these insights add a new perspective to knowledge-/capability-based views of the firm and related competitive strategies (7.2.3).

7.2.1 New perspectives on knowledge transfer theory

Research on knowledge transfer has identified various impacting factors. Besides the receiver, the transfer knowledge, the partners' interaction and relationship, the knowledge sender also plays an important role in knowledge transfer success. Since Teece's work on technology and related knowledge transfer (1977), research scholars have been investigating characteristics of the knowledge sender. Nevertheless, until lately the sender had been mainly regarded as an anonymous source providing knowledge (e.g. spill-over effects, Cohen *et al.* 1990). This attitude has recently begun changing,

and attention placed mainly on the knowledge receiver (*see* research studies on absorptive, relative-, or partner-specific absorptive capacity reflecting this inequality) has begun shifting more and more to the knowledge sender. Along with this development, research has begun calling for provision of empirically based and structured insights into knowledge sender capabilities and their impact on transfer success (Chini 2004; Minbaeva *et al.* 2004).

Practice indicates that some organizations generate greater benefits from knowledge transfer activities. Driven by this phenomenon, researchers have investigated knowledge sender characteristics among other factors in order to find root causes for those differences. So far these studies have focused on single attributes, intra-organizational transfer settings, or are of a conceptual nature (*for an overview see* Table 1.01 or Chini (2004)) and provide fragmented insights into knowledge sender capabilities. This research work is a step forward, developing a structured concept of knowledge sender capabilities impacting knowledge transfer success, i.e. disseminative capabilities and provides systematic evidence from empirical investigations. In doing so, this study brings together related concepts from the contributing theoretical streams to provide a solid construct. Additionally, the work at hand deploys a new measurement approach to indicate knowledge transfer success. The latter aspect allows one to picture and consider the inter-relatedness of the dimensions of DiC and their impact on transfer performance, a perspective lacking so far in existing studies on the knowledge sender, her capabilities, and their impact on transfer success. This approach enables me to move beyond the view of the knowledge sender as the spill-over source of knowledge.

The investigations at hand show that disseminative capabilities indeed qualify as relevant for knowledge transfer and, more generally, for joint work success. In-depth analyses of this phenomenon reveal evidence of their value, rarity, and the difficulties in copying or substituting for them in order to transfer knowledge successfully. Furthermore, the investigations show that this phenomenon addresses different dimensions of capabilities which as a bundle realize their full impact. Empowering relationships between capabilities underline the necessity to understand and develop the whole construct of disseminative capabilities. Finally, my detailed analysis operationalizes the construct of DiC and sets the stage for large-scale empirical investigations.

7.2.2 New perspective on related research streams

The thesis at hand deploys three different theoretical research streams in order to draw a complete picture of knowledge sender capabilities. Relationships between the re-

search fields are not new, for example, in knowledge transfer theory a communication-focused stream is becoming more and more established (e.g. Gupta *et al.* 2000; Joshi *et al.* 2007; Murray *et al.* 2007). Unlike the interface of communication science and knowledge transfer theory, my work additionally underlines the necessity to focus on the value of teaching theories for knowledge transfer theory. As the analogy is more than obvious and repeatedly deployed in research (e.g. Winter 1987; Zander *et al.* 1995; Lane *et al.* 1998; e.g. Zhao *et al.* 2004), most works relating these research streams focus on the learning effect. Hence, these works do not pay sufficient attention to the role of the teacher as the initiator and enabler of the transfer of knowledge. As knowledge transfer researchers are increasingly focusing on the knowledge sender and her impact, attention to the teacher is also rising. Interesting approaches can be found in Zhao *et al*. (2004) and Heller (2002; Heller 2006), who will establish a new theoretical stream on organizational teaching for the transfer of knowledge and capabilities. Deploying teaching theory as the basis for my construct of disseminative capabilities provides insights into the capabilities of the 'teaching' knowledge sender and contributes thereby to the development of the developing research stream as well.

7.2.3 New perspectives on knowledge-/capability-based views of the firm

Resource- and capability-based views of the organization try to identify the relationships between organizational resource endowments and competitive advantage. Nowadays, knowledge is one of the most important resources for competitive advantages, and it has been shown that organizations successfully managing, and especially transferring, knowledge outperform competitors and are more likely to survive (e.g. Argote *et al.* 2000). The thesis at hand therefore focuses on activities and procedures related to disseminative capabilities. Following Winter (2000), I define the DiC as resulting in activities impacting knowledge transfer success. This functional end represents the source of competitive advantages (Eisenhardt *et al.* 2000). My research defines the functional end as successful knowledge transfer resulting in an application of the knowledge to advance the joint work. Upon reaching especially the latter aspect, both organizations gain a competitive edge due to successful combining capabilities and thereby the opportunity to leverage the strengths of the partners involved. The work at hand provides arguments underlining how and why disseminative capabilities affect knowledge transfer success, impacting the performance of the collaborative PD project, and thereby generate rents for the partner organizations. This aspect in turn clearly identifies the inter-linkage between resources, in this context: knowledge, the

disseminative capabilities, and the competitive edge gained through the successful transfer of knowledge. The analyzed, in-depth cases confirm this relationship.
This research not only moves beyond a high-level construct of the knowledge sender capability to impact transfer success, it also identifies a set of capabilities, procedures, managerial actions, or organizational processes as the micro-foundations of disseminative capabilities. My research, then, challenges the work by Priem *et al.* (2001), which often leaves practice in the dark by deploying highly aggregated, all-inclusive capability descriptions, and fails to try to answer the questions of why and how a capability matters to competitive advantage. Additionally, this micro-level foundation of the DiC construct serves as an excellent basis to derive management implications, as seen in chapter 7.1.

7.3 Summary

After analyzing the practical and theoretical implications, I want to draw attention to the goals set at the beginning of this thesis. Table 7.02 compares the objectives of my research outlined in chapter 1.5 and what has actually been achieved in that regard.

Table 7.02 - Research objectives and actual achievements

Objective	Reached/ Fulfilled	Actual achievements
In particular, my research aims to contribute to the understanding of **how to increase the success of knowledge transfer, especially by analyzing the role of the knowledge sender**. Mechanisms underlying the knowledge transfer process will be explored. Based on that, management implications are derived to increase the success of knowledge transfer from the sender's side.	**Yes** (for the automotive industry)	▪ Knowledge transfer mechanisms in collaborative, inter-organizational project settings are revealed. Knowledge sender capabilities - disseminative capabilities - reflect the process of knowledge transfer and outline the impact of the knowledge sender. ▪ Managerial implications for the knowledge sender to develop disseminative capabilities and thereby to increase her impact on transfer success have been outlined (for a summary *see* Table 7.01)

Objective	Reached/ Fulfilled	Actual achievements
My research provides a **systematic, structured, and fundamental work on knowledge sender capabilities** impacting transfer success. Thus, I structure the piecemeal and fragmented work on knowledge sender capabilities by integrating existing findings from knowledge transfer theory. Additionally, I supplement new capabilities to develop the sound theoretical concept of DiC, observe this phenomenon in practice, and analyze its impact on knowledge transfer success. In doing so, I add an important aspect to knowledge transfer theory by answering the outlined research questions.	**Yes**	▪ The DiC concept provides a structured and systematic work on knowledge sender capabilities. Based on the three literature streams of knowledge transfer theory, teaching theory, and communication science, this construct merges overlapping research streams and combines complementary aspects in the DiC concept. ▪ The in-depth case studies investigations deployed serve as a solid empirical basis for observing the DiC phenomenon in practice and revealing the impact of the bundle of DiC on the knowledge transfer success. ▪ The work at hand adds a basic foundation of the knowledge sender capability dimension to the model of influencing factor domains on knowledge transfer success.
While my research follows the design of Ulrich (1984), I **develop a practical guideline to increase the knowledge transfer from the sender**, thereby solving the problem of establishing a successful knowledge transfer approach and providing valuable insights for consulting organizations.	**Yes** (consulting the practice still to come; dates already fixed summer '08)	▪ In sections 7.1.1-7.1.8 managerial implications are derived to develop disseminative capabilities successfully and to impact knowledge transfer success more effectively. ▪ After I have finished the thesis, all participating companies will get a printed guideline for developing their disseminative capabilities, and the company visits in summer '08 will provide additional support when applying the findings in practice.
Furthermore, I **provide hypotheses** serving as a starting point **for large-scale empirical testing**.	**Yes**	▪ Hypotheses are derived in chapter 6 as a result of the cross-case analysis. ▪ Currently, a large-scale empirical investigation has started which uses insights from this work and the hypotheses to structure the investigations on the knowledge sender capabilities.

The achievements outlined indicate that the research objectives set at the early beginning of my research journey have been reached. As this is a mixture of objectives related to managerial as well as theoretical issues, I am satisfied with the degree of complexity and the challenge these goals provide.

7.4 Research limitations and thesis pitfalls

In the following section, I outline the research limitations of this work (7.4.1). Afterwards, the dilemmas and shortcomings of this work are delineated. During my research, many difficulties arose which might have been prevented. Thus, to provide a complete picture of the dissertation thesis, these aspects should be mentioned as well (7.4.2).

7.4.1 Research limitations

Although I am confident that my research findings allow some generalizations, the research approach and the investigations show some notable limitations which have to be considered when interpreting the results. Additionally, this argumentation contributes to a more balanced discussion of the research findings.

First, the data on the dependent variable in the focus, namely, knowledge transfer success, came from the same interviewees as the information on the independent variable set (disseminative capabilities). In quantitative empirical research investigations, the problem of bias is a well-known issue. Even though I deploy a qualitative empirical research approach, the underlying idea that respondents may feel pressure to give socially desirable answers or the influence of the consistency motif (Prodsakoff & Organ 1986) is also relevant to my work. To prevent these issues from arising and biasing the research findings, I deployed two perspectives on the same dependent variable and used corporate records and secondary data, which provided additional insights into the knowledge transfer performance.

Secondly, as, for example, the BMW-Magna Steyr collaboration on the BMW X3 involved 500 employees; it was difficult to interview complementary project team members within the partner companies. The idea was to interview project team members of both partners involved in the same work, e.g., the module project leader for electrics and electronics. Based on this coupling, the interviewees would refer to the same transfer knowledge, during the same project phase, and relate it to the person with the greatest interaction potential. That would have been the ideal case; however, it was not realizable in all cases. Unfortunately, the project organization was not the same as it had been earlier: people had already left the company or were not available for the investigations.

Thirdly, the collaborations were, contractually speaking, of the same nature; nevertheless, they differed in the character of their execution in terms of the procedures deployed to interact with the partner company. Investigating both sides of the collaboration entailed the problem of power and fear underlying the buyer-supplier relationship. This was clearly indicated when the investigations within Magna Steyr received approval from the Corporate Communication under the condition that Mercedes Benz and BMW approved it as well. Therefore, it can be assumed that similar resistance might underlie the information gathered.

Fourthly, the research investigations providing the data and therefore the foundation of this work stem from German-speaking countries (Germany, Austria). This implies that cultural differences between Europe and Asia, North-America, or South-America

would hinder a transfer of research findings (Hofstede 1991). Especially, collaborations in Asian countries appear to be completely different in their approaches from those in Europe.

The fifth point is the limitation to the automotive industry. As the collaboration phenomenon is not limited to the automotive industry, value chains and collaboration motivations might be different in other industries. This in turn demands further investigations on disseminative capabilities and their impact on transfer success in other industries. Therefore, results of this research study emerge from investigations in the automotive industry and they cannot be applied 1:1 in other industries. Even in this industry generalization has to be done carefully as the analyzed cases are limited to the OEM-Magna Steyr collaborations.

Sixthly, deploying a multi-indicator approach to measure knowledge transfer success, on the one hand, opens the possibility of considering all different aspects of transfer impact. On the other hand, the direct relationship between certain disseminative capabilities and a specific outcome are not investigated in detail.

Seventh, I conducted research investigations completely on my own. There was no second researcher to challenge findings and interpretations during the investigation phase. Nevertheless, to keep the research validity I involved various people who challenged the case study work with the actual conducted data (interview minutes, recordings, etc.).

Eight, as my work focuses the knowledge sender perspective investigations reveal that the single-actor focus is not adequate to fully capture the interactive phenomenon of knowledge transfer. Both actors switch roles during the interaction and therefore neither can be fully separated nor investigated without considering the other part. This is especially true for the receiver perspective (e.g., absorptive capacity research stream) and my work contributes to balance this in-equality, nevertheless shows a similar weakness then.

Ninth, the selection of in-depth cases is limited to successful ones concerning the intended product launch. All three analyzed collaborations succeeded in means of launching a completely developed and produced vehicle. Nevertheless, unsuccessful examples of product development collaborations in inter-organizational settings would have widened and deepened the insights into the different knowledge transfer activities. During the acquisition phase of the in-depth cases I contacted companies involved in less successful inter-organizational PD projects such as the Transrapid (e.g., Siemens and ThyssenKrupp) but they did not participate in the investigations.

Finally, as previously outlined, inter-organizational knowledge transfer often required company-internal transfer procedures as well, the findings of this work emerge from an inter-organizational setting in the PD field. Therefore, scholars, when using these findings in areas other than inter-organizational PD projects have to adjust the findings to the individual aspects of the actual investigation setting.

7.4.2 Difficulties along the dissertation road

As the thesis at hand developed over the last 18 months, the road was sometimes rocky and difficulties occurred along the way. To complete this work, to give the reader an impression of these issues, and to prevent other researchers from falling into the same traps, the issues are outlined in the following section.

- *Timeline vs. estimated time* - One of the biggest sources of potential problems along the way to the finish line was the project plan. Especially, tasks relying on external partners (interviews, review of notes, etc.) should be calculated with an adequate time buffer. Furthermore, my timeline suffered under chapter reviews, proofreading, iteration loops, and simple underestimations of required writing time.
- *Case studies work* - The planning and scheduling of case study investigation are more than critical to the whole case study work. Often interviews are rescheduled or are even completely rejected by the company due to daily work. Interviews (about 30 in my case) took almost 6 months, which was one of the biggest tasks in the timeline. Additionally, as researchers heavily rely on the empirical data set, one should acquire more than the aimed number of cases and leave those out which are incomplete or abandoned over the time. In my case, the number of cases abandoned equaled the number finally finished in this work.
- *Research topic development* - As of now my research focus is quite clear and I am able to outline the boundaries of the work. However, this took a long time and the writing process suffered heavily from the lack of clarity regarding the research topic. What helped me finally to shape the topic and get a more precise view were extensive discussions with colleagues, professors, and especially people from other fields of the profession. From the very first moment the research idea arises, the scholars should present their idea as often as possible in many different ways (research talks, poster sessions, conferences, publications, etc.). Once the topic is clearly shaped, the relevant sources for the research field

should be observed carefully in order to stay informed about the latest publications and research findings. Presenting the idea and the ongoing work externally results in the positive side-effect that people relate the topic to a specific person and help from time to time with ideas, thoughts, or publications they find.

- In my special case, the clear shape of the *research idea*, the setting, and the focus took a rather long time, and I tended to 'waste' time during the process. On the other hand, that time helped me to further develop the idea and to shape a clear research setting.

7.5 Further research on disseminative capabilities

The research on disseminative capabilities revealed that this is a construct with practical relevance and contributes to knowledge transfer theory, with special attention to the role of the knowledge sender. As this work focuses to answers to the derived research questions, it gives rise to even more new questions. In the following paragraphs, some implications and connecting factors are outlined to help interested scholars to find new research ideas and to underline the urgent need for researchers to answer those questions.

Three starting points for further investigations can be derived directly from the research limitations. First, the investigations on disseminative capabilities can be transferred to industries other than the automotive industry with different clock speeds (Fine 1996). It can be assumed that differing value chains, markets tendencies, or product life cycles impact knowledge transfer procedures. One interesting area to look at might be the pharmaceutical industry collaborating with biotech companies in order to learn about new compound developments. Secondly, collaboration approaches and thereby knowledge transfer might differ in other regional areas in the world; thus, an examination of Asian or American companies might reveal different disseminative capabilities, or at least the disseminative capabilities might show different emphasis in impacting transfer success. Thirdly, I analyzed three cases featuring Magna Steyr and an OEM. It might be interesting to look at PD collaborations between two suppliers or two OEMs as well and see if these differing constellations have an impact on knowledge transfer procedures and especially how disseminative capabilities contribute to the results.

Furthermore, disseminative capabilities are analyzed along the process of knowledge transfer. As the project tasks and the intensity of the joint work might change in the course of the project, so might the disseminative capabilities and their impact as well.

This investigation could be interesting for project scheduling and the staffing of the project team over time.

Related to this Figure 1.02. calls for a clear distinction between capacities and capabilities. A detailed investigation from a knowledge transfer perspective concerning these four partly established partly evolving concepts (receiver and sender) would be pretty valuable to develop this research stream further on.

As disseminative capabilities in some sense provide a complementary construct to both heavyweight absorptive capacity and relative absorptive capacity, it might be interesting to analyze the reciprocity of the two constructs and how they are interrelated. Which construct is the dominant one or is there a change over the knowledge transfer process?

