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Master Thesis

**Harnessing Innovations Pushed from Suppliers:
An Exploratory Study in the Railway Supply Chain**

- Public Version -

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Contents

1 Integrating theory and practice in a model for harnessing supplier innovations	1
1.1 Practical problem and research gap: fuzzy concept of supplier innovation	1
1.2 Defining and delineating supplier innovation as crucial spadework.....	2
1.3 Approach, goal and central question: how to harness the innovation potential in the supply base	4
2 Process, seller's and buyer's perspective form the theoretical foundation.....	7
2.1 From idea to innovation – definitions and process consideration	7
2.1.1 Innovation as the final outcome: a myriad of classifications	7
2.1.2 The wellsprings of innovation: suppliers as important collaboration partners	9
2.1.3 Corporate innovation process to integrate external ideas and more	10
2.2 Selling innovation: understanding the supplier's perspective	12
2.2.1 The business of suppliers: long-term value creation with intermediate products	12
2.2.2 Innovation as one means of providing value – without extra charge for preferred customers	14
2.2.3 Providing innovation for industrial customers: market orientation and cross-functional selling team as enablers	16
2.3 The buyer's perspective: organisational and relational requirements	18
2.3.1 Two modes of supplier innovation: buying vs. co-developing	18
2.3.2 Organisational requirements: early and cross-functional integration of purchasing, the gatekeeper for supplier innovation	20
2.3.3 Open communication, mutual trust and customer attractiveness: Relational success factors to be fostered	22
2.4 Innovation management to enable and follow up supplier innovation process	24
2.4.1 Seizing innovations by innovation meetings, fairs, web platforms and more	24
2.4.2 Evaluation and integration of innovative ideas as challenge for the buying firm	26
2.5 Supplier innovation push – possible, but expected to be contingent on various parameters at buyer and supplier side.....	28

5.2	Cross-case analysis: understanding innovation in the buyer-supplier-dyad	53
5.2.1	Suppliers' innovation activities: contingent on strategy, industry affinity and impact on the buyer's product.....	53
5.2.2	Fairs endorsed by all suppliers as interface for seizing innovation.....	54
5.2.3	Integration of procurement, engineering and innovation: not explicitly defined.....	56
5.2.4	Innovation driven by project and end customer requirements	57
5.3	Contrasting theory and empirical insights: varying accordance	58
6	Using theoretical concepts to solve the real-life problem: not all issues covered by prior research	59
6.1	Main barriers: rooted in innovation uncertainty, strong project-focus and end customer dependence?.....	59
6.2	Developing an intermediate model for Bombardier: introduce advanced sourcing, actively use fairs to seize innovation and establish a test train	61
6.3	Final model: taking restrictions and feedback from practice into account	64
7	Discussion: exploring a complex topic in an innovation-averse environment	66
7.1	Conclusion: industry and firm specialities impede application of best practices.....	66
7.2	Lesson for others: integrate cross-functionally, but understand context first	67
7.3	Limitations and theoretical implications: more research needed for supplier innovation in other project-driven settings.....	68
	References	70
	Annexure 1: List of referenced informal conversations	A1
	Annexure 2: List of referenced internal documents	A2
	Annexure 3: Acquisition history of Bombardier Transportation	A3
	Annexure 5: Comparative case study - overview of cases	A5
	Annexure 6: Comparative case study - overview of interviews	A8
	Annexure 7: General interview guideline	A45
	Annexure 8: Photographs of the flipcharts from the workshop	A52
	Annexure 9: Management summary	A55

Index of figures

Figure 1: Producer's vs. user's view on innovation.....	8
Figure 2: Innovation classification by Henderson & Clark	8
Figure 3: The generic Stage-Gate process for NPD.....	11
Figure 4: The entire innovation process.....	11
Figure 5: Buying vs. co-developing innovation.....	18
Figure 6: Categorisation of supplier inputs to innovation.....	27
Figure 7: BT analysed in terms of the amplified Porterian diamond.....	36
Figure 8: Rail-related revenues of the 'Big Five' in 2011	38
Figure 9: Conceptual project design	42
Figure 10: Buyer-supplier-relationship as context of supplier innovation push	45
Figure 11: Barriers to supplier innovation push at Bombardier Transportation	59
Figure 12: The supplier innovation push process	61

Index of tables

Table 1: Project plan	6
Table 2: Basic value strategies in business-to-business marketing.....	14
Table 3: Characteristics of an evaluation situation	26
Table 4: Preliminary findings - direct barriers to supplier innovation push	30
Table 5: Preliminary findings - indirect barriers to supplier innovation push.....	31
Table 6: Divisions of Bombardier Transportation	33
Table 7: Contrasting preliminary theoretical findings and empirical insights.....	58

List of abbreviations

BT	Bombardier Transportation
ESI	Early supplier involvement
GIM	Group Innovation Management at BT
NDA	Non-disclosure agreement
NPD	New product development
OECD	Organisation for Economic Co-operation and Development
OEM	Original equipment manufacturer
P-Dev	Pre-development
R&D	Research and development

1 Integrating theory and practice in a model for harnessing supplier innovations

1.1 Practical problem and research gap: fuzzy concept of supplier innovation

As one of the ‘Big Three’ train builders, Bombardier Transportation is an attractive target for suppliers to sell their innovations to. In the past, however, innovative ideas became lost in between Bombardier’s 64 production and engineering sites that are spread all over the world. Although the topic of supplier innovation is recognised by the innovation management and purchasing departments, explicit structures and processes are not yet in place. Previously, due to this lack of organisation, innovations pushed from the supply base could not immediately be harnessed by Bombardier. In one case, an innovative concept was presented to one division without success, only to be taken up by another division two years later.