Finally, the work at hand provides the foundation for large-scale quantitative empirical investigations. These investigations are already underway at the Institute of Technology Management at University of St.Gallen, and the results might open up another field and new insights for ongoing research on disseminative capabilities.

Appendices

A-2.1 - Case study participants

Company	Participant	Function
Magna Steyr Fahrzeugtechnik AG & Co KG	Mr. Peier	Head Pre-development Phase
	Mr. Andraschko	Head of Quality Engineers, QM BMW X3
	Mr. Zwanzigleitner	Vice President Global Business Development, Magna Steyr Engineering
	Mr. Haselwanter	Closures Engineering
	Mr. Stiegler*	Project leader BMW X3 project
	Mr. Evers	Project team member BMW X3 (module head doors)
	Mr. König	Project leader Audi all-road Quattro
	Mr. Fandl	Leitung Montage BMW X3
	Mr. Jagersbacher	Montageplanung BMW X3
	Mr. Gutmann	Montageplanung BMW X3
	Mr. Heinzle	Assistant to the Mr. Stiegler
	Mr. Polic	Project team member BMW X* (module head interior)
	Mr. Thum	Project team member BMW X3 (assistant to Mr. Evers)
	Mr. Kopsch	Project leader BMW Z4
	Mr. Fink	Project team member BMW X3 and BMW Z4 (electrics, electronics)
	Mr. Muchitsch	Project team member BMW Z4
	Mr. Olbert	Project leader SEC-4-matic project
	Mr. Felgitscher	Project team member SEC-4-matic project
	Mr. Adelwöhrer	Project team member SEC-4-matic project
BMW AG	Mr. Ochmann	Project team member BMW X3
	Mr. Voss	Project team member BMW X3
	Mr. Klein*	Project team member BMW X3
	Mr. Klanner	Project leader BMW Z4 project
	Mr. von Soosten	Project team member BMW Z4
	Mr. Popp	Project team member BMW Z4 (technical facilitator)
	Mr. Eberhardt	Project team member BMW Z4 (technical facilitator)
Mercedes Benz Cars	Mr. Fischer*	Project leader SEC-4-matic project
	Mr. Hitzfeld	Project team member SEC-4-matic project
	Mr. Käfer	Project team member SEC-4-matic project
Sonstige	Mr. Grace (MIT)*	Researcher/Prof.
	Mr. Whitney (MIT)*	Senior Lecturer
	Mr. Fixson (MIT)*	Researcher/Assistant Prof.
	Mr. Rebentisch (MIT)*	Researcher
	Mrs. Anja Schulze* (ETH Zurich)	Researcher
	Mrs. Heller (Novartis)	Head of Strategic Alliances

* Informants revising the case study reports/comment on the results

Appendix A-2.2 - Interview guideline

Leitfaden für ein Interview im Rahmen des
Internationalen Forschungsprojektes

Wissenstransfer in Kooperationen zur Neuproduktentwicklung

Ein Projekt des Institutes für Technologiemanagement,
Universität St.Gallen

Informationen zum Projekt

- Es handelt sich um ein internationales Forschungsprojekt zum Thema „Wissenstransfer in Kooperationen zur Neuproduktentwicklung".
- Hierzu werden mit Partnern ausgewählter Neuproduktentwicklungskooperationen Interviews geführt, um den Know-how Austausch im Projektteam zu untersuchen.
- Wir konnten Sie als einen Partner einer erfolgreichen Kooperation im Bereich der Neuproduktentwicklung identifizieren.
- Es werden drei Mitarbeiter Ihres Unternehmens und des entsprechenden Kooperationspartners zu diesem Zweck interviewt (je ein Projektleiter sowie zwei Projektmitarbeiter).
- Im Nachgang zu den Interviews werden wir Ihnen ein Protokoll zur Durchsicht vorlegen.

Statement vorab

- Die nachfolgenden Fragen dienen als Anhaltspunkte für das Interview.
- In dem Interviewleitfaden werden wir Sie immer wieder den Begriff Know-how finden, den wir stellvertretend für Erfahrungen, Wissen und Informationen verwenden werden und schwerpunktmässig auf die ersten beiden abzielen.

Situationsbeschreibung

Beide Kooperationspartner tragen zum Erfolg eines gemeinsamen Entwicklungsprojektes bei, indem Sie Ihr Know-how kombinieren und so etwas Neues gemeinsam hervorbringen, was Sie allein nicht hätten realisieren können. Stellen Sie sich beispielsweise zwei Unternehmen vor, die gemeinsam ein neues Mobiltelefon entwickeln möchten. Der eine Partner hat seine Kompetenzen im Bereich der Gehäusefertigung und der Tastatur und der andere im Bereich der Kamera, des Displays und des qualitativ hochwertigen Produktionsprozesses. In der Zusammenarbeit sind wichtiges und relevantes Know-how somit auf beiden Seiten der Partnerschaft vorhanden. Für den Erfolg muss dieses Know-how in die Kooperation transferiert werden. Im täglichen Projektgeschäft bringen beide Partner Ihr Know-how in die Arbeit ein, ergänzen sich und sind so in der Lage ein sehr erfolgreiches neues Mobiltelefon zu bauen.

Fragen

Allgemeine Informationen

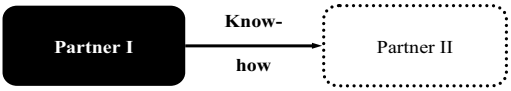
(1) Welche Art der Kooperation haben Sie mit Ihrem Partner gegründet?
(2) Besteht eine Zusammenarbeit im Entwicklungsbereich schon seit längerer Zeit?
(3) Wie viele Mitarbeiter waren zur Zeit des Projektes in der von Ihrer Seite involvierten Abteilung/en angestellt?
(4) Wie viele Mitarbeiter haben an dem Projekt aus dieser/diesen mitgearbeitet?
(5) Welches Budget hatte dieses Projekt?
(6) Wie lange hat dieses Projekt gedauert?
(7) Haben Sie örtlich getrennt von Ihrem Kooperationspartner gearbeitet?
(8) Hat das Projekt die im Voraus festgelegten Ziele hinsichtlich
Qualität des Produktes,
Budget und
Zeit
erreichen können?
(9) Sind Sie der Meinung, das Projekt aus Sicht Ihres Unternehmens/Ihrer Abteilung ein wichtiges Projekt mit hoher Priorität war?

Art und Weise der Beziehung zum Kooperationspartner

(10) Wie würden Sie die Zusammenarbeit mit dem Projektpartner bezeichnen?
vertrauenswürdig,
offen,
angenehm,
zielführend,
bereichernd etc.
(11) Wo sehen Sie Unterschiede zwischen Ihnen und den Projektmitarbeitern des Kooperationspartners? (fachlich, kulturell, …)
(12) Wie empfanden Sie persönlich die Unterschiede für das Ergebnis des Entwicklungsprojektes? Eher als Bereicherung oder eher als Hindernis?
(13) Welche Unterschiede würde Sie davon als hinderlich für den Know-how Transfer einordnen?

Perspektive I

Bitte stellen Sie sich die Projektsituation vor, in der Sie auf Know-how des Kooperationspartners angewiesen waren, um die Projektarbeit weiter voranzutreiben. Sie sind in diesem Fall der Nicht-Wissende.



Ihr Partner als der ‚Wissende'

(14) Wie hat Ihr Projektpartner in der Projektarbeit Know-how an Sie weitergegeben?
(15) Welche Wege und Instrumente hat er hierzu schwerpunktartig genutzt?
(16) Welche Ansätze empfanden Sie hierzu am meisten geeignet?
(17) Wie hat der Partner auf Ihre Rückfragen / Feedback bzgl. des transferierten Know-how reagiert?
(18) Konnten Sie dann das noch benötigte Know-how bekommen bzw. Unklarheiten beseitigen?
(19) Hatten Sie das Gefühl Ihr Kooperationspartner konnte Ihnen mitteilen, was er wusste?
(20) Wie wurden Sie durch die Mitarbeiter des Partners bei der Anwendung und Nutzung des erfahrenen Know-hows unterstützt?

Sie als Know-how empfangender Kooperationspartner

(21) Konnten Sie das transferierte Know-how des Partners verstehen oder hatten Sie hierbei Schwierigkeiten?
(22) Wo lagen diese Schwierigkeiten?
(23) Wie haben Sie Ihrem Partner zu aufgetretenen Schwierigkeiten Feedback gegeben?
(24) Hat dies die Schwierigkeiten beseitigen können?
(25) Hat es Sie viel Aufwand (Zeit, Kosten, Ressourcen) gekostet, das erhaltene Know-how in dem Projekt zu nutzen?

Erfolg des Know-how Transfers

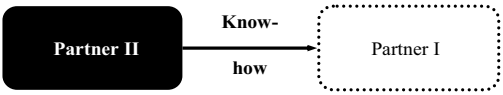
(26) Wie würden Sie persönlich den Erfolg des Know-how Transfers Aktivitäten aus Perspektive I beurteilen?
(27) Wie zufrieden sind Sie mit dem Know-how, was Ihnen der Kunde transferiert hat?
(28) In welcher Art und Weise hat Ihnen das transferierte Wissen in der Projektarbeit helfen können.
(29) Hat dieses Know-how in Ihren Augen einen längerfristigen Nutzen für Sie oder wird sich dessen Nutzung auf den Fall des Referenzprojektes beschränken?
(30) Was hätten Sie anders machen können, um den Know-how Transfer in der Perspektive I zu verbessern?
(31) Was hätte Ihr Partner anders machen können, um den Know-how Transfer in der Perspektive I zu verbessern?

Erfolg des kooperativen Entwicklungsprojekte

(32) Wie zufrieden sind Sie persönlich mit dem Ergebnis des Projektes?

Perspektive II

Bitte stellen Sie sich nun die Situation anders herum vor, in der Sie nun der 'Wissende' waren und Ihrem Partner Know-how vermittelt haben.



Sie als 'Wissender'

(33) Wie haben Sie in der Projektarbeit Know-how an Ihren Partner weitergegeben?
(34) Welche Wege und Instrumente haben Sie hierzu schwerpunktartig genutzt?
(35) Welche Ansätze empfanden Sie hierzu am meisten geeignet?
(36) Wie haben Sie auf sein Feedback und Rückfragen bzgl. des transferierten Know-hows reagiert?
(37) Wie haben Sie gewährleistet, dass Sie dem Partner das 'richtige' Know-how vermittelt haben?
(38) Haben Sie Ihr Know-how uneingeschränkt dem Kooperationspartner zur Verfügung gestellt?
(39) Hatten Sie in einigen Situationen Bedenken Ihrem Partner zu viel Wissen zu vermitteln?
(40) Wie haben Sie die Mitarbeiter des Partners bei der Anwendung und Nutzung des von Ihnen vermittelten Know-how unterstützt?

Der *Kooperationspartner* als Know-how Empfänger

(41) Hatten Sie den Eindruck Ihr Kooperationspartner hatte Schwierigkeiten das ihm vermittelte Know-how zu verstehen?
(42) Wenn ja, wie hat sich dieses geäussert bzw. wie haben Sie dies gemerkt?
(43) Worauf würden Sie dieses 'Nicht-Verstehen' zurückführen?
(44) Hat Ihr Partner aktiv Know-how von Ihnen eingefordert?

Erfolg des Know-how Transfers

(45) Wir würden Sie persönlich den Erfolg des Know-how Transfer aus Perspektive II beurteilen?
(46) Hatten Sie den Eindruck, dass der Partner zufrieden war mit dem transferierten Know-how?
(47) In welcher Art und Weise hat das transferierte Wissen dem Partner in der Projektarbeit helfen können?
(48) Hat dieses Know-how in Ihren Augen einen längerfristigen Nutzen für Ihren Partner oder wird sich dessen Nutzung auf den Fall des Referenzprojektes beschränken?
(49) Was hätten Sie anders machen können, um den Know-how Transfer in der Perspektive II zu verbessern?
(50) Was hätte Ihr Partner anders machen können, um den Know-how Transfer in der Perspektive II zu verbessern?

Abschlussfragen

(51) Was denken Sie welchen Stellenwert Know-how in Ihrem Unternehmen hat?
(52) Wie wichtig ist es Ihrer Ansicht nach, Know-how ausserhalb des Unternehmens zu suchen und für das eigenen Unternehmen zu nutzen?
(53) Sehen Sie in diesem Zusammenhang ein Potential für ein neues Geschäftsfeld, welches sich mit der Vermarktung des Unternehmenswissens beschäftigen könnte?

Appendix A-3.1 - Knowledge transfer success factor domains

Context domain	Construct	Author	Description / Impact on knowledge transfer
Knowledge	Tacitness	Zander and Kogut (1995), Polanyi (1962; Polanyi 1966)	▪ Highly personal knowledge, hard to formalize and communicate. The higher the degree of tacitness, the more difficult knowledge is to articulate and codify. ▪ Rather than using knowledge tacitness as a single dimension, codifiability, teachability, complexity, system dependence, and product observability have to be considered to capture the characteristics of an organization's knowledge, especially to visualize its tacitness. ▪ The transfer of tacit knowledge requires close personal interactions between the sender and the receiver.
	Knowledge embeddedness	Cummings and Teng (2003), Argote and Ingram (2000), Moreland *et. al* (1996)	▪ Knowledge is embedded in people, tasks, routines, and sub-networks combining these three elements. The more knowledge is involved in these sub-networks, the higher the degree of embeddedness. ▪ Moving knowledge from one of these categories independently from the embedding network limits the success of a later integration. However, moving the knowledge-specific sub-network, consisting of people, tools, and tasks, is an even more complex issue to manage. Transferring individual embedded knowledge, e.g., through a high degree of engineering mobility, avoids difficulties on the knowledge receiving side.
	Knowledge articulability	Polanyi (1966)	▪ Knowledge articulability is a measure of to what extent knowledge can be verbalized, written down, in general, can be articulated. Articulability is strongly related to knowledge tacitness because the degree of tacitness limits the extent to which knowledge is articulable. ▪ Especially, knowledge assets deeply rooted in action, involvement, and commitment within a specific context exceeds an acceptable effort to articulate it.

Context domain	Construct	Author	Description / Impact on knowledge transfer
	Causal ambiguity	Argote and Ingram (2000), Szulanski (1996), Lippman and Rumelt (1982),	▪ Causal ambiguity is the situation where it is hard or even impossible to relate the consequences or effects of a phenomenon to its initial states or causes. ▪ The higher the extent to which knowledge can't be articulated due to its tacitness, the more the phenomenon of causal ambiguity occurs. As mentioned, transferring knowledge without the related sub-network leads to difficulties in understanding, identifying the elements of interest, and putting knowledge into action.
Relationship	Organizational distance[33]	Argote (1999), Uzzi (1996), Granovetter (1985), Tushman (1977)	▪ The organization mode through which the sender and the receiver transfer the knowledge (e.g., franchises, JVs, alliances, etc.). A bigger distance means that the two partners are less organizationally related. ▪ Knowledge transfer, especially in the case of tacit knowledge, shows better results between related actors than to/from outsiders. The level of trust and the strength of social ties, just to name two, lead to a better performance.
	Physical distance	Athanassiou and Nigh (2000), Wheelwright and Clark (1992), Galbraith (1990)	▪ The physical distance is a measure of the proximity of people working together as they should be getting together in face-to-face interactions. ▪ Increasing physical distance slows down the transfer process. Complex knowledge requires close and frequent interaction, which in turn benefits from physical proximity. Especially, the results and performance of interaction-intensive activities like PD increase with closer work.
	Cultural and norm distance	Lane and Lubatkin (1998), Gersick and Hackman (1990), Allen (1977), Tushman (1977)	▪ Differences in work values or organizational cultures of the participating partners. ▪ An increase in cultural distance leads to a decrease in the transfer performance. The relationship set-up becomes easier as the cultural and norm aspects are similar between the partners. This in turn improves predictability and understanding.
	Cognitive distance	Nooteboom (2004), Cummings and Teng (2003), Hinds *et. al* (2001), Nonaka and Takeuchi (1995), Hamel (1991), Nelson and Winter (1982)	▪ Refers to the distances between the partners' knowledge bases. ▪ An appropriate degree in common knowledge bases between the partners is a precondition for successful knowledge transfer. Furthermore, the degree to which knowledge bases are overlapping determines the innovation and unlearning potential. ▪ Knowledge engineering paradox - The more expert the knowledge sender is, the more compressed is her knowledge, and the harder it is to extract this knowledge.

[33] In general, the success of inter-organizational knowledge transfer decreases with an increased distance.

Context domain	Construct	Author	Description / Impact on knowledge transfer
Interaction		Cummings and Teng (2003), Szulanski (2000), Hansen (1999), Davenport and Prusak (1998), Lane and Lubatkin (1998), Hargadon and Sutton (1997)	▪ Scholars agree that knowledge transfer is a multi-stage process containing different yet interwoven phases. In general, all processes outlined show three main phases, however, the labeling differs. Processes always start with an assessment phase, where the form and the embeddedness are analyzed. Secondly, the administrative issues of the transfer relationship are set up, before. Thirdly, the main transfer phase starts. Each of the three phases is of equal importance to the transfer outcome.
Receiver	Absorptive capacity	Lucas and Olgilvie (2006), Mowery *et. al* (1996), Cohen and Levinthal (1990),	▪ The ability to recognize the value of external knowledge, assimilate it, and apply it to commercial ends is described in the construct of absorptive capacity. A higher degree of absorptive capacity supports a successful knowledge transfer, as the knowledge assimilation and application success increases.
	Relative absorptive capacity	Lane and Lubatkin (1998)	▪ Partner-oriented absorptive capacity refers to the dyadic construct which describes the process of assessing, assimilating, and applying knowledge from a specific partner.
	Prioritization	Cummings and Teng (2003) Bresman, Kirkinshaw and Nobel (1999), Simonin (1999), Yeung, Ulrich, Nason, and von Glinow (1999), Szulanski (1996), Hamel (1991)	▪ The motivation, learning intent, receiver's firm size, business context, and collaborative experience all refer to the prioritization of the project. High priority projects normally attract higher (management) attention and more resources are deployed for those activities. This in turn leads to a higher success rate in knowledge transfer.
	Learning culture	Rogers (2003), Davenport and Prusak (1998), Szulanski (1996), Leonard-Barton (1995), Katz and Allen (1982)	▪ Considering knowledge transfer as important, the receiving partner has to allow the newly transferred knowledge to be integrated in the company's processes. Additionally, acceptance for this new knowledge has to be created within the receiving unit. ▪ Regarding organizational learning as an important goal for the company and applying this maxim to the firm's culture helps to ensure (i.) the acceptance and the potentials of external knowledge, (ii.) the application of newly transferred know-how, and (iii.) thereby to increase the knowledge transfer success.

Appendix A-5.1 - BMW X3 case study project

Case study BMW X3
(Project E-83)

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De-contextualize and encode knowledge 168
Designing the knowledge transfer approach 169
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Selecting transfer knowledge 172
Supporting the knowledge application 174
Considering and deploying feedback 174

The knowledge receiver 175

Project description[34]

BMW and Magna Steyr signed a collaboration agreement for developing and producing the BMW X3. BMW engineers developed the original concept. T^{MSF} came into the project in the later concept phase, when the product specifications were fixed. The collaboration lasted throughout the serial development and ongoing production phase as shown in Fig. 01. Although the collaboration contained two partners, the physical execution of the development and the ongoing production took place in Graz at the Magna Steyr facilities. The E-83 project was considered to be very prestigious and of high interest for BMW as well as Magna Steyr. The partners, especially BMW, intended to investigate whether this kind of collaboration with an external partner was feasible or not. Previous attempts had failed, for which reason this project was under great pressure and intensively observed by BMW management. The main motivations to work with an external partner revolved around capacity restrictions on BMW development facilities and building up a common base to extend cooperative PD activities with Magna Steyr. Originally, BMW expected the X3 model to be a niche product combining all-wheel technology and a luxury car and anticipated low sales volume. The bigger sibling of the X3, the BMW X5, had already been launched on the market with huge sales success, and the X3 was designated to fill the niche in the product portfolio. Therefore, the degree of innovativeness was not that great compared to the technology already being deployed in other vehicles and the X5 in particular.

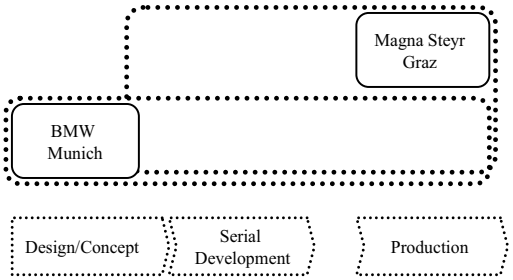

Figure A-5.1.01 - Project E-83 constellation

The collaboration was based on two contracts, product development-focused (serial development) and manufacturing-focused (serial assembly), stipulating payment of

[34] Throughout this case study I use the company names as the synonym for the whole organization, whereas T^{MSF} represents the team from Magna Steyr in the E-83 project and T^{BMW} represents the team from BMW Munich in the E-83 project.

Magna Steyr for its work in both phases separately. Regarding the development phase, Magna Steyr covered the development-related costs exceeding contractual stipulations. Tool costs were covered by BMW. The X3 project had a budget of about 500 billion €. Throughout the project 500 employees (about 100 from BMW and 400 from Magna Steyr) were involved in the collaboration. The project lasted for almost three years (six-month concept phase, 28-month serial development phase). It was the first time BMW had cooperated throughout the complete development and the ongoing manufacturing process with one single external partner. The BMW X3 went from Magna Steyr directly to BMW sales facilities and to the end-customer market. Magna Steyr had no direct market contact throughout the project, for which reason they were not able to evaluate the market needs either for the car or to use the feedback from the end-customer for product improvement.
The project was organized into six divisions (chassis, doors & dampers, equipment, electrics & electronics, body, and drive train) covering about 40 different modules, each run by one module leader who reported directly to the project leader. As members of the smaller partner in terms of firm size, employees at Magna Steyr were involved in one project a time. This implies that they hold a higher level in general knowledge than employees within BMW who work on different projects in parallel while focusing one specific field. Given Magna Steyr's smaller size, people within the company were more connected to each other than within BMW, which enabled shorter decision cycles. Especially the project team members and the operating departments were linked more intensely than within the partner's organization.

Partners' knowledge bases

As outlined, this project was challenging from the way it was organized and the newness of the governance form, especially for BMW. Additionally, the project team, consisting of T^{MSF} and T^{BMW}, faced enormous pressure from the management. To turn the collaborative project into a success, the partners involved had to combine their special capabilities. From a knowledge perspective, the success of the project was closely related to the knowledge bases both partner contributed to the joint work. In general, both partners could have realized the project on their own. Nevertheless, the combination of the partners' knowledge bases made the project a resounding success. The challenge from the project angle was to integrate all-wheel drive technology into a luxury car which would be developed and produced on a low scale.

As a player in the niche car market, Magna Steyr deploys lean development and production processes of great flexibility which are successfully integrated and applied in a consistent manner. According to its business model, Magna Steyr is very experienced in conducting cooperative PD with other car manufacturers. Coming from the supplier side, the 0.5-tier[35] Magna Steyr lacked the characteristic business units of an OEM such as design and marketing. BMW had chosen Magna Steyr due to its experience with all-wheel technology. BMW, on the other hand, has a strong product presence in the end-customer market in terms of design, marketing, and quality. Within BMW, processes were structured and documented in a very detailed way, tending toward a more bloated PD process for high-volume projects. Unlike with Magna Steyr, the development of a complete car is daily business.

It was the first collaboration of its type between Magna Steyr and BMW, and a joint knowledge base from collaboration on such a project was thus lacking. Therefore, BMW had to enable its partner to develop and assemble a BMW which would be launched to the market as a BMW rather than a Magna Steyr car. In other words, the main challenge for BMW was to ensure the transfer of all types of knowledge necessary to develop and produce a BMW in order to be successful in the market. Both partners were aware of that necessity. Knowledge transfer was very extensive due to, e.g., a missing structure for inter-organizational work, the lack of a common understanding of processes and procedures, especially the PD process, or knowledge gaps concerning the development and production of the BMW X3. One can distinguish among four different fields of knowledge transferred between both partners to overcome the above-mentioned challenges and to build up a solid base for the cooperative PD project.

Firstly, especially in the set-up phase, T^{MSF} lacked *system-specific* knowledge to be capable of working in the partner's environment and to get access to the necessary information for the product development. For this reason, BMW had to adjust its systems to the client's requirements and train the partner's employees in how to work in BMW systems. Especially the two-digit million € amount they spent to that end was considered a long-term investment. Secondly, the PD *processes* and the specific approaches of both partners were exchanged in the kick-off meeting in order to combine best of both worlds and to design an appropriate process for the project. Thirdly, T^{BMW} tried to duplicate its modular *organization* architecture within T^{MSF} to optimize the

[35] The term tier refers to the position of the supplier related to the OEM in the value creation chain. A supplier developing and producing systems or modules used directly in the assembly within the OEM is a 1-tier supplier. Magna Steyr calls themselves 0.5-tier according to the extent of their value creation, their development and manufacturing capabilities, and their product portfolio.

interfaces between the partners' organizations. Fourthly, *product-specific* knowledge had to be transferred between both partners. BMW had to ensure that all its product-specific requirements (e.g., noise, vibration, harshness, etc.) could be met in the development and the production phase. T^{MSF} had to be enabled to develop and produce a BMW car.

The transfer of system- and process-specific knowledge was not limited in the project; however, BMW did restrict the product-specific knowledge transfer to T^{MSF} as follows. Access to knowledge and information about and experience with parts already deployed in other projects was denied. However, T^{BMW} tried to leverage existing knowledge from this field to highlight some potential dangers and pitfalls during the development stage without relating them to a specific product or project. In general, and especially in case of the outlined transfer limitation, one has to distinguish between the project team members and the operating department. The latter restricted the know-how transfer because of their fear of losing knowledge to an external partner. T^{MSF} however did not limit its knowledge transfer.

The valuable knowledge source

The existence of the partner's supplementing knowledge bases was one motivation to found the collaboration. Additionally, up to that point, no closer examination of the extent and quality of the knowledge bases had been made. T^{MSF} as well as T^{BMW} recognized that an accepted and trustworthy knowledge source was a success factor for the transfer process. Both T^{MSF} and T^{BMW} identified that a level of trust and confidence in the partner's knowledge base was important. The partner gained confidence in the knowledge base through market reputation, during the joint work, or in former collaborations. Being considered a trustworthy knowledge source required the build-up of a certain level of confidence and reliability over a longer period.

BMW is very well-know for its effective processes and their integration in the field of product development. Applying methods and procedures repeatedly helped BMW to interpenetrate their processes and to be able to document the knowledge in the best possible way to meet the company's own needs. In doing so, they relied on their experiences in utilizing approaches frequently (advantages, disadvantages, potential pitfalls, etc.) and transferred them to Magna Steyr. This in-depth understanding of their own processes enabled T^{BMW} to transfer the knowledge and helped T^{MSF} to understand and apply it more easily. Even call-backs were able to be answered easily due to this deep understanding. T^{BMW} gained confidence in T^{MSF} from its market reputation in the

field of flexible and lean PD processes. T^{MSF} constantly developed its expertise further during the joint project work, which enabled the company to provide knowledge of high quality in order to meet the partner's needs.

For Magna Steyr the case turned out to be different. Of course, BMW selected Magna Steyr as the collaborating partner based on its market reputation. Nevertheless, the process of proving reliability as a knowledge source was challenging for T^{MSF}. It started during the offering phase, when T^{MSF} outlined its approaches to realizing the project, and lasted until the end of the project, with BMW employees continuously observing and challenging the steps of the PD. During the offering and the set-up phase, BMW called on Magna Steyr to present and document their PD approaches. At the kick-off meeting, T^{MSF} presented their processes and outlined the methods, procedures, and tools to be utilized for the product development. In doing so, they were forced to interfuse their own knowledge for this 'audit' presentation. Additionally, their reputation as a superior know-how carrier for niche product development generally came from market reputation. Although BMW was convinced of Magna Steyr's reliability, T^{MSF} was required to prove it over and over again. T^{BMW} operated as a sparring partner, challenging every step.

In identifying trustworthiness and reliability as such important factors to the successful dissemination of knowledge to the partner, both T^{MSF} and T^{BMW} underlined the necessity to spend effort and cultivate one's reputation. Especially T^{MSF} identified the necessity to interpenetrate knowledge repeatedly for that purpose. Before transferring knowledge to the partner, they scrutinized it, thereby smoothing out any remaining obscurities which might hinder complete understanding. Poorly conceived knowledge was not sent. Otherwise, Magna Steyr would have lost the potential of those knowledge assets, and on the other hand, they did not want their reputation to diminish. Striving to be recognized as a valuable sender had the positive and important side effect of removing doubts about external knowledge sources and new approaches by building up confidence in the partner. Especially the fear concerning external knowledge caused difficulties in the project because the operating department within BMW acted in a reserved manner, both when transferring knowledge to the project team (of both partners) as well as when accepting extraneous knowledge from T^{MSF}.

Knowledge transfer success

Overall, both partners were satisfied with the knowledge obtained from the joint PD project as well as the way it was transferred. Both T^{BMW} and T^{MSF} underlined that a successful knowledge transfer was an absolute necessity for the collaboration and the product to become a success. They both learned a great deal from each other during the joint work in the short as well as in the long run. In the short term, they benefited from the diversity of the partner's capabilities. These supplementary capabilities and know-how assets were indispensable conditions for achieving these project results. Although both T^{MSF} and T^{BMW} could have realized the project on their own, the combination of strengths made the collaboration a success. In turn, assets had to be transferred successfully during the project work in order to achieve the project goals. T^{MSF} and T^{BMW} underlined the high quality of the knowledge obtained from the partner. Members of T^{BMW} also stated that T^{MSF} succeeded in presenting, outlining, and successfully transferring knowledge to T^{BMW}. Additionally, T^{BMW} and T^{MSF} individually underlined their good knowledge transfer performance in terms of transferring required knowledge to the right people within the partner's organization at a given time. Nevertheless, T^{MSF} did not fully agree with T^{BMW}'s perception regarding its own transfer performance because of the limitations that constrained a faster understanding and caused double work or re-work.

Another important issue in the knowledge transfer was openness. A lack of openness is usually accompanied by a lack of understanding regarding the impact of knowledge transfer on the project success. Especially the operating departments within BMW had a lower level of openness. They regarded knowledge as a good worthy of protection rather than one to be shared with a partner. They feared an external partner would come up with better solutions to existing problems. Furthermore, T^{MSF} was viewed as a supplier rather than an equal partner in this setting. BMW management put forth no effort to turn this into equal-partner collaboration.

Although the impact of openness on knowledge transfer success was not limited to the sender's perspective and her willingness to transfer knowledge, receiving and accepting external knowledge was impaired. Even here, the employee's attitude had influence in terms of accepting the partner as a partner and also a valuable knowledge source. Again, this was exactly the case with T^{BMW} and its operating departments as the receiver of knowledge. Employees from T^{MSF} regretted that they had not tried hard enough to get the knowledge and the information they needed from BMW.

Another indicator of successful knowledge transfer was the successfully developed and produced BMW X3. Especially, T^{MSF} highlighted that knowledge transfer was the

essential process in fulfilling BMW's requirements to develop and build a car that was delivered from Magna Steyr facilities directly to the customer market as a BMW. Nowadays, noise, vibration, and harshness (NVH) measures are unique characteristics of cars and much effort is spent on meeting those individual sound specifications. In the case of the BMW X3, T^{MSF} faced the challenge to meet those specifications. Overall, customers did not even recognize that a car meeting such stringent requirements had come from a company other than BMW.

By combining their knowledge assets and capabilities, T^{BMW} and T^{MSF} designed a product development process that had never before been used. This indicated changes in the regular PD process approaches deployed within BMW and Magna Steyr. T^{MSF} in particular changed parts of its original process, methods, and tools. Knowledge and information about the new process, methods, and tools had to be transferred, understood, and successfully applied in order to shift away from their former product development process. Even though the knowledge transfer process was considered successful, both partners identified room for improvement.

Despite this success, the combination of competences of both partners left room for improvement, especially with respect to T^{BMW}'s attempt to push its partner into adapting to BMW's world. Contrary to the objective of deploying the insights from the competence analysis, the companies' strengths were not combined to a full extent. Although the potentials of combining the best from both partners in a broader way were identified, T^{BMW} sought to apply their own approaches. Besides losing those potentials, the approach led to a higher level of effort and inefficiencies by forcing T^{MSF} to adopt BMW processes and structures.

T^{BMW} highlighted shortcomings in their own transfer concerning knowledge about quality issues. T^{BMW} failed to provide sufficient knowledge from previous experience about potential problems during the development process to their partner. Anticipative transfer based on experiences within T^{BMW} would have helped T^{MSF} to avoid a number of problems and pitfalls during the product development. T^{BMW} perceived the issue differently, as they found fault with T^{MSF} for delaying feedback on problems that arose and in asking for knowledge within T^{BMW} to prevent already known problems simultaneously. Because of the underlying sense of the different partner roles in the collaboration, Magna Steyr often hesitated to give feedback to T^{BMW} about problems in understanding or even problems arising from the development process. T^{BMW} assumed that T^{MSF} strived to understand knowledge and problems by themselves before giving related feedback. This reluctance in turn led to longer reaction cycles and transfer ineffi-

ciencies. Overall, this could be identified as a typical communication-related issue that both partners had.
Even though it was unproblematic for T^{MSF} to understand and apply BMW's process knowledge, it nevertheless required great effort to do so due to the complexity of this process. BMW had challenging standards concerning process documentation and a complex PD process, which caused a greater expenditure of effort to understand and integrate the knowledge into Magna Steyr's PD process. In this relation, members of T^{BMW} utilized the term investment to characterize the time and money spent to transfer knowledge to Magna Steyr or to understand knowledge received from the partner. They intended to continue working with Magna Steyr in subsequent projects and therefore to leverage their investment in the partner and the relationship within later joint projects.