Supplier innovation can either be initiated by the buyer or the supplier.¹ In the Bombardier example above it was indeed the supplier who initiated the innovation activity. This form of supplier innovation, where a supplier unsolicitedly comes up with an innovative solution or a new idea and offers it to the buying firm² has recently been labelled as ‘supplier innovation push’.³ The second form, in contrast, is the initiation by the buying firm. While in the previously described push-process the buying firm passively waits for suppliers’ ingenious ideas,⁴ it instead takes a more active role in the second form of supplier innovation, which has been called ‘supplier innovation pull’.⁵ In this case, it rests with the buying firm to take the first step and approach the supplier, usually with a specific problem at hand.⁶

Bombardier, however, has no rich experience in supplier innovation push, and there is no clearly defined policy that guides procurement, engineering and innovation management professionals. Thus, although the company is aware of the innovation potential within the supply base and its importance for competitive advantage, it seems to struggle to actually implement structures and processes that enable supplier innovation push in a multinational organisation. This practical problem reflects a gap in prior research on open innovation in general (‘we still lack knowledge about how to do it and when to do it’⁷) and supplier innovation in particular (‘firms have not yet fully established how they will most

¹ See Groher, 2003, p. 222; Huizingh, 2011, p. 6; Monczka, Carter, Scannell, & Carter, 2011, p. 51.

² See Schiele, 2006, p. 927; Winter & Lasch, 2011, p. 84.

³ Winter & Lasch, 2011, p. 84.

⁴ See Schiele, 2010a, p. 28.

⁵ Winter & Lasch, 2011, p. 84.

⁶ See Schiele, 2006, p. 927, 2010a, p. 28.

⁷ Huizingh, 2011, p. 8.

effectively leverage external supplier capabilities to accelerate innovation⁸). Other authors also agree that supplier innovation is an ‘under-researched topic’.⁹ For example, Wagner states that the role of suppliers in the fuzzy front end of innovation has largely been neglected in the literature.¹⁰ Most existing research deals with supplier integration in the later stages of new product development that are ‘more formal and better structured’¹¹ than the early phases. One reason that may also make theory development difficult is the lack of a consistent definition of the term ‘supplier innovation’ in prior literature.¹² Thus, the following working definition is used in this thesis:

Supplier innovation is *any* development new to the firm that originates from *existing* suppliers, creating an obvious benefit for the buyer’s customer and promising economic success for the buying firm.

This definition builds on Bombardier’s understanding of innovation and includes product, process, as well as service and business model innovations, while excluding current non-suppliers as a source of innovation. Hence, topics like the selection of innovative suppliers¹³ or cross-industry innovation from non-suppliers¹⁴ only play a minor part in this work. Yet, to narrow down the scope of the theory and keep the work manageable, the theoretical framework mainly draws on literature related to product innovations.

To meet the interests of both research and Bombardier, a conceptual model for supplier innovation push is developed that combines insights from prior literature, and empirical data collected from employees of Bombardier Transportation and its suppliers. This exploratory research provides first recommendations for Bombardier, and, by identifying best practices, contributes to the emerging research¹⁵ on supplier innovation.

1.2 Defining and delineating supplier innovation as crucial spadework

This work is concerned with supplier innovation (as defined above). However, besides the recent literature that explicitly deals with this very topic,¹⁶ there may be two more research streams that touch the issue of innovation from and with suppliers: early supplier involvement, and open innovation.

⁸ Monczka, Carter, Scannell, & Carter, 2010, p. 3.

⁹ Brem & Schuster, 2012, p. 68.

¹⁰ See Wagner, 2012, p. 37.

¹¹ Wagner, 2012, p. 37.

¹² See Winter & Lasch, 2012, p. 238.

¹³ See Schiele, 2006, p. 926.

¹⁴ See Gassmann, Zeschky, Wolff, & Stahl, 2010, p. 639.

¹⁵ See Schoenherr et al., 2012, pp. 4562–4563.

¹⁶ See Wagner, 2009, p. 8; Monczka, Carter, et al., 2010, p. 8; Winter & Lasch, 2011, p. 86.

A considerable amount of literature¹⁷ has been written about the (early) involvement, integration or inclusion of suppliers in new product development (NPD).¹⁸ However, the one term that is most often used to refer to this topic is ‘early supplier involvement’ (ESI) – a rather fuzzy label: Dowlatshahi, for instance, broadly defines ESI as ‘a means of integrating suppliers’ capabilities in the buying firm’s supply chain system and operations’¹⁹, while other authors stress suppliers’ contribution to NPD projects.²⁰ Thus, the goals of ESI are many and varied as well. On the one hand, there are goals that have a rather operational background, such as cost reduction and quality improvements of the purchased materials,²¹ a better ‘manufacturability’ of the final product,²² or the in-time completion of a development project.²³ On the other hand, ESI also has a strategic component: It aims at accessing suppliers’ innovation capabilities,²⁴ increasing the innovativeness of the buying firm’s products,²⁵ or assuring access to critical technologies from suppliers.²⁶ In order to achieve these goals and reap the benefits of ESI, several practices can be applied, e.g. the sharing of technology related information via periodic meetings or electronic systems, the alignment of technology roadmaps between buyer and supplier, or the co-location of staff from both sides. A further useful distinction is provided by Le Dain and her colleagues: The authors distinguish between cases where the supplier is already integrated in the concept design stage²⁷ and cases where the supplier is not involved before the ‘industrialisation and manufacturing of the delegated product’.²⁸ Therefore, actual supplier *innovation* is only covered by parts of the ESI literature. While, for example, the alignment of technology roadmaps in order to create more innovative products clearly is an endeavour geared towards innovation, this may not pertain to meetings between buyer and supplier with the purpose of defining the most appropriate material for a specific part of a product. Thus, as Schoenherr and colleagues phrase it,

¹⁷ See Ragatz, Handfield, & Scannell, 1997, p. 192.

¹⁸ See e.g. Petersen, Handfield, & Ragatz, 2003, p. 284; Schiele, 2006, p. 928; van Echtelt, Wynstra, van Weele, & Duysters, 2008, p. 181.

¹⁹ Dowlatshahi, 1998, p. 143.

²⁰ See van Echtelt et al., 2008, p. 182.

²¹ See Ragatz et al., 1997, p. 199; Handfield, Ragatz, Petersen, & Monczka, 1999, p. 80.

²² See Dowlatshahi, 1997, p. 526; Schumacher, Schiele, Contzen, & Zachau, 2008, p. 247.

²³ See McIvor, Humphreys, & Cadden, 2006, p. 376.

²⁴ See Schiele, 2012, p. 48.