Project success

Two different perspectives are deployed to outline the dimensions of the success of this collaboration. First, the product and its market success are analyzed. Secondly, I deploy internal project measures to indicate the success of the collaboration. The project turned out to be a complete success from the product as well as the collaboration perspective. All goals set for the project were achieved and both partners described the joint work as a successful experience. Utilizing the collaboration contract both companies signed, one can look at quantifiable measures, such as whether the start of production (SOP) was realized at a required quality level within the stipulated budget. Overall, the goals set for the joint development project were achieved. All quality gates were passed without noticeable re-work, the SOP was realized, and Magna Steyr was fully released from its responsibilities. Being released by the partner means that the product has been developed successfully and all specifications have been met.
The highly prestigious project went smoothly and is still considered a cornerstone in automotive PD. The BMW X3 is a best-seller on the SUV (more precisely Sports Activity Vehicle (SAV®)) market and outdid all sales forecasts, almost attaining the sales figure of its BMW X5 sibling. Originally, two different versions of the car appeared on the market: 2.5i and 3.0i six cylinder engine. Based on its great success, BMW launched other versions and added a tremendous variety of X3 specific equipment. After this project, the benchmark for a complete car development and launch was pushed to 30 months, which at the time of the collaboration was considered impossi-

ble. The first BMW X3 left the Magna Steyr facilities in 2004. Both partners stated that the combination of competencies, especially in designing a new generic product development process, enabled the record time of development and production. Referring to the success of the X3 collaboration project, Joachim Milberg, the former chairman of BMW's supervisory board, confirmed that intelligent collaboration helped the participating partners to multiply their assets and capabilities (Wilding 2006).

The knowledge sender capabilities

De-contextualizing and encoding knowledge

As we have seen, both partners contributed specific sets of capabilities reflecting their varying knowledge bases. These knowledge bases developed along an individual pathway within each project team member. Transferring this knowledge represents time travel along this path, as the sender has to decide which part of the development path - the knowledge context - the receiver needs in order to understand and apply the transferred know-how. Knowledge then has to be written down or explained in other ways for transfer purposes. Each company has its own approaches to PD, building a car, or an all-wheel gearbox, and every single engineer has his own individualized methods and tools under certain organizational constraints (technical manual, audited procedures, etc.) to achieve this approach. Furthermore, deployed approaches vary within the same industry as well as between industries: BMW and Magna Steyr followed different processes according to their experience and backgrounds. In order to combine assets in the joint development project, members from T^{MSF} and T^{BMW} had to draw knowledge from their specific environment in order to transfer it to the partner. Without this essential background, understanding and ongoing application were accompanied by difficulties.

CAD drawings, product specifications, patents, and process documentation were frequently used for transfer purposes. Knowledge transfer limited to context-free knowledge was considered insufficient. To understand new knowledge the receiver also desired contextual knowledge like experiences residing within people, processes, and routines. This kind of knowledge represented the individual development aspect within the sender. As previously mentioned, due to varying backgrounds, neither T^{MSF} nor T^{BMW} was able to completely understand new knowledge without knowing its context. Even worse, a lack of contextual knowledge created room for (mis)interpretations and thereby the likelihood of the transfer to fail. Deploying the transferred knowledge in a

new context was frequently accompanied by unsatisfactory results. To minimize the room for interpretation, T^{MSF} and T^{BMW} endeavored to transfer experiences and contextual knowledge along with documented knowledge. One way to transfer contextual and continuative knowledge was to move knowledge carriers such as technical experts to the point of need. Experts who were moved could decide then how to solve the trade-off between the effort required in transferring contextual knowledge and the benefits gained by enabling an easier understanding within the receiver. With an increase in the transfer of experiences and contextual knowledge, the richness and effort of the transfer were boosted. Which contextual knowledge was necessary in order to understand and apply the new knowledge was an especially important issue because experts tended to have a different perception of what constituted relevant details to be transferred or an adequate degree of detaching know-how from its context for transfer purposes.

Besides the obligation to provide ongoing contextual knowledge, T^{MSF} and T^{BMW} identified the order of the transfer to be of relevance, too. Therefore, core knowledge was exchanged to prepare the transfer of ongoing contextual knowledge in, e.g., review meetings in order to enable in-depth understanding, to resolve obscurities, or to overcome lacks of understanding. This approach enabled a good understanding and a successful application in the joint PD setting.

Designing the knowledge transfer approach

During the joint project work both partners deployed a variety of transfer mediums and communication approaches in order to transfer knowledge to the partner, for example, email, telephone, video conferences, meetings of various types and intents, on-site visits at the partner's facilities, and interactive work. Additionally, T^{MSF} connected into the T^{BMW} systems and established a dedicated line to access product-specific information such as test results or the latest demand forecasts in real time.

Notwithstanding the importance of deploying an adequate approach for the know-how transfer, T^{BMW} as well as T^{MSF} described their selection of the transfer channels and media as based on a gut decision. Nevertheless, a closer look revealed that both partners rather utilized loosely-structured selection mechanisms. Using face-to-face meetings or interactive work between experts in the case of complex problems or sending missing part measures via email clearly indicated a selection process following an underlying mechanism. According to the kind of knowledge, the content and the amount, its complexity, and the current project phase, among others, T^{MSF} and T^{BMW} orches-

trated different transfer channels and media. As previously mentioned, T^{MSF} and T^{BMW} deployed different instruments and transfer channels for different transfer settings. With an increasing knowledge complexity, both partners tended to deploy transfer channels and media with greater interaction potential. If a problem turned out to be of a complex nature, T^{MSF} and T^{BMW} moved the knowledge carriers to work interactively. T^{MSF} installed stand-up tables in the entrance hall of its development facilities beside the coffee machines, where people could meet spontaneously and, more importantly, unofficially to exchange knowledge. Transferring knowledge in a direct (without mediators) way tended to be more successful. T^{BMW} stated that an increase of mediators participating in the transfer from the sender to the receiver was related to difficulties in understanding.

It turned out that the joint project work itself was an extraordinary way to transfer knowledge either through observations or learning by doing. Realizing the complete project together gave each partner the opportunity to learn from the other while working together on different tasks. In such situations they gained insights into new methods, tools, and process approaches deployed throughout the development stage. T^{BMW} made use of this knowledge transfer instrument in order to learn about Magna Steyr's PD approaches by sending employees to the Magna Steyr development facility. The fact that the PD process deployed for this joint project was to some extent an adjustment of BMW's process toward the lean and collaborative project requirements maintained by T^{MSF} held learning potential for T^{BMW}. Observing how the new process or improvements in PD worked out in practice and being able to identify dangers or potential pitfalls were of benefit. Afterwards, BMW was able to apply new methods, tools, and approaches in PD for their own process improvement, which prevented a lot of obstacles from developing.

Designing an adequate transfer approach was also a critical issue. When it came to transferring knowledge in interactive ways like face-to-face meetings, the communication abilities of the employees involved in executing the transfer became another significant issue. As collaborative (PD) projects are a core part of Magna Steyr's business model, T^{MSF} was aware of the importance of employee's communication skills. For example, training engineers directly on the production line accompanied with related work helped them to take the perspective of the un-initiated. This behavior was seen as essential to the success of face-to-face interaction. Two procedures were identified by members of T^{MSF} and T^{BMW} as impact-critical, namely, active self-reflection and perspective taking. Self-reflection helped team members to look for what was essential to understanding a specific issue the engineers were working on jointly on the production

line. The knowledgeable party in these settings was more successful in her recognition advantages of transfer approaches when she reflected upon the requirements and enabling the understanding before starting any explanations. When engineers carefully considered this issue in advance, they were able to communicate their ideas successfully. To take the perspective of the partner, e.g., asking questions like - How would I like to have this issue explained? or Would I understand the task with this and that information? - supported communication in the interactive work. Being able to communicate in a more effective way allowed T^{MSF} to transfer knowledge in a superior way and to provide better and richer feedback to the partner. Deploying coaching and training sessions with communication experts and psychologists was regarded as one way to achieve those objectives and as a step toward internal improvement for ongoing collaborations.

Building up and utilizing relational capital

Along with the idea of transferring knowledge efficiently arose the need to address the right people within the receiver or to interlink the experts within the sender and the receiver organization concerning specific tasks. Therefore, both partners tried to build up relationships between the project members before the project started. During the kick-off phase of the project, partners designed the project organization and deployed interactive working procedures as often as possible to get team members connected. Based on that, project members were able to identify more easily sources of required knowledge or employees in need of further knowledge. BMW regarded this project and the efforts made, e.g., the IT environment alignment, as an investment in future collaborative work with Magna Steyr, i.e., building up a common base in understanding and knowledge regarding working in BMW systems. Throughout the joint project work both T^{BMW} and T^{MSF} built up a partner-specific knowledge base, e.g., knowing the employees involved, decision procedures, or working approaches. As it was the first collaboration of this dimension, a joint knowledge base was lacking. Nevertheless, in the course of the project, knowledge transfer success increased due to the aforementioned results from a growing common knowledge base and its deployment in the joint work.

Even though T^{BMW} and T^{MSF} identified the necessity to build a joint knowledge base quickly, the ramp-up did not work out perfectly in the project. Particularly, the people-related capital was built up slowly. The movement of people to work together or at least to get to know each other for joint ongoing work took place too late in the

project. Along with sluggish growth in confidence between the partners, knowledge transfer struggled, especially in early phases, resulting in an increase in the workload to catch up in later phases and avoid project delays or quality issues.

Selecting transfer knowledge

Both partners mentioned that it was important for transfer purposes to have insights into the partner's existing capabilities and knowledge assets in order to identify strengths and weaknesses according to given project tasks. Additionally, in evaluating the partner's strengths and weaknesses, T^{BMW} and T^{MSF} tried to estimate the partner's knowledge in related fields to get an impression of what context or basic knowledge was missing to be able to understand the transferred knowledge. T^{BMW} and T^{MSF} deployed a special kind of portfolio thinking, presenting a picture of the knowledge assets and their carriers. They did not set up something formal or an extra document; nevertheless, this idea guided their interaction in a rudimentary way. To realize this idea the project started with a competence 'analysis', and based on that, development activities were compartmentalized between T^{BMW} and T^{MSF} according to their individual portfolios.

Based on portfolio insights, T^{BMW} and T^{MSF} tried to align the know-how transfer activities to be able to address the right people with the right knowledge for a specific task at a given time and in the most appropriate form. Project team members from both partners first tried to evaluate existing knowledge gaps before transferring knowledge. Mainly, the kick-off meeting and the regular review meetings were the most frequently used procedures to do this. In fact, the evaluation took place in every form of interactive work. Talking about actual and upcoming milestones in a review meeting clearly showed the status concerning the milestone in question and where problems arose or would occur. Based on that, T^{MSF} and T^{BMW} were able to investigate upcoming tasks and potential problems in order to explore missing knowledge assets. Identifying potential weaknesses in the capabilities or knowledge assets made it possible to align the ongoing knowledge transfer in terms of addressing the right people with the relevant knowledge. T^{MSF} and T^{BMW} both intended to enable a partner-specific process transferring knowledge grounded in the partner's knowledge base. Moreover, this assessment promoted the combination of the strengths of both companies to design a new PD process. Even though both partners identified the potential of combining their strengths, they did not always proceed in this way. Instead, T^{MSF} mainly had to utilize the PD process of its partner BMW. This indicates that the combination of the existing

capabilities and knowledge assets was not realized as successfully as possible. T^{MSF} stated that their capabilities and knowledge assets were not considered in the intended way In turn, they acknowledged that they had had to promote their own strengths even more, especially at the beginning during the designing of the joint PD process, when all process steps, methods, and tools were being outlined. T^{BMW} confirmed T^{MSF}'s observation recognizing the potential of that procedure for the knowledge transfer process. They experienced the potential inherent in a successful combination in various fields and recognized the room for improvement this approach still held.

The portfolio idea showed additional notable limitations. In order to be able to evaluate the partner's knowledge portfolios, T^{MSF} as well as T^{BMW} relied on information and feedback, forcing them to clearly depict their own knowledge assets internally first. Otherwise, it would have been impossible to identify either strengths or weaknesses in the knowledge bases. Sometimes feedback was not available, was non-specific, or even failed to reflect reality. Repeatedly, members of T^{MSF} discovered problems understanding the knowledge transferred as members of T^{BMW} adjusted knowledge transfer to their own knowledge portfolio rather than to T^{MSF}'s. This caused T^{MSF} problems in understanding due to a misaligned transfer process. The knowledge sender also had to deal with a degree of arrogance, such as when the receiver acknowledged that he already knew what the sender was talking about. From that point on the knowledge transfer was insufficient because the receiver finished the knowledge transfer by aborting the receiving processes. In this special case the knowledge sender was not able to disseminate, i.e., transfer, knowledge any more.

One organizational instrument for aligning the portfolio idea of combining knowledge assets was the concept of the technical networker[36], a member of T^{BMW} from a technical background. In addition to having detailed technical knowledge, he was strongly connected to the networks within the operating departments of BMW and other knowledge carriers within the organization. Providing technical knowledge as well as occupying this network position, the technical networker enabled the supply of required knowledge to the receiver or at least identified and tapped the right sources within BMW for missing knowledge. In doing so, he also established transfer channels between the relevant people, thereby contributing to the efficiency of knowledge transfer.

[36] Within BMW there were many terms for this special position. In conclusion with the interview partners I use the term technical networker

Supporting the knowledge application

The members of the project team who were interviewed underlined that the application of transferred knowledge represented the main benefit. After knowledge was sent to the receiver, ongoing transfer activities were used to close gaps in understanding and to enable the application of the transferred knowledge. T^{BMW} and T^{MSF} offered coaching, workshops, and other forms of topic-related work to enable the partner to fully understand transferred knowledge. The joint work of project members on a specific task was a frequently used and efficient approach to disseminating knowledge of a complex nature to enable its application in the project. Problems and critical issues were able to be solved in an easier way when this kind of interaction took place. T^{MSF} and T^{BMW} were able to transfer both contextual and application knowledge along with providing application support in terms of further explanations as well as joint application activities. As knowledge transfer was even stipulated in the collaboration contracts, Magna Steyr developed procedures such as constant joint work to support a knowledge application.
With the introduction of the concept of the technical networker, BMW deployed another instrument to provide ongoing support in applying transferred knowledge. Based on its technical background and deep involvement in the organizational network, this role was able to provide required knowledge, thereby supporting application.

Considering and deploying feedback

Recognizing the interactive and iterative nature of knowledge transfer, the sender's field of responsibility exceeded the unidirectional sending process. Nevertheless, managing feedback and improving the knowledge transfer were significant issues as well. To realize knowledge transfer success and to avoid limitations due to misunderstandings or, worse yet, no understanding, both partners deployed feedback. T^{MSF} recognized feedback as an especially rich resource for enhancing knowledge transfer by either deploying feedback to T^{BMW} concerning problems as well as weaknesses in the transfer or using feedback from T^{BMW} to enhance its transfer process according to the partner's preferences and its existing strengths and weaknesses. While identifying feedback as important for knowledge transfer, T^{MSF} did add one stipulation: Feedback was only valuable if it addressed specific topics and issues causing problems or misunderstandings. In some situations, T^{BMW} provided feedback on problems in under-

standing due to unsatisfactory knowledge transfer without outlining the existing gaps or problems. BMW made no concrete statements on the content or the quality of the transferred knowledge. This limited the possibilities for the partner to use feedback to enhance the transfer. Unlike the value of detailed feedback, general feedback caused inefficiencies due to unnecessary re-work, the time spent on preparing additional knowledge transfer, and providing support without knowing where problems had occurred.

The consideration and deployment of feedback led to an individualization in terms of adopting the transfer approach, the transfer content, the communication approach, etc. Besides the joint knowledge base and the knowledge about the partner, feedback helped to create a partner-individual knowledge transfer procedure, e.g., orchestrating the individualized ways of selecting the right knowledge or the right transfer channels.

The knowledge receiver

Knowledge transfer, as was established by both partners, was regarded as an interactive and iterating process rather than a unidirectional process where knowledge was just sent from T^{BMW} to T^{MSF} or *vice versa*. To facilitate the understanding and application of transferred knowledge for the project's advancement, both partners launched a multi-loop interaction process which involved sending and receiving knowledge, providing and receiving feedback as well as ongoing support

Being the knowledge receiver, both T^{BMW} and T^{MSF} had few problems understanding the transferred knowledge from the partner. Understanding was enabled mainly due to the qualifications and the training level of both partners' employees along with experiences from former projects related to the development of a product. Although working with different OEMs, even with BMW, over the past several years in the field of PD had allowed T^{MSF} to learn how to develop car parts, entire systems, or a complete car for another OEM, T^{MSF} had never before developed a complete vehicle for another OEM on its own. Both companies have the same industry background, giving them a solid base in technological and process knowledge, which was identified as one reason for the ability to understand transferred knowledge more easily. One illustrative example of what happens if this base is missing involves BMW's monitoring team. The team observed the processes at the Magna Steyr facilities in order to learn from the partner and had problems understanding processes, procedures, and tools because of a lack of experience in this field and the non-technical backgrounds that its team members came from. The X3 was actually the second SUV (more precisely, the X3 was a

SAV®) in BMW's product portfolio and was not highly innovative either with respect to the concept or to deployed technologies and systems. The small degree of product innovativeness contributed to an easier understanding of the product-specific knowledge transferred between both partners.

Regarding process knowledge, the case was a bit different because both partners saw themselves confronted with completely new methods, tools or approaches along the product development process. Lacking experience with those new approaches, T^{BMW} as well as T^{MSF} had some initial problems with saturating the transferred know-how in those areas. For T^{MSF} understanding process knowledge seemed to be easier because of their business model. Working with various partners, even simultaneously, had forced them to develop process platform structures and process aligning abilities to be capable of cooperating with different partners more efficiently. This allowed them to adopt specific procedures from BMW's PD process, e.g., specific testing procedures, into their own approach without making big changes in the overall PD process. Both partners shared the impression that this process flexibility allowed T^{MSF} to understand and apply new knowledge. While both were able to benefit from their former experiences to understand transferred product and process knowledge, they lacked such understanding when it came to more highly detailed transferred knowledge, e.g., specific procedures for test runs.

Appendix A-5.2 - BMW Z4 case study project

Case study BMW Z4 coupé
(Project E-86)

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Project description[37]

The idea of the coupé derivate arose from an internal material test that took place at the BMW production facility in Spartanburg, SC, USA. At that time, the BMW Z4 roadster had already been launched and BMW was testing a new car body shell by closing a roadster from the running production line. Thereby the idea to design a Z4 coupé version was born. Because they took the cars from the ongoing production, all functionalities were already working in this 'prototype'. Overall changes from the roadster to the coupé version were about 15%-18%, mainly the roof, the hatch, and the car body shell.

At that time, product development capacities within BMW were filled and therefore the designing of the Z4 coupé version was postponed. Magna Steyr, at that time the collaborating partner in the E-83 project, recognized the idea of the coupé concept. Unlike at BMW, the Magna Steyr development facility in Graz held free capacity and so they proposed jointly developing the concept of the Z4 coupé version into a serial car. The Z4 coupé was planned to be assembled in BMW's US production facility in Spartanburg in order to realize a full load production as well as to leverage the existing production facilities used for the Z4 roadster. Magna Drive was already involved in the production of the Z4 roadster, supplying stamping parts from a nearby factory. Overall, Magna Steyr appeared to be a good partner for collaboration on this project. The management of BMW put a challenging development timeline of eighteen months to launch the car. The coupé version was supposed to be launched to the market before the Z4 roadster would be phased out.

BMW intended T^{MSF} to support the integration of the vehicle in the ongoing production in Spartanburg as well. In addition, T^{MSF} was in charge of the supplier management and purchasing, functions they had never managed before. The project featured three partnering players (BMW Munich, BMW Spartanburg, and Magna Steyr) from three countries (USA, Germany, and Austria), while BMW Munich and Magna Steyr were the partnering companies for the serial development phase. According to the setting, the project was of a complex nature. Magna Steyr was intended to take the position BMW Munich held in the E-85 (BMW Z4 roadster) project. The design/concept was partly a co-conceptualization to the extent that both partners contributed and merged their own concepts. Figure A-5.2.01 shows how the partners worked together in the project. A closer look at the players in the Z4 roadster project (E-85) highlights

[37] Throughout this case study I use the company names as the synonym for the whole organization: T^{MSF} represents the Magna Steyr's team in the E-86 project and T^{BMW} represents the BMW Munich's team in the E-86 project.

aspects essential to understanding where the knowledge about the antecessor BMW Z4 roadster resided within BMW. BMW Spartanburg was in charge of the production process in both projects (E-85/86)

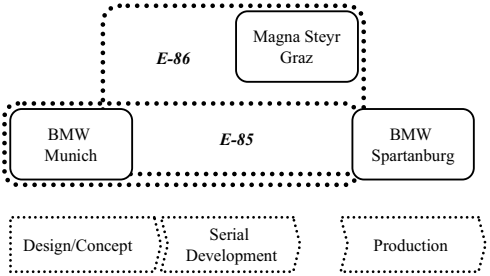

Figure A-5.2.01 - Project E-86 constellation

Another important issue arose from this setting. By giving the back-end of the product development to BMW Spartanburg, the serial development and, even earlier, the design/concept phase had to ensure the producibility of the developed car on the BMW production line. The project started in December 2004 and closed after transferring the completely developed vehicle to the Spartanburg manufacturing facility in October 2006. Magna Steyr worked with about 100 project team members during the product development phase on that specific project.

Partners' knowledge bases

In the E-86 project both partners had to combine and therefore transfer knowledge of different kinds and from different fields. In these different fields partners differed from their original knowledge bases. Even though this project was not the first joint vehicle development collaboration between BMW and Magna Steyr, knowledge transfer was necessary in order to deploy the partner-specific knowledge and the existing common knowledge base from the E-83 project. To realize the new value chain featuring three partners and to ensure the success of the Z4 coupé project, different kinds of knowledge had to be transferred.

Even though the degree of innovativeness, despite the design of the BMW Z4 coupé, was low, T^{BMW} had to transfer *product*-specific knowledge. Coupé- and roadster-, and, especially Z4 roadster-, specific knowledge needed to be transferred to the partner. About 15% in product changes compared to the roadster model underlined this neces-

sity to transfer experiences from former roadster (BMW Z1, Z3, and Z8) and coupé projects from BMW.

Magna Steyr had never before developed a coupé derivate and they had no product-specific insights from the Z4 roadster. Z4-specific knowledge (tests, specifications, simulation results, etc) was second nature within BMW due to the long-running production of the Z4 roadster.

The transfer of *process*-specific knowledge was more intensive in this project, as partners faced the need to design a PD process they could meet, on the one hand, the tight project timeline and, on the other hand, the low-volume specialties. For example, BMW's original PD process was detailed and supposed to fit high-volume products not at all applicable to the strict timeline and the forecasted project volume of the Z4 coupé project. BMW on its own was not able to adapt its process to the requirements of this low-volume project. Furthermore, the existing PD processes of BMW and Magna Steyr would not have been sufficient to meet the timeline. Therefore, both partners created a new PD process that combined their strengths. In addition to the newly required process, the tight timeline called for new tools to realize the short development cycle. T^{MSF} integrated virtual development techniques to shorten the development process. Being a firm with lean and flexible structures and pragmatic PD approaches especially for niche-products, Magna Steyr turned out to be a rich source for creating the new joint PD process.

Besides the PD process, T^{MSF} and thereby Magna Steyr were supposed to grow into new *supplementing process* fields. In this project, T^{MSF} also inherited more supplier management and purchasing issues for the serial development. Therefore, BMW invested in Magna Steyr's, and thus in the joint, knowledge base by training and coaching project team members and related operations departments in these fields.

The previously mentioned new value chain form, with T^{MSF} as the 'connecting element' between T^{BMW} in Munich and BMW Spartanburg (*see* Figure A-5.2.01), required knowledge transfer from the *production* phase backwards. Simply by successfully integrating the production-specific knowledge into serial development activities, an ongoing producibility was achievable. Therefore, the project required the transfer of production-specific knowledge from the Spartanburg plant.

System-specific knowledge transfer was limited in the product development as both partners deployed the joint knowledge base created in the BMW X3 project, which contained know-how about the partner and previously transferred knowledge. Furthermore, a collaboration of this dimension also required the transfer and exchange of

business measures and the procedures with which business metrics were calculated or which were the underlying assumptions the calculations were based upon.

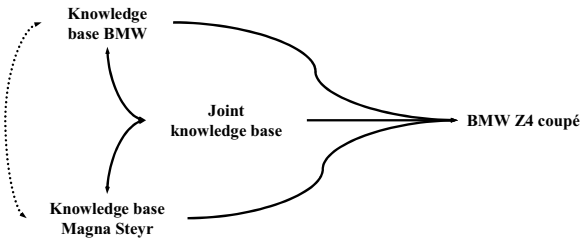

Figure A-5.2.02 - Combination of knowledge bases of BMW and Magna Steyr for the BMW Z4 coupé

Summarizing, from a knowledge point of view the project realization was based on the combination and therefore the transfer of different knowledge bases as outlined in Figure A-5.2.02. Individual capabilities and knowledge of different types as well as the existing joint knowledge base from the E-83 project between BMW and Magna Steyr had to be utilized. This in turn required an exchange and transfer of knowledge between the partners (dashed arrow) that transferred knowledge directly to the partner and at the same time enriched the joint knowledge base. This constellation helped to realize the BMW Z4 coupé.

Valuable knowledge bases

The existence of the partners' supplementing knowledge bases was one motivation to found this collaboration. Additionally, up to that point, no closer evaluation of the extent and quality of the knowledge bases was considered necessary. Both T^{MSF} and T^{BMW} identified a level of trust and confidence in the partner's knowledge base as important. Confidence in the knowledge base of the partner was gained through market reputation, during the joint work, or in former collaborations like the BMW X3 project. Although T^{BMW} relied on the existing level of trust in the partner's knowledge base, T^{MSF} proved its competence. Virtual development technology, for example, was a field relatively new to Magna Steyr, and the company lacked a reputation in and a 100% internal understanding of the field at that time. For transfer purposes, T^{MSF} had to go to unusual lengths in conducting intensive presentations and workshops to prove that the company was a valuable knowledge source. Procedures and approaches were outlined down to the very last detail in order to guide T^{BMW} through the entire process.

This was undertaken to ensure BMW's complete understanding and to convince them that they would be capable of applying the virtual development approach. Nevertheless, the existing level of trust in other knowledge bases made it easier for them to convince T^{BMW} of their reliability and capability, even in a new field like virtual development, than had been the case in the earlier project.

Because they already enjoyed T^{BMW}'s trust, T^{MSF} was able to focus more on its efforts to give detailed insights into the existing capabilities. Therefore, they spent time involving the BMW project team members earlier and in a deeper way throughout all development activities. Additionally, T^{MSF} deployed approaches to sustain confidence in their own knowledge base, such as trying to exclude new or poorly understood knowledge as well as to interpenetrate knowledge internally before transferring it to an external partner. Although the character of the collaboration was somewhere in between a horizontal (equivalent development partners) and a vertical governance form (buyer-supplier relationship), BMW as the original OEM did not have to prove its trustworthiness to the same extent as T^{MSF}. Nevertheless, T^{BMW} saw the importance and the impact of trust in and reliability of the knowledge source from the opposite perspective (T^{MSF} as the sender) and initiated activities itself to prove the value of its knowledge base. The impact of a valuable knowledge source was especially clear in the PD process and the product-specific knowledge about the X3. BMW was well-known for its process understanding, its integration in everyday procedures, and the quality of their process documentation. Their PD process had developed generically over the preceding decades, with the company repeatedly interpenetrating and improving every single step in various projects. Their many years of experience in application enabled T^{BMW} to transfer this expertise to T^{MSF}, to answer call-backs, and to provide the partner with deeply understood knowledge. Given the fact that just about 15% of the Z4 coupé parts, modules, and systems differed from the roadster version, product-specific knowledge was deeply saturated within BMW from former coupé and roadster projects (Z1, Z3, Z4, and Z8). By the beginning of this collaboration, BMW had already completely developed and been producing the slightly different roadster version for over five years at its production facilities in Spartanburg, USA. Hence, BMW had almost completely covered all possible product and process-specific problems in the development and the production phase. It turned out that the more experience with specific knowledge the company gained over time, the better its understanding was. Both partners agreed that a solid reputation concerning core capabilities and the existing knowledge base implicitly contributed to the level of existing confidence in the knowledge base.

Along with a lack of trust and confidence between BMW Spartanburg and T^{MSF}, there were cultural differences limiting good interaction at the development production interface. T^{MSF} and T^{BMW} both identified this interface as the root cause of problems in fulfilling certain specifications related to producibility. In other words, differences in working approaches, languages, or time zones caused difficulties in understanding production-specific requirements, and problems occurred with meeting related specifications. The biggest issue T^{MSF} and T^{BMW} faced was the different attitudes toward handling problems. In general, Magna Steyr follows a problem-hiding rather than displaying approach. This limited the transfer of critical knowledge to identify and to solve the problems that arose promptly.

Knowledge transfer success

Displaying the partner's capabilities gave a clear picture of who brought which capabilities and underlying knowledge into the collaboration. Referring to Figure A-5.2.02 again, three different kinds of knowledge were required to realize the project. From the partner's knowledge base section, one can derive the necessary knowledge flows according to the core competencies and the project requirements. Changes, more precisely increases, in the knowledge bases are one indicator of the successful transfer of knowledge. Two different aspects of transfer success can be distinguished. Short-term success describes the combination of assets to realize the project. Long-term success depicts the learning within the receiver as well as the increase in the joint knowledge base. Short-term success was the prerequisite to realizing the project. In the short term, partners benefited from their diversity, for example, T^{BMW} and T^{MSF} combining their approaches, methods, and tools to be able to design a new PD process to meet the project timeline. By combining knowledge assets in designing a PD process, both partners contributed to the joint knowledge base. Through the joint work and the associated application of the knowledge, BMW and Magna Steyr gained knowledge for their later internal approaches. Besides the increase in the joint knowledge base, deploying a new process indicated behavioral and procedural changes compared to the regular PD approaches in both organizations. Knowledge and information about the new process, the methods, and tools had to be transferred, understood, and applied first to be able to depart from the former product development process.

In the long run, Magna Steyr learned how to develop a coupé vehicle. Furthermore, supplier management and purchasing issues, which T^{MSF} had to tackle for the first time in this project, were handled well. The increase in knowledge in topics related to those

fields helped closing gaps in the capability portfolio. T^{MSF} is now also capable of managing suppliers and purchasing processes. BMW observed and discovered how to develop a niche car and became familiar with approaches to reduce the complexity of their own PD processes and instruments for realizing a lean and more flexible PD process. Insights into Magna Steyr's approaches enabled BMW to adjust internal structures based only on the increase in the knowledge base. Furthermore, the fact that the PD process deployed for the joint project was a combination of BMW's and Magna Steyr's processes offered great learning potential. Both partners were able to learn how the new process or improvements in product development worked out in practice, which enabled them to identify dangers or potential pitfalls without the necessity to deploy the process on their own. Afterwards, especially T^{BMW} was able to apply new methods, tools, and approaches in PD for their own processes, allowing them to prevent obstacles from arising without any previous application. Virtual development technology was another important field where BMW increased its PD-related knowledge base. T^{MSF} transferred related know-how to T^{BMW}, in spite of its newness and the transfer difficulties resulting from a lack of full interpenetration before the transfer.

Besides these individual long-term transfer successes, both partners advanced their joint knowledge base, increasing their relational capital in the fields of collaborative activities. Furthermore, T^{BMW} highlighted the learning effect from this project with respect to the maximum development time reduction and resulting transfer efforts as well as quality problems.

The two partners underlined their satisfaction with the knowledge transfer, both from the sending and the receiving perspective. They characterized the knowledge transfer as successful in both directions. At all times knowledge from the partner was considered to be of great value and of good quality in terms of applicability for project advancement.

Project success

The success of the project is indicated by internal (goals set in the contract) and external (market success, forecasted vs. achieved sales figures) success measures. Based on the contract both companies signed to initiate the collaboration, one can look at the quantifiable measures such as whether the start of production (SOP) was realized at a required quality level and at budgeted costs. Overall, the goals set for the joint development project were achieved. All quality gates were passed without considerable rework, the SOP was realized, and Magna Steyr was fully released from their responsi-

bilities. Being released by the partner means that the product has been developed successfully and all specifications have been met. Another indicator of project success can be distinguished by looking at the intentions of both partners. BMW was not able to realize the car at the time the design emerged. Therefore, they were looking for a partner to provide development capabilities or to be able to develop a car which would then later be producible on BMW assembly lines. The two companies seemed to be a perfect match because BMW found a partner who fulfilled their requirements, helping them to realize the serial development and thereby the whole car project. Although the SOP was realized, the tight project timeline required more effort than estimated to meet the schedule.
Looking at the project success from a market perspective, the Z4 coupé was launched at a time when sales figures for the Z4 roadster were struggling and were about to fall dramatically. The Z4 coupé was a complete success in terms of public resonance. With changes totaling about 15%-18% of the entire Z4 roadster, the car was recognized as a new breakthrough concept and design. While the short and tight timeline for the market introduction gave the BMW sales department a perfect basis for good forecasts, actual sales figures were 4 times higher than predicted.