²⁵ See Lau, Tang, & Yam, 2010, p. 763.

²⁶ See Hakansson & Eriksson, 1993, p. 30.

²⁷ See Le Dain, Calvi, & Cheriti, 2011, p. 63.

²⁸ Le Dain et al., 2011, p. 62.

supplier innovation ‘goes above and beyond what current studies have termed as early supplier involvement in new product development initiatives’.²⁹

The second field that is closely related to the topic of supplier innovation is the research that builds on Chesbrough’s seminal work on open innovation.³⁰ Generally and originally, open innovation has been defined as ‘the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively’.³¹ This definition is much broader than the concept of supplier innovation, in two important aspects. Firstly, it implies a distinction between inbound and outbound open innovation, whereby, from a buyer’s perspective, only the internal use of external knowledge is related to supplier innovation. Secondly, the open innovation paradigm stresses the collaboration with *any* external partner, hence not only suppliers, but also customers, competitors, universities, research institutes, and consultants.³² Yet, most of the existing research is focused on open innovation with customers, whereas suppliers receive less attention.³³ Not all findings from prior literature are thus useful and applicable to the ‘upstream part of open innovation’.³⁴

1.3 Approach, goal and central question: how to harness the innovation potential in the supply base

Prior research does not provide sufficient advice on how to implement supplier innovation – either because it is focused on open innovation with customers,³⁵ deals with the integration of suppliers in the late stages of the new product development process,³⁶ or merely provides a theoretical framework in the absence of any empirical evidence.³⁷ To the best of the author’s knowledge, Monczka and his colleagues from the CAPS Research Institute for Supply Management were the first to examine the implementation of supplier innovation in a similar vein to that defined above. In the executive summary of their multiple case study, the authors claim that ‘firms worldwide are recognizing that suppliers can serve as important sources of innovation by bringing new thinking and even finished

²⁹ Schoenherr et al., 2012, p. 4563.

³⁰ See Chesbrough, 2003, p. 43.

³¹ Chesbrough, 2006, p. 1.

³² See Bahemia & Squire, 2010, p. 604.

³³ See Gassmann, Enkel, & Chesbrough, 2010, p. 214; Schiele, 2010b, p. 138.

³⁴ Schiele, Veldman, & Hüttinger, 2011, p. 2.

³⁵ See Schiele, 2010b, p. 138.

³⁶ See Wagner, 2012, p. 30.

³⁷ See Winter & Lasch, 2011, p. 103.

concepts, shortening new product and service development time significantly'.³⁸ This statement also applies to Bombardier Transportation, the principal of this graduation project. Especially the central function Group Innovation Management is interested in supplier innovation in general and the supplier innovation push process in particular. Therefore, the main research question is:

RQ: How can Bombardier Transportation harness innovations that are unsolicitedly pushed from their supply base?

This central research question can be further divided into two sub-questions, which helps to structure the work and make the single work packages more tangible:

SQ1: What barriers exist for such a company to harness supplier innovation push?

SQ2: How can processes, tools and organisational structures be shaped to overcome these barriers and enable supplier innovation push in this setting?

To address these exploratory questions, a customised research approach is deployed that draws on methodology from theory-based business problem-solving³⁹ and case study research.⁴⁰ The corresponding six-step project plan is depicted in Table 1; more details on the methodology can be found in the fourth chapter.

Based on an extensive literature review, a preliminary, theoretical model for supplier innovation push is drafted (*step 1*, see second chapter). For that purpose, the topic of innovation is considered not only from a general process (definition, origins of innovation, Stage-Gate, etc.) and the buyer's perspective (buying vs. co-developing, organisation of purchasing, relational success factors), but also from suppliers' point of view, acting as innovating firm in an industrial market. To make the comprehensive view complete, the role of innovation management tools completes the literature review. It is important to notice that the first theoretical model (chapter 2.5) is general, that means not tailored to the case of the focal company. It provides general solution concepts, including means of, barriers to and enablers for supplier innovation push.

The process of supplier innovation push takes place within a buyer-supplier-relationship and involves diverse professionals from both sides. For such complex social issues, a case study approach (*step 2*) is suggested.⁴¹ More precisely, the research is designed as a

³⁸ Monczka, Carter, et al., 2010, p. 8.

³⁹ See van Aken, Berends, & van der Bij, 2007, p. 33.

⁴⁰ See Yin, 2009, p. 46.

⁴¹ See Yin, 2009, p. 4.

comparative case study, as it allows the discovery of contrasts, similarities and patterns across several buyer-supplier-relations,⁴² the locus of supplier innovation. As the study is exploratory in nature, qualitative empirical evidence is likely to yield higher benefits than quantitative methods, such as a broadly based survey.⁴³ Thus, data collection relies on semi-structured interviews, memos, other company documents and observations.⁴⁴ For the reader to understand the case study, it is required to explain the particularities of Bombardier's business, its environment as well as the organisation of purchasing, engineering and innovation. This is done in the third chapter, before the methodology is explained in the fourth chapter. The actual case study evidence is presented in the fifth chapter, divided into the within-case and the cross-case analysis.

Working step	Presented in
1. Conduct literature review and develop preliminary model	Chapter 2
2. Empirical analysis of the business problem (case study)	Chapter 3, 4 & 5
3. Formulate main barriers, their causes and consequences	Chapter 6.1
4. Explore solution directions and develop intermediate model	Chapter 6.2
5. Present intermediate model to principal and get feedback	Chapter 6.2 & 6.3
6. Elaborate final model and derive recommendations	Chapter 6.3 & 7.1

Table 1: Project plan (based on van Aken et al., 2006, p. 54)

The barriers identified in the case study are formulated as *step 3*, together with their causes and consequences. Based on these insights and the literature review, an intermediate model, which is adjusted to Bombardier's requirements (the 'first redesign'⁴⁵), is developed as *step 4*. This second model is then presented to professionals from purchasing and innovation management in order to further refine and revise it (*step 5*). Eventually, from the resulting final model (the 'second redesign'⁴⁶), recommendations are derived on how Bombardier can enable supplier innovation push and thereby harness the innovation potential in its supply base (*step 6*).