The knowledge sender capabilities

De-contextualizing and encoding knowledge

As we have seen, both partners contributed to the project's success with their specific set of capabilities reflected in their varying knowledge bases. These knowledge bases developed along an individual pathway within each project team member involved. Transferring this knowledge represents a path along which the sender had to decide which part - the knowledge context - the receiver needed in order to understand the transferred knowledge. This knowledge then had to be written down or explained in other ways for transfer purposes. Each company had its own approaches to conducting PD, building a car, or an all-wheel gearbox, and every single engineer had his own individualized methods and tools to actualize this approach under certain organizational constraints (technical manual, audited procedures, etc.). Furthermore, deployed approaches vary within the same industry as well as between industries; thus, BMW and Magna Steyr followed different processes according to their experiences and backgrounds. In order to combine these assets in the joint development, project members from T^{MSF} and T^{BMW} had to draw on knowledge from their specific environment to

transfer it to the partner, as for example T^{MSF} did in the case of transferring their lean and flexible PD methods and tools to T^{BMW}. It was not possible to transfer all of Magna Steyr's accumulated know-how in this field to T^{BMW}, for which reason T^{MSF} detached its know-how from the specific context and encoded it in different ways such as written or oral form. For BMW it was neither necessary nor possible to transfer the knowledge gained over the previous five years in the Z4 roadster project. Nevertheless, the PD-relevant knowledge had to be detached for transfer purposes and put in a transferable form.

T^{MSF} members selected essential information and knowledge about the virtual development methodology and transferred it to T^{BMW}. They did that by detaching it from their own understanding following a deployment of their inside know-how, which is in line with the concept of teaching a novice. Here again the tight timeline was an important constraint. T^{MSF} had to abstract the knowledge to a certain level so that it could be transferred in an acceptable period. The problem with de-contextualizing knowledge always revolves around finding the right balance between core know-how (abstracted from the context) and contextual knowledge. T^{BMW} worked from the very beginning directly on the Z4 coupé prototypes to see how the knowledge transferred to the partner emerged and how it was put into action. They tried to find a good balance between a level of abstraction and contextual knowledge transfer by providing face-to-face transfer activities. A high level of abstraction opened the door to misinterpretations as occurred along the transfer of business metrics. Highly aggregated and transferred business measures were of no use for either partner. Both T^{BMW} and T^{MSF} deployed different measurements and, in particular, ways of aggregating and calculating business metrics. Therefore, they understood the meaning of their measures and the procedure behind it. Lacking that measurement framework behind the transferred metrics made it impossible to use them or to have any clear idea about their meaning.

Expertise about certain testing environments, simulation parameters, or calculation frameworks - knowledge explaining the context is mainly stored in the company's processes or individual's heads and not documented for transfer purposes. T^{MSF}, utilizing the new PD process, was asked to document every single step taken. At the end of the project, the complete documentation was handed over to T^{BMW}. Due to the complexity of the PD process and to be able to understand it in its entirety, BMW sent a team to Magna Steyr's development facilities. BMW was aware of the nature of the application knowledge and sent their team to observe the process application in order to obtain the application know-how which was not stored or written down in the process documentation. As mentioned earlier, T^{MSF} was already cognizant of the im-

pact of contextual knowledge on understanding transferred knowledge and integrated members of T^{BMW} into the project work at a very early stage in the PD.

Designing the knowledge transfer approach

In the course of the project both partners deployed a variety of transfer channels and media in order to transfer knowledge, such as email, telephone, a dedicated line to access product-specific information such as test results or the latest demand forecasts, video conferences, meetings of various types and intents, on-site visits at the partner's facilities, or interactive face-to-face work.

The selection of an adequate transfer channel and media followed a loosely-structured selection mechanism rather than a gut decision. Utilizing face-to-face meetings or interactive work between experts in the case of complex problems or sending a missing part specification via email to the project team members of the partner clearly indicated a selection process following underlying mechanisms. Members of T^{MSF} and T^{BMW} selected appropriate channels and media according to the transfer setting including the kind of knowledge, the content and the amount, the transfer knowledge complexity, the collaboration setting, the transfer efficiency, and the current project phase. In the analyzed case the knowledge sender orchestrated the different transfer channels and transfer media. The selected combination of deployed channels and media provided a picture of the current project status at any given time, meaning that at any given time needs and problems in the transfer process were transparent.

With a rising complexity of knowledge, both partners tended to select transfer channels and media with greater interaction potential, i.e. in the case of complex knowledge, face-to-face interaction between the people and experts involved was required. For example, if a problem turned out to be of a complex nature, hence not solvable by one partner on its own, T^{BMW} and T^{MSF} moved the relevant knowledge carriers from the project team or the operating department to the point of interaction. For instance, due to the high complexity of production-specific knowledge, employees from BMW Spartanburg were integrated into T^{BMW} during the serial development phase and worked closely with T^{MSF}. This approach helped to ensure the producibility of the vehicle on the BMW assembly lines later on. As this was the second collaboration of this type between the two partners, T^{BMW} and T^{MSF} recognized the limits of communication channels and media to transfer especially complex and non-documented knowledge. As outlined, both partners tried to deploy interactive transfer approaches as often as possible. In addition, they agreed that a co-location would increase the transfer

process, particularly for complex knowledge. Working more closely without setting up the co-location, BMW and Magna Steyr aligned their project team structures as well as the organizational rooting. Magna Steyr reproduced in detail the organizational structure 1:1 to enable knowledge to flow across organizational borders.

It turned out that the joint project work itself was an extraordinary way to transfer knowledge: either by doing or by supporting ongoing application (knowledge sender) as well as through observations or learning by doing (receiving knowledge). Realizing the complete project together gave both partners the opportunity to transfer knowledge in a direct way or to learn from the other by working together. The sender deepened his know-how in these activities, whereas the receiver gained insights into the new methods, tools, and process approaches deployed throughout the development stage. An illustrative example is how T^{BMW} made use of this knowledge transfer instrument in order to learn about Magna Steyr's PD approaches.

Besides selecting the transfer approach, the deployment of channels and media was also a critical issue. First, members of both teams were aware of relationships between the type of knowledge delivered and the channel chosen. For the more interactive transfer channels such as face-to-face types of work, they underlined the necessity to communicate effectively and work on the understanding within the receiver. Coaching engineers directly on the production line and involving them in related work helped them to take the perspective of those unfamiliar with the processes, technology, procedures, etc. This behavior was seen as essential to success when it came to face-to-face interaction. Two success-critical procedures were identified by members of T^{MSF} and T^{BMW}, namely, self-reflection and perspective taking. Self-reflection helped them to see what was essential for the understanding of the specific issue engineers were working on jointly on the production line. The knowledgeable party in such settings was more successful when she reflected on this before starting any explanations. To take the perspective of the partner, e.g., asking questions like - How would I like to have this issue explained? or Would I understand the task with this and that information? - supported communication in the interactive work.

Building up and utilizing relational capital

As introduced in the knowledge base section, this collaboration was established on different knowledge bases. One essential success lever, according to both T^{MSF} and T^{BMW}, was the joint knowledge base. BMW and Magna Steyr agreed upon the fact that in order to realize an efficient knowledge transfer process, they had to address the right

people within the receiver and thereby to interlink the experts in the sender and the receiver organizations concerning a specific task. Both partners tried to build up relationships between the project members before the project kicked off. Based on that and the deployed 'Leistungsschnittstellenvereinbarungen' (LSV's), project team members were able to identify sources of required knowledge or the people in need of knowledge more easily. Originally, LSV's showed project tasks and related responsibilities in structuring project work. T^{BMW} and T^{MSF} enriched this tool by also displaying the underlying knowledge flows necessary to fulfill each task to pass the next project milestone. Furthermore, carriers of specific knowledge assets were identified in the LSV's. BMW regarded this project as an investment in the future - developing the existing joint knowledge base as well as knowledge about the partner Magna Steyr. Relational capital, e.g., the knowledge about the partner, the organizational structure, decision procedures or a joint knowledge base, helped to reduce the effort to find the right people, to support an easier understanding of the partner's knowledge, and to choose the right degree of de-contextualizing knowledge according to the partner's preferences even before the transfer. The efficiency of knowledge transfer and the project work in general increased through the deployment of this relational capital.

In the E-83 project between Magna Steyr and BMW, relational capital in various fields was built up, for example, as related to the partner's working procedures, strengths and weaknesses, and social ties between the team members involved. For example, project team members of Magna Steyr were trained to work in BMW's IT and database systems. This in turn meant that the Z4 coupé project members from T^{MSF} did not need to be trained in using the system architecture. When planning and launching this collaboration, the management of BMW, assuming its existence, built upon the knowledge base.

Even though a joint knowledge base helped to transfer knowledge more easily, the idea posed potential problems. First, to leverage relational capital the sender had to diffuse knowledge about the partner and the joint knowledge base within its own collaboration, which required internally functioning knowledge transfer procedures. The knowledge already transferred within both companies had to be transferred to T^{MSF} and T^{BMW} in order to be deployed, for which purpose internal transfer was necessary. Both partners used the rotation of employees for the dissemination of relational capital or partner-specific procedures stored in the systems. Secondly, most of the relational capital was people bound. Changing project team members resulted in the need to re-evaluate the actual joint knowledge base within the receiver. Thirdly, if the actual evaluation was not done properly or there was no evaluation at all, mistaken anticipa-

tion of the existing joint knowledge base posed the danger of worsening rather than improving knowledge transfer. Leveraging relational capital by focusing transfer activities, and the transfer knowledge required a precise picture of the existing knowledge base of the receiver. A wrong picture caused failure in the transfer, e.g., the anticipated knowledge did not exist and selected transfer knowledge could not be understood because important parts were missing from the receiver's base. To avoid the above-mentioned dangers, T^{BMW} tried to influence the project staffing within Magna Steyr so that they would be able to work with people already involved in the BMW X3 project. However, involving the same people again would have limited the growth of the relational capital base.

Selecting transfer knowledge

As mentioned earlier, the timeline of this project was very tight and both partners needed to combine their capabilities to meet the schedule. Therefore, both partners agreed to spend more effort in the identification and ongoing combination of strengths and weaknesses in the knowledge bases at an early PD stage. In the negotiation phase of the project, they outlined the project's requirements and their strengths and weaknesses concerning those tasks. According to the concept of a knowledge portfolio, the procedure helped T^{BMW} and T^{MSF} to assess the partner's knowledge base as related to the goals set for the collaboration. In the kick-off meeting the LSV's were designed as an instrument to inter-relate the knowledge transfer and the project plan.

To be able to combine knowledge assets to create a new process, both partners outlined their own knowledge bases over the PD process for the project to provide a picture of their strengths and weaknesses. Presentations and meetings in the early phase or even earlier, in the negotiation phase, helped to display those pictures. Deploying the LSV's over the PD process illustrated which knowledge had to be transferred, which person or department was providing required knowledge, and when as well as where the know-how was needed. Afterwards, those documents were also passed on to internal experts at BMW from different fields and involved in the Z4 roadster project to challenge the LSV's from their knowledge and experience.

Even though both partners designed the LSV's to structure the knowledge transfer and to integrate the transfer into the project plan, this instrument showed two notable limitations. First, LSV's were designed very early in the process and not revised according to dynamic changes in the project. To overcome that pitfall, T^{BMW} additionally challenged T^{MSF}'s knowledge in on-site visits or in meetings by sending experts to identify

knowledge gaps on specific tasks. Based on the gaps identified, experts in related fields were rotated to address the gaps and provide missing knowledge. Secondly, besides increasing the effort to transfer knowledge successfully, the tight project line had another negative impact on the transfer. The relevant knowledge sources within both partners were not informed of and therefore not appropriately prepared for the know-how transfer. Operation departments did not even know that they had to provide certain knowledge assets to the partner, which caused internal trouble as well as problems getting this knowledge in time. Both partners saw room for improvement in the coordination process during the early collaboration phases.
Besides utilizing LSV's to structure the project and to create an inter-linkage with necessary knowledge transfer and rotating experts who challenged the knowledge portfolios, BMW deployed the technical networker as an organizational solution to interlink the knowledge portfolios of both partners and to enable the combination of bases. The technical networker, being a technician by training, was part of the BMW project team. In addition to his detailed technical abilities, he was strongly connected to the networks within the operating departments of BMW and other knowledge carriers within the organization. Providing technical knowledge as well as holding this networked position allowed the supply of required knowledge to the receiver or at least the identifying and tapping of the right sources within BMW. In the Z4 coupé project one of the technical networkers was a former employee of Magna Steyr who was already involved in the E-85 project and in charge of the material testing which led to the concept of the BMW Z4 coupé.

Supporting the knowledge application

Interviewed members of the project team underlined that the application of transferred information and knowledge was the main benefit. Without an ongoing application, the transfer would have been regarded as taking time from the already tight schedule. Initially working on their own and afterwards merging the Z4 coupé concept ideas led to close inter-organizational work from the early design/concept phase. T^{MSF} and T^{BMW} offered coaching, workshops, and other forms of topic-related work to enable the partner to fully understand transferred knowledge. The joint work of project members on a specific task was a frequently used and efficient approach for disseminating knowledge of a complex nature and to enable its application in the project. Especially, problems and critical issues were able to be solved in an easier way when this kind of interaction took place. In that way, T^{MSF} and T^{BMW} were able to transfer knowledge, con-

textual and application knowledge as well as ongoing application support in terms of providing further explanations and joint application activities. As knowledge transfer was even stipulated in the collaboration contracts, Magna Steyr developed procedures to support knowledge application such as constant joint work.
The concept of the technical networker represented another instrument to provide ongoing support in applying transferred knowledge. With his technical background and deep involvement in the organizational network, the technical networker was able to provide required expertise and support of the application by himself. His permanent presence and network position helped him to attend to the project work and to identify further gaps in understanding. When needed, he could instantly provide additional help, needed knowledge, or access to relevant knowledge sources.

Considering and deploying feedback

Reflecting the interactive and iterative nature of knowledge transfer, the sender's field of responsibility exceeded the unidirectional sending process. Managing feedback was, however, a significant issue as well. Feedback was a valuable resource for being able providing supportive activities to the receiver to avoid transfer knowledge application difficulties due to misunderstandings, or even worse, a complete lack of understanding. T^{MSF} and T^{BMW} identified feedback as one of the most valuable resources for the optimization of joint work and knowledge transfer in particular. T^{BMW} highlighted a special procedure to release the full potential of feedback. Before reacting to feedback, T^{BMW} pushed the partner to reflect upon it. What were the real underlying problems and where were the lacks in the knowledge base? Where in the process were the weaknesses? They wanted T^{MSF} to come up with a clear picture of the knowledge gaps in order to optimize the transfer, the transfer approach, or even both. This approach helped to increase the transfer in two different ways. First, T^{BMW} adjusted the knowledge transfer and thereby increased its efficiency. Secondly, T^{MSF} interpenetrated the problem and contributed to its solution.
The consideration and deployment of feedback led to individualization in terms of adopting the transfer approach, the transfer content, and the communication approach, among others. Besides contributing to the joint knowledge base and knowledge about the partner, feedback helped to establish a partner-individual knowledge transfer procedure, e.g., orchestrating the individualized ways of selecting the right knowledge or the right transfer channels. Based on the joint work between BMW and Magna Steyr in the X3 project and the ongoing Z4 coupé development, knowledge transfer became

more and more individualized. Both partners were able to set up transfer channels faster, select the feedback receiver according to the knowledge field, or target team members within the partner with the biggest diffusion effect to improve the accuracy of the process.

The knowledge receiver

As knowledge transfer was a reciprocal process featuring both partners in alternating sender and receiver roles according to their knowledge bases, the receiving process had an impact on transfer success as well. The motivation and the capability to absorb new knowledge from external sources in general and from a specific partner in particular were the main levers for the receiver to impact the transfer process. T^{MSF} and T^{BMW} saw the potential the joint project work held and were motivated to contribute to the success of the project from a receiving perspective. That motivation could be seen in as both sides put effort into understanding the transferred knowledge, sending project team members to observe the new PD process, or in the drive to pick up knowledge from the partner, as was the case with T^{MSF}. A lack of motivation within the knowledge receiving company caused problems in the transfer process. One illustrative example was BMW's skepticism about Magna Steyr's ability to realize the project. The operating departments in particular responded haltingly in accepting and deploying knowledge from the partner, thereby increasing the effort required of T^{MSF} to transfer its knowledge.

Another important aspect to successfully transferring knowledge was the capability to absorb the sender's know-how. T^{BMW} and T^{MSF} had few problems understanding the transferred knowledge from the partner. The training and education level of employees, their common industry background, and their experiences from other projects related to the PD field helped them to understand the transferred knowledge in general. Magna Steyr experienced from collaborative projects with other OEMs, and this project was their second time developing a complete vehicle for BMW. Especially the latter circumstance explicitly supported an understanding and application of knowledge from T^{BMW}. Besides having their collaboration experience, Magna Steyr and BMW had also gotten to know each other and built up a joint knowledge base in the 30-month development project for the BMW X3, giving them a good joint base for their second collaboration. In that setting, the partner-specific knowledge deployed, e.g., knowing the right people, or having insights into decision processes supported the joint work. While both partners identified former joint experiences as facilitating the

understanding of transferred product and process knowledge, this understanding was limited when transfer know-how became detailed. For example, BMW, as a high-volume car manufacturer, was not familiar with niche car development approaches and had problems understanding Magna Steyr's procedures and process approaches.

With respect to the transfer of process knowledge, initial problems in understanding occurred because both partners saw themselves confronted with new methods, tools, or approaches along the product development process. Lacking experience with those approaches, T^{BMW} as well as T^{MSF} recorded some initial problems with saturating the transferred knowledge.

Appendix A-5.3 - Mercedes Benz 4-matic series case study project

Case study
Mercedes Benz E-class 4-matic
(Project W 211)

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Project description[38]

In 1999 Magna Steyr and Mercedes Benz[39] signed a collaboration contract for the development of the 4-matic family and an ongoing production of the E-class 4-matic at Magna Steyr production facilities. This project was part of the so-called SEC-project, which proposed the development of 4-matic versions of the latest S-, E-, and C-class. Additionally, T^{MSF} was supposed to develop and produce a diesel particle filter engine version and to accompany the timely ramp-up of the S- and C-class within the Mercedes Benz production facilities. 4-matic is the name of a four-wheel drive system developed and used by Steyr-Daimler-Puch. This system was invented especially for off-road terrain. Almost all Mercedes Benz vehicles featuring the 4-matic system have an automatic transmission included in the base equipment, and that is where the term 4-matic originally came from (*4*-wheel drive and auto*matic*).

In 1984 the first generation (124 series) of the 4-matic technology was developed and produced by Mercedes Benz. This model and especially the 4-matic technology fell below expectations in terms of performance and market success. The second 4-matic generation, actually the first collaboration in this field between Magna Steyr and Mercedes Benz, was introduced in 1999. At that time the forerunner of the W211[40] series, the W210 series, was launched from a joint project. The project was a resounding success (surpassing sales forecasts). Based on that success, the new SEC 4-matic project again was jointly initiated between Magna Steyr and Mercedes Benz, with the development of all three cars and the assembly of the E-class 4-matic. The S- and C-class went to Mercedes Benz facilities (S-class, plant Sindelfingen, C-class, plant Bremen) for production purposes. However, the collaborative setting was complex, involving three car concepts, two development, and three production facilities, as depicted in Figure A-5.3.01. At the time, the joint project was set up, the 4x2 basic version of the S-, E-, and C-class had already been launched to the market and came from Mercedes Benz's Sindelfingen (S- and E-class) and Bremen plants (C-class). They provided the concept and product specifications for the three derivates, which were mostly derived from experiences in the 4x2-wheel project and amplified by the diesel particle filter engine version. The outline indicates where the knowledge and expertise for the

[38] Throughout this case study I use the company names as synonymous for the whole organization: T^{MSF} represents the team from Magna Steyr involved in the 4-matic project, and T^{MBC} represents the team members of Mercedes Benz Cars involved in this 4-matic project.

[39] Mercedes Benz AG was a part of DaimlerChrysler AG at the time both partners signed the contract. Since October 2007, this unit belongs to Mercedes Benz Cars of Daimler AG.

[40] W in this term refers to the type of car and stands for the E-class, the car project focused on here. The 211 is a running number representing the generation of 4-matic vehicles.

project resided within the cooperating partners. Figure A-5.3.01 illustrates the way both partners cooperated along the value chain in the SEC projects for the 210 and the 211 series, representing the two latest 4-matic generations introduced by Mercedes Benz over the past 23 years. Although three different Mercedes Benz locations were involved in the 4-matic project, Sindelfingen was the development partner in this setting.

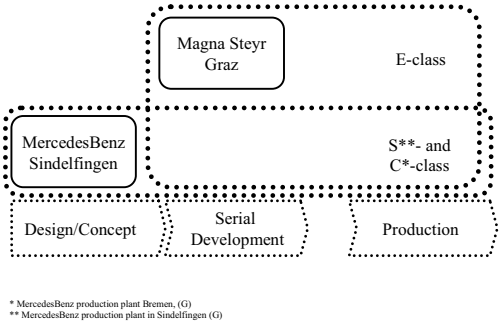

Figure A-5.3.01 - Three generations of 4-matic series and the collaboration's setting

In addition to the development of the three 4-matic versions and the assembly of the E-class 4-matic (SOP January 2003), T^{MSF} was also in charge of the logistic and purchasing issues in the project, managing about 280 suppliers for the 4-matic system on their own. When T^{MSF} and T^{MBC} signed the collaborative contract, Mercedes Benz had recently introduced a major cost cutting initiative, which was also relevant for cooperative projects as well as supplier management issues. The latter issues involved the abilities of members of T^{MSF} in the project. Because the development took place in Graz, T^{MSF} also worked especially closely with the other two assembly locations. That gave rise to another issue in the project. Producing only one of the three 4-matic derivates on its own assembly facilities required T^{MSF} to ensure producibility on the partner's assembly lines as well. During the development phase, about 200 engineers from the Magna Steyr facility were involved in the project. The contract stipulated a volume of 3.7 billion €, and Magna Steyr was to be paid by Mercedes Benz for the development of the SEC 4-matic family, the assembly of the E-class 4-matic, and the ramp-up support of Mercedes Benz assembly plants for the S- and C-class. This case study focused on the W211 development project. Where necessary, remarks are made to distinguish between development-related activities for the product family and the W211 project in particular.

Partners' knowledge bases

In the W211 project both partners had to combine and therefore transfer knowledge of different kinds and from different fields. In these different fields, partners differed in their original knowledge bases. Even though this project was not the first joint vehicle development collaboration between Mercedes Benz and Magna Steyr, transfer was necessary in order to deploy the partner-specific knowledge and the existing joint knowledge base from the 210 series project. In order to realize this project and ensure its success, individual value chains featuring three partners were deployed as well as knowledge of the following kinds: partner-individual capabilities and the existing joint knowledge base.

At the serial development - assembly interface, two of the four versions went to Mercedes Benz production facilities, for which reason *production-specific* knowledge had to be transferred to T^{MSF} during the development phase. For the two versions which stayed at the Magna Steyr facilities for assembly, such transfer was not necessary because T^{MSF} had to ensure the producibility of those versions on their own assembly lines. Nevertheless, they built in production-specific know-how to be able to work effectively, transfer the prototypes more easily, and support a ramp-up at the partner's facilities.

In the case of *process-specific* knowledge, two tendencies could be observed. Due to their business model, Magna Steyr implemented process platforms throughout all fields at potential interfaces with external partners. This allowed the rapid adaptation of partner-specific methods, tools, or instruments as, for example, partner-specific test requirements in the case of this project. On the other hand, it enabled Magna Steyr to develop lean and highly flexible processes. As this vehicle program required lean and flexible development and production capabilities, Magna Steyr appeared to be a knowledgeable collaboration partner. Furthermore, Mercedes Benz chose Magna Steyr because of their experience in noise and comfort issues as well as the 'Steirische Weg'. The 'Steirische Weg' embodied a pragmatic and solution-oriented way of adjusting structures and processes to current project requirements. In assigning logistics and purchasing issues to T^{MSF} in the project, T^{BMW} faced the need to transfer knowledge and expertise, including knowledge about methods, tools, and approaches to adhere to the cost-cutting guidelines.

As mentioned before, this was the second collaboration of its type; *system-specific* knowledge had already been transferred in the 210 series project. In that project, Mercedes Benz invested in the training of Magna Steyr project team members to enable

them to work in their systems and to access information and knowledge relevant for the project's advancement. Hence, system-specific knowledge transfer was kept to a minimum, as Mercedes Benz assumed an existent base. Besides system-specific knowledge, both companies had further joint knowledge bases, e.g., knowledge about people, decision procedures, and working approaches.

Product-specific knowledge transfer was of high importance in the collaboration. Knowledge about all derivates (S-, E-, and C-class) and engine specifications needed to be transferred to T^{MSF} to ensure the serial development and to leverage existing knowledge from Mercedes Benz. On the other hand, Magna Steyr was the expert in terms of 4-wheel technology knowledge, an important piece of the puzzle in realizing a 4-matic system properly. Furthermore, they transferred knowledge related to problems that occurred with those products or potential improvements they discovered during the development phase. This helped to avoid problems in ongoing production processes as well as to improve the product itself.

Along with the technical knowledge about product specifications or tests procedures, the business case was also very important. To keep track of the case, *business metrics* had to be exchanged. In general, such knowledge was stored in data sheets. Nevertheless, data frameworks and underlying assumptions had to be transferred as well to enable an understanding of the aggregated business metrics and the ongoing application in order to calculate the business case and to forecast the project.

From a knowledge point of view, the project realization was based on the combination and therefore the transfer of different knowledge bases as outlined. Individual capabilities and knowledge of different types as well as the existing joint knowledge base from the 210 series project had to be utilized.

The valuable knowledge source

Both partners identified trustworthiness of the knowledge source as one important attribute impacting on the success of knowledge transfer. A more reliable and of course knowledgeable source could transfer knowledge to its partner more easily. Callbacks and open issues were able to be addressed and solved from the sound and deep understanding. The reliability of the knowledge source was strongly related to the effort the knowledge receiver had to spend to be able to understand the transferred knowledge. Magna Steyr had gained its reputation as a valuable knowledge source in various fields from the market and former collaborative work with Mercedes Benz.

Relating the reliability and trustworthiness of the knowledge source to experience in a certain field was a result of frequent knowledge application and improvement in specific knowledge. Being a well-known expert in the field of, e.g., niche PD and assembly gave Magna Steyr the opportunity to apply and thereby deepen their expert knowledge in various projects. This status helped Magna Steyr to acquire more projects in this field and thereby increase the frequency, the intensity, and the application variety of knowledge to deepen its interpenetration. That in turn helped them to develop their knowledge into a very deep understanding. Gaining trustworthiness initiated a self-empowering circle, increasing in turn the level of trustworthiness. This empowering effect seemed to work in both directions if one considers the knowledge in the field of the diesel particle filter.

T^{MSF} in particular appreciated the impact of being considered a trustworthy knowledge source and therefore did not want to rely only on the self-empowering cycle. To turn this process into a more active approach, T^{MSF} internally reflected on knowledge before sending it to a partner, e.g., by challenging know-how with new application contexts within the receiver or by internal presentation, as they did in the case of the project in question. Reflecting on the knowledge before sending it provided T^{MSF} the opportunity to identify lacks in understanding and open issues they could remedy before the transfer. Nevertheless, T^{MBC} underlined that in the case where problems in understanding occurred on their side, these issues could be traced back to a lack of understanding within T^{MSF}. That was the same phenomenon that occurred when T^{MBC} transferred knowledge to T^{MSF} which was not fully interpenetrated and understood internally beforehand. Even knowledge about problems that arose followed the same rules. A lack of understanding of a problem had a negative impact on solving it, i.e., it decreased the chances of solving it easily.

Knowledge transfer success

Knowledge transfer showed its impact in different ways, on different levels, and at varying time horizons. Therefore, success was determined based on a number of indicators. While identifying the urgent need to successfully exchange knowledge for a combination of strengths, both T^{MSF} and T^{MBC} showed room for improvement in knowledge transfer. In general, team members were satisfied with the quality of the knowledge that was transferred enabling its understanding and application for advancement of the project. Both project teams agreed that the knowledge transfer from T^{MSF} to T^{MBC} was more successful than in the opposite direction, as the knowledge

transfer from T^{MBC} to T^{MSF} was considered rather un-focus, chaotic, and piecemeal, which resulted in re-work. That unsystematic character permeated all aspects of the knowledge transfer. At the beginning the partners did not outline the entire project, identify necessary knowledge sources for certain project tasks, or arrange for project team members to get to know each other better. There was no evaluation of strengths and weaknesses, which could have been deployed afterwards to focus knowledge transfer or to avoid re- and double work. MB internally was not even capable of shaping a picture of its capabilities and existing knowledge assets. Three years prior to the collaboration with Mercedes Benz, Magna Steyr had instituted a plan as a standardized step in setting up collaborations with an external partner. That plan indicated which knowledge resided where, when that knowledge needed to be transferred, and who was supposed to be the right receiver. However, Mercedes Benz did not see the necessity to use such an approach, nevertheless identified it as one of the biggest issues for the collaborations afterwards. A constant and effective knowledge flow was established at no point.

The knowledge transfer resulted in short- and long-term benefits. In the short term, partners benefited from a combination of their existing knowledge bases, which was necessary to enable development and ongoing production in the project. The collaboration of Mercedes Benz and Magna Steyr enabled the successful development and production of the third 4-matic generation. In the long run, Magna Steyr learned how to develop a diesel particle filter engine and interpenetrated the underlying technology. Mercedes Benz acquired new knowledge in the areas of idle speed vibrations and noises, root cause analysis in that field, and about the dynamo, which was deployed in the next generation of Mercedes Benz cars. Besides the increase in the technical knowledge base, both partners gained a great deal of partner-specific knowledge for ongoing collaboration. T^{MBC}'s dissatisfaction with the knowledge transfer in the project could also be seen as a long-term benefit, as they gained important insights into how to initiate and run such kinds of collaborations and especially the set-up of the knowledge transfer process.

T^{MBC} admitted that they could have contributed to the transfer success easily by providing more knowledge about potential pitfalls in the project and by transferring knowledge in a more proactive and preemptive way. Considering possible fields of improvement, they identified the mindset as significant (openness, confidence, and trust in the partnership) of the employees who did not fully recognize the importance of the knowledge transfer and thereby hindered a constant knowledge flow.

Another import issue was the limitation of knowledge transferred to the partner. Both partners limited the transfer of knowledge, whether consciously or unconsciously. Within T^{MBC}, the operating departments insisted on adhering strictly to the signed contract, and they limited the know-how transfer to Mercedes Benz due to strong self-interest, i.e., seeking to protect their knowledge from an external partner. Having T^{MSF} come up with better solutions than the internal T^{MBC} operating department would have caused them internal trouble. Transfer limitation reached its peak with the re-integration of some specific project tasks into T^{MBC}, which T^{MSF} assumed to have happened because of knowledge transfer limitations. T^{MBC} also unconsciously limited the transfer because of its inability to picture the knowledge assets residing within the company. Therefore, it was not possible for T^{MBC} to provide T^{MSF} the knowledge they asked for, even if they had intended to do so. T^{MSF} limited their transfer activities only in selected fields, such as confidential business metrics.
Another field of transfer limitations involved the gearbox technology and its related technical knowledge. Magna Steyr developed and produced the gearboxes. Giving that knowledge to Mercedes Benz was equivalent to handing it over to a competitor, i.e., Mercedes Benz would have been able to use those insights to start working with other suppliers. According to both teams, limited knowledge transfer had a negative impact on knowledge transfer and project success.

Project success

The success of this project is indicated by internal (e.g., goals set in the contract) and external (e.g., market success, forecasted vs. achieved sales figures) success measures. Referring to the contract both companies signed, one can look at quantifiable measures such as whether the start of production (SOP) was realized, at a required quality level, and at stipulated costs. In general, the joint work was regarded as a success. Almost all goals set (about 100) were reached, with one exception. Concerning teamwork and cooperative work, both T^{MBC} and T^{MSF} identified room for improvement. T^{MBC}, for example, stated that the joint work did not succeed in the fields where the partner showed lacks in capabilities, e.g., the development of the diesel particulate engine. T^{MSF}, on the other hand, underlined that trust, transparency, and respect for the partner were lacking and resulted in a lower collaboration performance.
From a market perspective, this joint project was an average success. The 4-matic technology turned out to work perfectly fine, as did the first jointly developed 4-matic version. Nevertheless, the car had quality issues after the market launch. That cost

Mercedes Benz, as the only partner with end-consumer market access, some degree of its reputation as a high-quality car manufacturer.

The knowledge sender capabilities

De-contextualizing and encoding knowledge

In the collaborative work it was a great challenge to tap an individual's body of knowledge for transfer purposes. Magna Steyr's way of developing and producing a car contains a large number of approaches, tools, and methods developed in numerous iteration and learning loops. Team members deploying these instruments had built up a sizeable knowledge base about the application and the context of that know-how over many years. In order to understand the knowledge, which was one of the contract goals, information covering the (knowledge) context was of importance. T^{MSF} tried to initiate the movement of experts to ensure the transfer of contextual and supplementary knowledge. For that purpose, members of T^{MSF} tried to find an adequate degree of detaching knowledge from its context. That was done mainly on an individual base in accordance with the person's own perception and in internal meetings before the transfer took place. Additionally, they provided contextual and continuative knowledge in ongoing presentations or joint interactive work, among other things.
As the transfer of contextual knowledge resulted in higher transfer effort, T^{MBC} decided to work on that issue and lowered this effort. Therefore, knowledge transfer activities mainly entailed providing information and technical data, such as technical specifications provided through the IT systems. Continuative and contextual knowledge was not transferred in a satisfactory way. As a result, T^{MSF} struggled to understand the knowledge, e.g., product- and production-specific issues from the plain documented data. Less effort for T^{MBC} resulted in a greater effort for the partner team. Time and again, knowledge was transferred late in the process and without contextual or continuative insights, which led to an increase in the effort to understand the transfer know-how. T^{MBC} gave a good illustration on that special situation by highlighting the development of the diesel particle filter engine. In that particular case, Magna Steyr lacked contextual knowledge in the specified area and was not able to understand, e.g., technical specifications for the diesel engine. Members of T^{MBC} de-contextualized transferred knowledge to a degree, which they considered T^{MSF} capable of understanding based on Magna Steyr's own statement. Limited contextual knowledge was the reason for T^{MSF}'s lack of understanding.