⁴² See Eisenhardt, 1989, p. 540.

⁴³ See Eisenhardt & Graebner, 2007, p. 28.

⁴⁴ See Yin, 2009, p. 103; Blumberg, Cooper, & Schindler, 2011, p. 258.

⁴⁵ van Aken et al., 2007, p. 29.

⁴⁶ van Aken et al., 2007, p. 29.

2 Process, seller's and buyer's perspective form the theoretical foundation

2.1 From idea to innovation – definitions and process consideration

2.1.1 Innovation as the final outcome: a myriad of classifications

According to its literal Latin origin, 'innovation' means renewal, or alteration.⁴⁷ This translation resembles the macro-economic understanding of Schumpeter, who defines innovation as 'the carrying out of new combinations'.⁴⁸ He claims that innovation arises from the process of 'creative destruction':⁴⁹ Entrepreneurs combine existing resources in a new way to create innovative solutions that disrupt the market and devalue the competencies of established firms.⁵⁰ The Schumpeterian definition does, however, not necessarily apply to all kind of innovations – this fact becomes clear in the following review of innovation definitions and classifications that can be found in prior literature.

Fairly universal, the OECD and Eurostat define innovation as 'the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations'⁵¹ (cf. business model innovation⁵²). Similarly, Tidd, Bessant and Pavitt distinguish between product, process, position and paradigm innovations, but acknowledge that a clear-cut distinction might not always be possible.⁵³

Innovations are sometimes classified according to their degree of novelty as either new to the world, new to the market, or new to the firm.⁵⁴ Another frequently used approach is to distinguish between incremental ('small') and radical ('big') innovations, depending on their impact, or magnitude.⁵⁵ Incremental innovations 'involve relatively minor changes in technology and provide relatively low incremental customer benefits per dollar',⁵⁶ whereas radical innovations 'involve substantially new technology and provide substantially greater customer benefits per dollar'.⁵⁷ Innovations that highly increase customer benefit, but involve only low technological change for the producing firm, may be called application innovations, while the term technical innovation is used to label innovations that entail

⁴⁷ See Wiktionary, 2012.

⁴⁸ Schumpeter, 1971, p. 47.

⁴⁹ Schumpeter, 1942, p. 83.

⁵⁰ See Schumpeter, 1942, p. 83.

⁵¹ OECD & Eurostat, 2005, p. 46.

⁵² See Osterwalder & Pigneur, 2010, p. 5.

⁵³ See Tidd, Bessant, & Pavitt, 2005, p. 10.

⁵⁴ See OECD & Eurostat, 2005, p. 57.

⁵⁵ See OECD & Eurostat, 2005, p. 58; Tidd et al., 2005, pp. 11–12.

⁵⁶ Chandy & Tellis, 1998, p. 476.

⁵⁷ Chandy & Tellis, 1998, p. 476.

high technological change for the producing firm, but only marginally increase customer benefit⁵⁸ (see Figure 1).

Henderson and Clark, however, suggest an alternative classification (see Figure 2).⁵⁹ The authors consider products as systems that are composed of a set of components, or core concepts. Thus, product innovations have two dimensions: Firstly, there are the core concepts of a product that are either reinforced or overturned. Secondly, there are the linkages between these core concepts that are either changed or unchanged.

		Producer's View: Technological Change		Core Concepts		
		<i>Low</i>	<i>High</i>	<i>Reinforced</i>	<i>Overtuned</i>	
User's View: Increased Benefit	<i>Low</i>	Incremental Innovation	Technical Innovation	<i>Unchanged</i>	Incremental Innovation	Modular Innovation
	<i>High</i>	Application Innovation	Radical Innovation		<i>Changed</i>	Architectural Innovation

Figure 1: Producer's vs. user's view on innovation
(Gobeli & Brown, 1987, p. 26)

Figure 2: Innovation classification by
Henderson & Clark (1990, p. 12)

While incremental and radical innovations are also included in their framework, Henderson and Clark refine the traditional classification and extend it by the concepts of modular and architectural innovation, the latter of which is more remarkable. Because architectural innovations as well as radical innovations change the linkages between core concepts, they destroy the usefulness of existing architectural knowledge that is embedded in the structure and information-processing procedures of established firms.

For Christensen,⁶⁰ however, a radically new technology – even if it is discontinuous⁶¹ – does not necessarily have to be disruptive. It can indeed be sustaining, if it improves the performance of a product or service along the performance dimensions that customers have historically valued, and *complements* existing technologies. If a radical innovation, however, creates a new value network, and *destroys* existing technologies, it is disruptive (and then again reflects Schumpeter's creative destruction). According to Christensen, these disruptive technologies often originate with new market entrants rather than incumbents.

⁵⁸ See Gobeli & Brown, 1987, p. 26.

⁵⁹ For the subsequent description see Henderson & Clark, 1990, pp. 9–29.

⁶⁰ For the subsequent description see Christensen, 1997, pp. xvi–xx.

⁶¹ See Linton, 2002.

2.1.2 The wellsprings of innovation: suppliers as important collaboration partners

Every innovation is based on an initial idea – and where this idea comes from is likely to influence how radical and disruptive an innovation is.⁶² However, the origin of these ideas, i.e. the sources of innovation, can be distinguished on two wholly different levels.

Conceptually, innovation is either triggered by unsatisfied customer needs (market pull or need pull), or prompted by the development or discovery of new technological know-how (technology push or supply push).⁶³ Consolidating several prior studies, Boehme states that 60 – 80% of innovations resulted of market pull, whereas only 20 – 40% were pushed by technology.⁶⁴ Even though this distribution may be contingent on the industry and its lifecycle,⁶⁵ Mowery and Rosenberg find that the supposed predominance of market pull is not justified by empirical evidence: ‘the primacy of market demand forces within the innovation process is simply not demonstrated’.⁶⁶ Also, ex post, most successful technology push innovations can be connected to a customer need and thus be classified as market pull innovation.⁶⁷ Therefore, the authors conclude that any innovation is the result of an iterative process, involving both market pull and technology push.⁶⁸

From a firm’s perspective and regardless of the push or pull paradigm, innovation may either be the outcome of in-house R&D (‘closed innovation’⁶⁹) or emerge from the cooperation with external partners (‘open innovation’⁷⁰). Of the EU-27 companies that were active in product and/or process innovation in 2008, about 10% use customers as source of information, while suppliers are a source of information for 9% of firms.⁷¹ In Leiponen and Helfat’s study among 336 Finnish manufacturing firms, suppliers only rank the fifth important knowledge source for innovation activities, after the own firm, other firms in the business group, customers and competitors.⁷² These findings are in line with a study among 1,170 German manufacturing and service firms,⁷³ and empirical evidence from English health care⁷⁴ (n=62) and manufacturing⁷⁵ (n=2,707): In all cases, customers

⁶² See Arnold, Fang, & Palmatier, 2010, pp. 244–245.

⁶³ See Mowery & Rosenberg, 1979; Boehme, 1986.

⁶⁴ See Boehme, 1986.

⁶⁵ See Rothwell, 1994, pp. 23–24.

⁶⁶ Mowery & Rosenberg, 1979, p. 139.

⁶⁷ Mowery & Rosenberg, 1979, p. 141.

⁶⁸ See Mowery & Rosenberg, 1979, p. 143.

⁶⁹ Chesbrough, 2003, p. xx.

⁷⁰ Chesbrough, 2003, p. xxiv.

⁷¹ See European Commission, 2008, p. 99.

⁷² See Leiponen & Helfat, 2010, p. 228.

⁷³ See Salge, Bohné, Farchi, & Piening, 2012, p. 11.

⁷⁴ See Salge, Farchi, Barrett, & Dopson, 2013, pp. 9–10.

⁷⁵ See Laursen & Salter, 2006, p. 139.

are rated as the more important source of information and knowledge, compared to suppliers. For actual cooperation in NPD, however, the latter seem to be approached more often. According to a Danish study, suppliers are the most common partner in NPD, slightly ahead of customers.⁷⁶ Also among innovative EU-27 enterprises, more companies cooperated with suppliers (a bit more than 6%) than with customers (a little less than 6%); yet this difference is hardly significant.⁷⁷ A study from the United Kingdom (n=8,172) revealed that 57% of collaboratively innovating enterprises co-operated with suppliers, while only 50% worked together with customers.⁷⁸ Another interesting perspective is provided by Palmberg's study of 1,600 Finnish innovations: He finds that the importance of customers as collaborating party increases with the R&D intensity of the industry, while the relevance of suppliers is more or less independent of the latter.⁷⁹ Hence, suppliers are relatively more important for industries with *low* R&D intensity.

Regardless of whether an idea stems from customers, suppliers, consultants, competitors, universities, research organisations or any other source – if an idea is to be commercialised, it eventually needs to run through the intra-firm innovation process, which is described in the following section.

2.1.3 Corporate innovation process to integrate external ideas and more

For a company to successfully commercialise an innovative idea, it is required that new product development is managed in an effective and efficient way⁸⁰ – that means that there are idea-to-launch practices that yield marketable products.⁸¹ A recognised methodology that is widely used in practice⁸² has been conceptualised by Robert G. Cooper and is commonly known as the Stage-Gate system.⁸³ In this generic approach, the NPD process is divided into a predefined set of stages, ranging between four (n=4) and seven (n=7). Each stage (e.g. detailed investigation, prototype testing) is preceded by a corresponding gate which determines whether the stage is taken or not. It is usually the responsibility of a cross-functional team of senior managers to man the gate, and approve, cancel or redefine the project. When all gates and stages are passed, the new product is commercialised, i.e. introduced in the market.

⁷⁶ See Knudsen & Mortensen, 2011, p. 57.

⁷⁷ See European Commission, 2008, p. 98.

⁷⁸ See Stones, 2001, p. 3.

⁷⁹ See Palmberg, 2004, pp. 189–190.

⁸⁰ See Cooper, 1990, p. 44; Cooper & Edgett, 2008, p. 49.

⁸¹ See Cooper & Edgett, 2012, p. 47.

⁸² See Cooper, 1994, p. 3; O'Connor, 1994, p. 183; Bigwood, 2004, p. 38.

⁸³ For the subsequent description see Cooper, 1990, pp. 45–46.

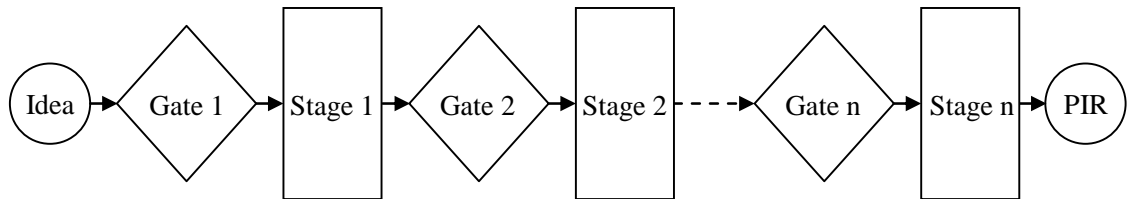


Figure 3: The generic Stage-Gate process for NPD (based on Cooper, 1990, p. 46)

A properly managed innovation process reflects a funnel rather than a tunnel.⁸⁴ Only the very best ideas make it through the process,⁸⁵ and it needs about 100 ideas to yield one successful product.⁸⁶ Thus, it is imperative for companies to increase the number of high-value ideas. This task – which is not covered by the Stage-Gate process⁸⁷ – is referred to as the management of the fuzzy front end of innovation and involves activities that are often chaotic, unpredictable and unstructured.⁸⁸ The entire innovation process thus consists of three phases: the fuzzy front end (including ideation), the actual new product development (cf. Stage-Gate) and the final commercialisation phase (see Figure 4).