Especially the latter example illustrates that the degree of de-contextualization determines whether transferred knowledge can be applied or not. For example, a high degree, i.e., a lack of context, made it almost impossible to understand the full value of the transferred knowledge. Referring again to the diesel engine development, one can see that the transferred knowledge from T^{MBC} was not understood by the team members within Magna Steyr. Besides those problems in understanding, a high degree of de-contextualization opened the door to (mis)interpretation and therefore the possibility of failing in the application of transferred knowledge.
After the de-contextualization, knowledge was encoded for transfer reasons. Members of T^{MSF} and T^{MBC} had to write down or orally formulate what they thought was essential to understanding knowledge and to enabling the partner to apply it as well. Often partners failed to understand one another because of the terms employed. In particular, experts had difficulty in finding common terminology, and as the knowledge became more detailed, they were not capable of encoding it in a way that the receiver could understand. T^{MSF} struggled to encode knowledge effectively. Project team members were not experienced in articulating their knowledge in a general way without using their specific terminology or terms the partner's team could easily understand.

Designing the knowledge transfer approach

Throughout the joint work, knowledge transfer was a constant issue, whether consciously (e.g., coaching, meetings) or unconsciously (e.g., joint problem solving). To transfer know-how, T^{MBC} and T^{MSF} deployed a broad variety of transfer channels and media, including the exchange of CAD drawings, phone calls, email, regular meetings, face-to-face communication, and the shifting of experts. None of the project team members interviewed seemed to follow set rules in the selection process for the right channel and media. Nevertheless, they mentioned at least some factors influencing the underlying decision. According to the complexity of the content as well as its breadth, both partner teams preferred some transfer channels and media over others. The more complex the content was, the more likely the cooperating partners were to deploy richer transfer channels like joint work or interactive problem solving. In the course of the project, the transfer approach changed in that people preferred less rich channels and media. T^{MBC} stated that they deployed interactive work or face-to-face meetings, especially at the beginning, to build up trust between the partners. Later, they preferred email and phone calls to reduce the transfer effort. Neither partner selected the transfer approach based on resource considerations. Both focused on the transfer rather than on

resource issues. There were frequently time limitations which restricted the deployment of certain channels or media like on-site visits or interactive problem solving. Overall, both partners applied the same transfer channels and media for transferring their knowledge.

Another indication that the design of the transfer approach was not based only on a gut decision was the introduction of regular meetings as a framework for knowledge transfer. The idea behind them was to provide team members a venue for exchanging knowledge. Additionally, they initiated different subgroup meetings to exchange more highly topic-related know-how between more expert employees. This network of general and more focused meetings was in place throughout the whole PD process and helped people to get to know each other, see who the knowledge carriers were, and establish a base for further knowledge transfer. This framework also indicated something essential: Both T^{MBC} and T^{MSF} deployed a two-level knowledge transfer. First, they exchanged all documented knowledge on a certain task, problem, or issue that arose. Afterwards, both partners were able to ask for further know-how to understand the knowledge already transferred. This took place in more interactive transfer approaches. T^{MBC} members mentioned that this additionally helped to reduce the effort for transferring knowledge by focusing only on the open issues.

From the perspective of T^{MBC}, knowledge transfer was not a matter of sending or transferring knowledge to the partner. Rather, they mentioned that know-how transfer was about Magna Steyr getting the knowledge from the systems of Mercedes Benz. In their opinion, providing knowledge most of the time in documented form via databases or other IT systems was the right approach for transferring the necessary know-how to Magna Steyr.

As both partners had seen the value of non-documented contextual knowledge, the movement of people, particularly experts, became an approach deployed for transfer purposes. T^{MBC}, for example, integrated two employees permanently at Magna Steyr facilities to observe and thereby acquire new knowledge from the partner, while T^{MSF}, for instance, sent team members to the partner's plants to support the production ramp-up of the C- and S-class 4-matic. With those more interactive transfer approaches, communication aspects between the people involved took center stage.

T^{MSF} identified a lack of communication skills on their own side as one root cause of problems in knowledge transfer. Project team members were not efficient or successful in preparing, displaying, and communicating knowledge in an appropriate way. Moreover they were generally not able to articulate their know-how adequately to enable understanding within the receiving partner. To close gaps in understanding or consider

the perspective of the receiving partner, T^{MSF} underlined the need to train their employees in presenting in-depth knowledge to potentially less knowledgeable people, in using more common language, and in communicating more effectively in general.

Building up and utilizing relational capital

The common history of the two firms, outlined earlier in this chapter, and especially the collaboration between Mercedes Benz and Magna Steyr to develop the first generation of the 4-matic series, provided them a solid joint knowledge base. For example, project team members from Magna Steyr had been trained in working in Mercedes Benz systems and become familiar with the project as well as the organizational structures within the partner in the W 210 4-matic series project. Both partners recognized the value of a joint knowledge base, knowing, e.g., employees within the partner, strengths and weaknesses, or decision and working procedures. Although they were aware of the effort necessary to build up a common knowledge base (coaching, training, workshops, on-site visits, etc.), T^{MBC} as well as T^{MSF} called it an investment rather than effort. While both partners identified the need for and the value of investing in relational capital, they did not follow this idea consequently. T^{MBC} pushed the utilization of the joint knowledge base too far without making much progress on building up further relational capital. Therefore, T^{MBC} adjusted knowledge transfer based on the joint knowledge base established in the W 210 4-matic series project. Knowledge transfer from T^{MBC} to T^{MSF} anticipated the existing expertise based on the first collaboration. In using that estimation, T^{MBC} underestimated the impact of changes within Magna Steyr. Since the previous collaboration, employees had lost knowledge or changed positions. In particular, the movement of team members in the course of the project was identified as one reason for problems in knowledge transfer. This led to a change in the joint knowledge base held within Magna Steyr for the project. Furthermore, the effort to understand the knowledge transferred increased in turn due to T^{MBC}'s 'wrong' knowledge transfer adjustments. Both companies struggled because of an internally insufficient knowledge diffusion of the partner's knowledge base. In consequence, the effort to transfer knowledge was reduced for T^{MBC}, however, increased for T^{MSF}.

Nevertheless, both partners recognized the potential of relational capital for their actual and ongoing collaboration and underlined its importance from a long-term perspective. To support the development of the existing joint knowledge base and to increase knowledge about the partner, T^{MSF} relied on the movement of people. Especial-

ly at the beginning of the project, they shifted experts around, and as previously mentioned, both partners established the series of meetings to give project team members the chance to get to know each other better.
Another weakness of both partners in this field involved the building of teams in the early collaboration phase. Both teams underlined the impact of teamwork throughout the joint project and criticized the failure to employ the approach to bring employees closer together. Especially T^{MBC} saw the necessity to integrate the operations departments in a broader way as well as to increase their acceptance of and openness to external partners.

Selecting transfer knowledge

T^{MSF} and T^{MBC} outlined which capabilities and knowledge assets partners needed to contribute to be successful in the collaborative PD. Therefore, they evaluated their own knowledge portfolios internally first. This internal evaluation allowed them to find sources of required knowledge. Nevertheless, T^{MBC} was not able to create an adequate picture of their own knowledge assets. Hence, it was hard to relate the knowledge source from T^{MBC} to the receiving unit from T^{MSF} within an appropriate timeframe. T^{MSF} found fault with the lack of a kick-off meeting to evaluate the partner's knowledge base and to roll out a knowledge transfer plan indicating what knowledge was required when and by whom. Insights into partners' capabilities and knowledge bases mainly came from the offering phase. The partners worked out a project plan, based on the assumption that T^{MBC} and T^{MSF} were capable of jointly realizing it. Although T^{MBC} and T^{MSF} had limited insights into each other's knowledge bases, both tried to adjust their knowledge transfer to those insights.
Instead of relying on an actual and recently evaluated picture of the partner's knowledge portfolio and existing knowledge gaps, both independently deployed their own 'solutions' to overcome this shortcoming on actual insights. T^{MBC} looked at two different aspects in order to create a picture of the partner's knowledge base. On the one hand, they referred to the joint knowledge base and Magna Steyr's know-how base they experienced during the first joint project. On the other hand, they based their assumptions on their own knowledge portfolio. Deploying an anticipated knowledge base to adjust the transfer rather than the actual one led to wrong selection approaches. T^{MSF} also lacked a clear picture of T^{MBC}'s knowledge base and deployed an estimation which did not represent the actual base. Both procedures failed with respect to their intention to optimize knowledge selection and actually increased transfer failure and

inefficiency. Both T^{MBC} and T^{MSF} identified as highly important this misalignment of knowledge transfer due to a lack of insights into and/or the wrong anticipation of the actual knowledge base of the partner.
One exception was the case of T^{MBC}'s obvious knowledge gaps in the field of all-wheel technology and niche car production. T^{MSF} tried to find out the current state of knowledge so that it could focus on the missing assets needed to understand the technology as well as the PD process completely. The knowledge and experiences emerging during the joint project work within T^{MSF} were directly transferred to the relevant positions within T^{MBC} for ongoing work.

Supporting the knowledge application

As both partners unequivocally stated, the primary goal of the project was not transferring knowledge from Magna Steyr to Mercedes Benz and *vice versa*. Rather, they intended to reach technical and economic goals set for the joint project to realize the successful development and assembly of the 211 series and the E-class 4-matic in particular. Especially T^{MBC} faced market pressure as the 'perceived' developer and manufacturer from the end-customer perspective. In consequence, the knowledge transfer was successful or both partners benefited when the transferred knowledge was applied to push the project further on. To close the gap between sending know-how and its application, T^{MSF} as well as T^{MBC} used a variety of approaches to support and enable the ongoing application. Both agreed that ongoing support was most successful under the conditions of time pressure and physical proximity, i.e., when working together on a specific task directly on the product. The time pressure was a given and did not need to be increased artificially. Nevertheless, over the time of the collaboration both partners deployed close, interactive, and product-related work to apply transferred knowledge. In doing so, they tried to overcome persistent knowledge gaps which had not been closed in the preceding knowledge transfer.
In one case, T^{MBC} was not able to understand some critical aspects of the all-wheel system in the 4-matic engine. Therefore, Magna Steyr decomposed such a systems to show members of T^{MBC} how it worked and thus closed the gaps in understanding. In another instance, T^{MBC} took prototypes from the Magna Steyr development facility and brought them to the Sindelfingen production plant, where T^{MBC} employees showed T^{MSF} certain aspects concerning the ongoing production on Mercedes Benz's assembly lines. In that way, they supported the application of the production-specific know-how in the development phase. T^{MSF} also did so: Facing a problem with noise, vibration,

and harshness characteristics, they looked at other cars from ongoing projects with similar issues to identify and locate the causes of and possible solutions for the problems. Aware of these cases, T^{MBC} identified the bridging of physical distance and the stronger connection of potential knowledge sources and receivers as important issues in enabling easier understanding and knowledge application. At the beginning of the project, T^{MBC} discussed internally the introduction of an organizational "boundary spanner". Originally, this function was supposed to interlink the sources of knowledge within both partners related to the business case of the project. Unfortunately, T^{MBC} did not recognize the position's potential and abolished the idea. Afterwards, they identified it as an approach to increase knowledge transfer. Besides the bridging of physical distance for the application of transferred knowledge, both partners deployed coaching and training sessions and on-site visits to provide ongoing and topic-related support. However, Magna Steyr criticized the ongoing supportive action from Mercedes Benz as marginal and always limited to very critical issues.

Considering and deploying feedback

Reflecting the interactive and iterative nature of knowledge transfer, the sender's field of responsibility exceeded the unidirectional sending process. Nevertheless, managing feedback and improving knowledge transfer were significant issues as well. Feedback was considered a necessary precondition to being able to provide support to the knowledge receiver, realizing a successful knowledge transfer, and avoiding limitations due to misunderstandings or, even worse, a complete lack of understanding. In general, both T^{MSF} and T^{MBC} recognized the potential feedback held for the improvement of joint work and knowledge transfer as well. As noted by T^{MSF}, feedback was usually limited to problem-related tasks and problems in understanding or lacks of knowledge which precluded a full interpenetration of transferred knowledge. Positive feedback was not given at any time during the joint work. However, both partners characterized their approach to managing feedback as sufficient. T^{MBC} deployed the feedback to improve the knowledge transfer as well as to improve the joint work itself by adjusting their activities in a certain field to the partner's feedback. T^{MSF} perceived it differently; stating that feedback was considered by T^{MBC}, nevertheless the ongoing effort to increase the transfer was not satisfactory. Feedback from T^{MBC}, and thereby the value of that resource, was limited, and T^{MSF} struggled because it lacked an important resource for increasing the knowledge transfer. The perception of considering and deploying feedback also diverged in the other ways. T^{MSF} mentioned using feedback to align the

transfer knowledge content according to the feedback received. Nevertheless, they did not change their way of transferring the know-how itself. T^{MBC} objected to T^{MSF}'s self-evaluation, noting that submitted feedback was not deployed sufficiently to increase the knowledge transfer.
While shaping completely contrary pictures of considering and deploying feedback for the improvement of know-how transfer and of the perception of such improvement from the partner's perspective, both sides did identify the three essential aspects to managing feedback. First, it is important to give feedback to the partner, to provide him this important resource for improvement and partner-specific adjustment. Secondly, the knowledge sender is required to be open to feedback and to consider feedback as a valuable resource. Thirdly, to unleash the potential of feedback, it is necessary to deploy the information in the selection of know-how according to the partner's knowledge base or to adjust the method of transferring knowledge.

The knowledge receiver

As knowledge transfer was a reciprocal process featuring both partners in alternating sender and receiver roles according to their knowledge bases, the receiving process had an impact on transfer success as well. Close interaction between the partners involved for transfer purposes cannot be neglected; thus, the knowledge receiver has to be considered as well. To facilitate the understanding and application of transferred knowledge, both partners launched a multi-level interaction process entailing sending and receiving knowledge, providing and receiving feedback as well as ongoing support of the receiver to ensure the application of transferred know-how.
All of the project team members interviewed underlined the importance of the knowledge receiver to the success of the transfer. The knowledge receiver understood the transferred knowledge more easily when the related knowledge base was extensive. Both partners mentioned industrial background, the training level of their employees, and the built-up knowledge base in related fields (e.g., Mercedes Benz first generation 4-matic and the 210 series collaboration with Magna Steyr) as drivers for increasing understanding. Along with the factors mentioned for successful reciprocal understanding, the project was not that highly innovative with respect to the product. Therefore, the understanding of transferred knowledge was almost a given. Even though T^{MBC} and T^{MSF} recognized the drivers as increasing knowledge transfer success from the receiver, they did not make an effort to realize that potential. Moving employees between the 210 and the 211 series projects without spreading relevant knowledge inter-

nally meant conterminously reducing the joint knowledge base. There was a lack of the internal knowledge transfer necessary to diffuse existing joint knowledge before the new project kicked off. Related to the internal knowledge transfer to diffuse knowledge throughout the company was the internal evaluation of the knowledge portfolio. As T^{MBC} had no clear internal picture of capabilities and knowledge assets, the knowledge transfer from T^{MSF} could not be very highly focused. Difficulties in understanding transferred knowledge mainly occurred in fields where the sender did not understand the knowledge completely before transferring it to the partner.

Nevertheless, the knowledge receiver mentioned additional instruments to increase knowledge transfer success from his perspective. One essential prerequisite to increasing the knowledge exchange success was the motivation to accept and therefore apply knowledge from the partner. T^{MBC} in general, and especially the operating departments had problems accepting outside knowledge or were at least very skeptical of its value. A lack of motivation to accept the partner's knowledge was an enormous challenge in the project.

Providing feedback to the knowledge sender represented an important resource for adjusting the knowledge transferred, the transfer process, or other parameters in order to increase the success of the transfer. However, both the sender and the receiver had to contribute to managing feedback in order to be able to unleash its potential. The knowledge sender considered and deployed feedback which she regarded as contributing to the improvement of the knowledge transfer process. To provide valuable feedback, the knowledge receiver interpenetrated the underlying problem in understanding so as to be able to outline the actual problem in the knowledge transfer. Lump-sum feedback did not have any value; even worse, it caused double work or re-work of the entire transfer process, instead of only the unsatisfactory part. For that reason, T^{MBC} pushed T^{MSF} to give detailed feedback. T^{MSF} had internally already identified it as a valuable resource for increasing the transfer process and tried to understand knowledge or problems before submitting feedback. When submitting feedback, they included their initial thoughts about possible issues to help to advance the problem-solving process. Both partners agreed that the more concrete the feedback was, the better the knowledge sender was able to react to it and the more easily she was able to improve knowledge transfer.

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