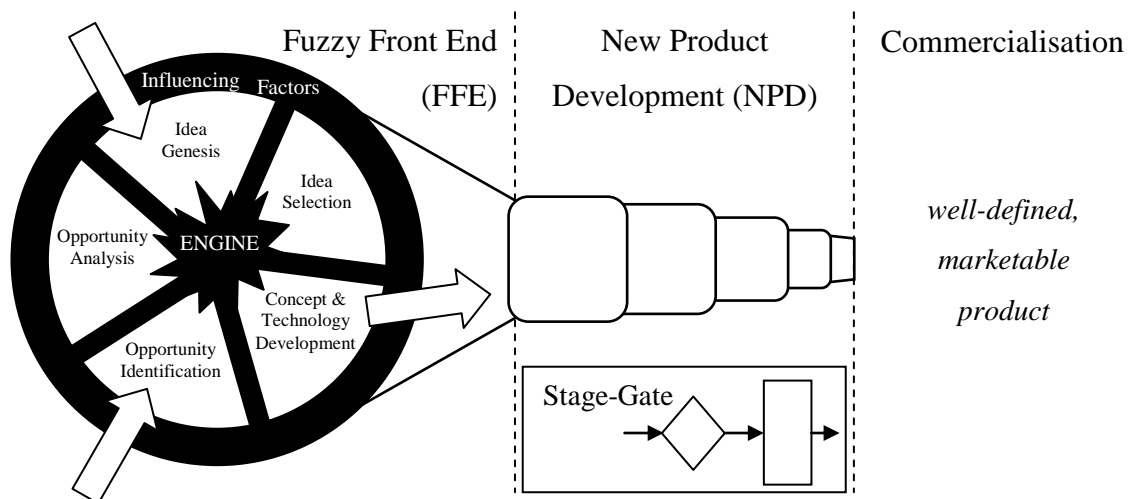


Figure 4: The entire innovation process (based on Koen et al., 2001, pp. 47, 51)

According to the open innovation paradigm, it is recommended that firms not only use internal, but also external ideas to fill their innovation funnel. Inbound open innovation is, however, not restricted to the inclusion of mere ideas. Companies may also acquire and integrate external inventions and the according intellectual property, early technology and product concepts, as well as fully developed, ready-to-commercialise products.⁸⁹

⁸⁴ See Cooper, 2009, p. 48.

⁸⁵ See Cooper & Edgett, 2008, p. 55.

⁸⁶ See Cooper & Edgett, 2007, p. 15.

⁸⁷ See Koen et al., 2001, p. 46.

⁸⁸ See Koen et al., 2001, p. 49.

⁸⁹ See Chesbrough, 2006, p. 106; Grönlund, Sjödin, & Frishammar, 2010, p. 13.

Harnessing the potential value of open innovation is not straightforward.⁹⁰ Thus, several authors stress the importance of absorptive capacity,⁹¹ a firm's ability to 'recognize the value of new, external information, assimilate it, and apply it to commercial ends'.⁹² In his study among Norwegian and Swedish companies, for example, Clausen found that investing in internal R&D and training, and a highly-educated workforce increase the ability of a firm to enter innovation cooperation with external partners.⁹³ These findings are backed by empirical evidence from the Mannheim Innovation Panel: In-house research capacity increases the positive impact of search openness on innovation performance; so do cross-functional collaboration and incentive systems for innovation.⁹⁴ Furthermore, open innovation seems to be more successful if the NPD project is explorative rather than exploitative, managed by an experienced leader, and situated in a supportive environment, that means team members are open for discussion and give feedback.⁹⁵

2.2 Selling innovation: understanding the supplier's perspective

2.2.1 The business of suppliers: long-term value creation with intermediate products

If a company wants to harness the innovation potential of its suppliers, it may be helpful to understand the attributes of suppliers' very business, that is serving original equipment manufacturers (OEMs), rather than consumers or end customers (which also can be companies).⁹⁶ The term OEM refers to firms that buy intermediate products from suppliers in order to incorporate them into their own end products.⁹⁷

The business of suppliers has, according to Backhaus and Voeth, two major distinguishing features.⁹⁸ The first, individualised service provision, refers to the increased need for interaction with the customer (OEM). In other words: The buying firm needs to play a part in defining the product characteristics in order to make sure that the supplied goods can be built into their products. This implies that the sales process takes place in advance to the production process. The second characteristic of suppliers' business is the long-term orientation of transactions between buyer and supplier, which means that the business relationship spans over the whole project or product lifecycle. Therefore, the OEM does

⁹⁰ Salge et al., 2012, p. 2.

⁹¹ See Rosell & Lakemond, 2012, p. 203; Salge et al., 2012, 2013; Clausen, 2013, p. 68.

⁹² Cohen & Levinthal, 1990, p. 128.

⁹³ See Clausen, 2013, p. 68.

⁹⁴ See Salge et al., 2012, p. 19.

⁹⁵ See Salge et al., 2013, p. 11,14.

⁹⁶ See Backhaus & Voeth, 2011, pp. 3, 493.

⁹⁷ See Eckles, 1990, p. 10.

⁹⁸ For the following description see Backhaus & Voeth, 2011, pp. 495–498.

usually not know the exact demand for a purchased part at the time when the contract is concluded. The intermediate products provided by suppliers can, for example, be differentiated into systems, modules, sub-systems, components, norm parts and raw materials.⁹⁹ Laseter and Ramdas provide a more sophisticated classification. Based on a study among 50 respondents from automotive OEMs and their suppliers, they applied a cluster analysis to develop a framework of supplier roles in product development.¹⁰⁰ For that purpose, seven variables were taken into account:¹⁰¹ interface complexity, the rate of technological change, impact on end consumer perceptions, product cost per unit, development cost per unit, manufacturing scale, and product clarity (performance specifications vs. physical specifications). In the end, a four-cluster solution was found to best capture the differences, and yielded the following categories: critical systems, hidden components, simple differentiators, and invisible sub-assemblies.¹⁰²

With regard to business market management in general – of which suppliers' market management is a sub-domain – several authors have stressed the importance of customer value.¹⁰³ Anderson and Narus, for example, recommend firms to put value as the cornerstone of business market management and suggest a process consisting of three steps: understanding, creating, and delivering value¹⁰⁴ – where value is commonly defined as the perceived benefit of a product minus both the product price and the costs of owning it.¹⁰⁵ However, suppliers' value creation is not restricted to mere products: As Golfetto and Gibbert found, buyers want 'know-how, support for their activities and involvement in specialized innovation'.¹⁰⁶ Therefore, it is important for suppliers to understand what competencies are valued by their customers.¹⁰⁷ For instance, a study among 155 Australian firms from diverse industries has shown that suppliers' product innovation and marketing capabilities have a directly positive relationship with customer value creation (performance, relationship and co-creation value), suggesting that managers are well-advised to endow marketing and R&D with the necessary resources.¹⁰⁸

⁹⁹ See Backhaus & Voeth, 2011, pp. 504–505.

¹⁰⁰ See Laseter & Ramdas, 2002, p. 107.

¹⁰¹ See Laseter & Ramdas, 2002, pp. 109–110.

¹⁰² See Laseter & Ramdas, 2002, p. 115.

¹⁰³ See Anderson & Narus, 2004, pp. 4–5; Golfetto & Gibbert, 2006, p. 904; Lindgreen, Hingley, Grant, & Morgan, 2012, p. 207; O'Cass & Ngo, 2012, p. 125.

¹⁰⁴ See Anderson & Narus, 2004, pp. 4–5.

¹⁰⁵ See Lindgreen et al., 2012, p. 208.

¹⁰⁶ Golfetto & Gibbert, 2006, p. 905.

¹⁰⁷ See Golfetto, 2003, p. 7.

¹⁰⁸ See O'Cass & Ngo, 2012, pp. 131–133.

2.2.2 Innovation as one means of providing value – without extra charge for preferred customers

If the OEM is in a clearly dominant position, suppliers usually follow an ‘adaption strategy’,¹⁰⁹ i.e. they create value through closer integration into the OEM’s manufacturing and delivery process.¹¹⁰ R&D is only done if requested by the customer.¹¹¹ However, there are also suppliers that pursue ‘emancipation through innovation’: By independently pursuing new ideas and developing innovative products, they try to create more value than their competitors.¹¹² What makes such approaches difficult is the very nature of suppliers’ business: As their intermediate products need to be incorporated into the buyer’s final product, the latter may need to be redesigned. Therefore, suppliers have to understand when it is the right time to introduce and implement a new product. Furthermore, buyers would require the supplier to prove the functionality, reliability and availability of the innovative component. This request, in turn, leads to a correspondingly long period from idea generation to commercialisation, and limits the applicability of an innovation strategy to financially strong suppliers.

	Supplier Strategy		
Buyer Strategy	Core value production	Value-added value production	Future value production
Core value production	Balanced	Supplier-driven	Implausible
Value-added value production	Buyer-driven	Balanced	Supplier-driven
Future value production	Implausible	Buyer-driven	Balanced

Table 2: Basic value strategies in business-to-business marketing (based on Möller, 2006, p. 918)

The distinction between adaption and innovation strategy fits well with the framework developed by Möller (see Table 2). The author distinguishes between three generic value creation strategies: *core value production*, which is focused on improving product quality, cost and delivery efficiency (thus, process innovation at most) rather than product innovation, *value-added value production* via incremental innovations, and *future value production* via radical innovations and emerging networks.¹¹³ The latter may include the thinking beyond current markets and business models. Contrasting supplier and buyer value creation strategies, it seems, for example, implausible that a cost leader’s supplier is

¹⁰⁹ See Engelhardt & Günter, 1981, p. 193.

¹¹⁰ See Laseter & Ramdas, 2002, p. 108; Backhaus & Voeth, 2011, p. 517.

¹¹¹ See Backhaus & Voeth, 2011, p. 522.

¹¹² For the following description see Backhaus & Voeth, 2011, pp. 528–529.

¹¹³ For the following description see Möller, 2006, p. 922.

working on radical innovation, whereas innovation is usually not supplier-driven if the buyer emphasises radical innovation. An empirical study of 161 suppliers of Swedish car and truck manufacturers provides support for the model proposed by Möller. Development commitment by the buyer is positively related to supplier's innovation strategy, which in turn positively affects supplier's product development activities.¹¹⁴

However, even if the buying firm follows an innovation strategy, purchasing managers might be concerned that suppliers charge inadequately high prices when selling new, innovative products.¹¹⁵ Consequently, Schiele, Veldman and Hüttinger expected that supplier innovativeness had a negative effect on supplier's pricing benevolence.¹¹⁶ Yet, in their empirical study of 166 German and Austrian high-tech suppliers, this relationship was not confirmed.¹¹⁷ This could be due to the reason that suppliers want to avoid high transaction costs resulting from intensive price negotiations,¹¹⁸ or because suppliers already have future orders in the back of their mind.¹¹⁹

Moreover, as they provide intermediate products only, suppliers need the buying firms to commercialise their innovative ideas, just like inventors who need a licensee with complementary capabilities to commercialise their intellectual property rights.¹²⁰ A study of 232 licensing agreements between publicly listed companies revealed that licensors (resembling suppliers) are more likely to grant licensees (i.e. buyers) exclusive licences if the latter is required to invest in complementary R&D and marketing assets.¹²¹ Slowinski and colleagues, however, claim that suppliers want to sell their innovations to the whole market – even if it was jointly developed with only one customer.¹²² Therefore, several authors suggest that supplier's behaviour is not only moderated by the R&D involvement of the buyer, but may also depend on whether the buyer has preferred customer status.¹²³ Schiele, Calvi and Gibbert claim that the latter is defined by the interplay between customer attractiveness and supplier satisfaction.¹²⁴ The attractiveness of a certain customer is, according to Schiele, mainly determined by its commercial and technical importance to the

¹¹⁴ See Wynstra, von Corswant, & Wetzels, 2010, p. 635.

¹¹⁵ See Koufteros, Vonderembse, & Doll, 2002, p. 337; Corsten & Felde, 2005, p. 450.

¹¹⁶ See Schiele et al., 2011, p. 6.

¹¹⁷ See Schiele et al., 2011, p. 14.

¹¹⁸ See Zbaracki, Ritson, Levy, Dutta, & Bergen, 2004, p. 515.

¹¹⁹ See Schumacher et al., 2008, p. 250.

¹²⁰ See Somaya, Kim, & Vonortas, 2010, p. 163.

¹²¹ See Somaya et al., 2010, pp. 164, 181.

¹²² See Slowinski, Hummel, Gupta, & Gilmont, 2009, p. 30.

¹²³ See Henke & Zhang, 2010, p. 43; Schiele et al., 2011, p. 16.

¹²⁴ See Schiele, Calvi, & Gibbert, 2012, p. 1180.

supplier.¹²⁵ In the same vein, Smals and Smits conclude from their case study of two high tech firms that suppliers benefit from collaborative new product development with buyers in three ways: financial payment for sales volume and product development services, technological knowledge, and the reputation of doing business with leading-edge firms.¹²⁶ However, preferred customer status does not only depend on customer attractiveness, but also on the extent to what the expectation (i.e. attractiveness) has been fulfilled and how it compares to alternative customer relationships.¹²⁷

2.2.3 Providing innovation for industrial customers: market orientation and cross-functional selling team as enablers

Again putting value as the cornerstone of business market management, actually supplying innovative products involves three generic steps: understanding, creating, and delivering value.¹²⁸ With regard to this process, researchers have emphasised the cooperation between marketing and sales,¹²⁹ and marketing and R&D, respectively.¹³⁰ The corresponding ‘set of cross-functional processes and activities directed at creating and satisfying customers through continuous need assessment’¹³¹ is generally referred to as a firm’s ‘market orientation’, which is considered to be positively related to innovativeness.¹³² This has, for example, been empirically confirmed by Vázquez, Santos and Álvarez in their study among 264 Spanish industrial firms.¹³³ However, there are several authors who claim that market orientation fosters incremental rather than radical innovation.¹³⁴ In this context, Slater and Narver emphasise the important difference between being customer-led vs. real market orientation.¹³⁵ While customer-led firms only listen to the expressed desires of their customers, market orientation takes both their expressed and their latent needs into account. Market orientation may, moreover, not be restricted to the supplier’s direct customers, but extend downstream and also pay regard to the needs of the customer’s customers.¹³⁶ In an empirical study of 88 supply chains in the Netherlands, Kibbeling and

¹²⁵ See Schiele, 2012, p. 48.

¹²⁶ See Smals & Smits, 2012, p. 162.

¹²⁷ See Schiele et al., 2012, p. 1180.

¹²⁸ See Anderson & Narus, 2004, pp. 4–5.

¹²⁹ See Guenzi & Troilo, 2006, p. 985.

¹³⁰ See Moenaert, De Meyer, Souder, & Deschoolmeester, 1995, p. 253.

¹³¹ Deshpandé & Farley, 1998.

¹³² See Vázquez, Santos, & Álvarez, 2001; Kirca, Jayachandran, & Bearden, 2005.

¹³³ See Vázquez et al., 2001, p. 82.

¹³⁴ See Ettl, Bridges, & Keefe, 1984, pp. 692–694; Atuahene-Gima, 1996, pp. 98–99.

¹³⁵ See Slater & Narver, 1998, p. 1002.

¹³⁶ See Bohlmann, Spanjol, Qualls, & Rosa, 2013, p. 241; Kibbeling, van der Bij, & van Weele, 2013, p. 504.

colleagues found that suppliers' end-user orientation is indeed positively related to their innovativeness.¹³⁷

Regardless of what strategy has led to an innovation, to be commercialised, it has eventually to be sold to the customer. Both academic literature and practice acknowledge the relevance of key account management to supplier companies.¹³⁸ However, for technical issues – such as innovation – engineers are the main interface between buyer and supplier.¹³⁹ This has led to the 'technicization of sales force'¹⁴⁰ and suggests an important role of the supplier's sales engineer.¹⁴¹ Selling innovation, still, is considered a 'new selling task'.¹⁴² In this situation, which is characterised by extensive problem solving at the supplier's side,¹⁴³ salespeople (including sales engineers) are highly dependent on other functions, such as marketing and R&D.¹⁴⁴ Thus, these departments also become part of the 'selling centre', which refers to 'all individuals from the selling side of the dyad who are involved in a particular sales transaction'.¹⁴⁵ The involvement of R&D managers – usually strong advocates of innovation¹⁴⁶ – could, on the one hand, help to overcome salespeople's reluctance to sell radically new products, which might in the first place not meet the needs of their present customers.¹⁴⁷ On the other hand, marketing could demonstrate the potential savings from a total cost of ownership-perspective, so that salespeople can in turn help purchasing managers to 'turn gray money into green money',¹⁴⁸ that is to quantify the real value of an innovation. To overcome potential innovation-related concerns at the buyer's side, suppliers can show confidence in their intentions, e.g. by assuming parts of the risk or even accepting contractual penalties in the case of non-performance.¹⁴⁹ Last but not least – thinking end customer orientation to the end – suppliers could also target the end customer when actually selling innovation.¹⁵⁰ Yet, as such a strategy is not always tolerated by the direct customer, suppliers need to be careful.

¹³⁷ See Kibbeling et al., 2013, p. 510.

¹³⁸ See Guesalaga & Johnston, 2010, p. 1063.

¹³⁹ See Fliess & Becker, 2006.

¹⁴⁰ Darr, 2002.

¹⁴¹ See Kopecka, Santema, & Hultink, 2012, p. 3.

¹⁴² Hutt, Johnston, & Ronchetto, 1985, p. 36.

¹⁴³ See Hutt et al., 1985, p. 37.

¹⁴⁴ See Moon & Gupta, 1997, p. 37.

¹⁴⁵ Moon & Gupta, 1997, p. 31.

¹⁴⁶ See Meyer, Marion, & Crane, 2010, p. 15.

¹⁴⁷ See Kauppila, Rajala, & Jyrämä, 2010, p. 308.

¹⁴⁸ Anderson & Narus, 2004, p. 8.

¹⁴⁹ See Backhaus & Voeth, 2011, p. 540.

¹⁵⁰ See Backhaus & Voeth, 2011, p. 532.

2.3 The buyer's perspective: organisational and relational requirements

2.3.1 Two modes of supplier innovation: buying vs. co-developing

As already explained above, supplier innovation can either be initiated by the buyer or the supplier.¹⁵¹ However, in this context, not only the trigger of innovation activity is of interest, but also when and how the supplier's innovative contribution is eventually integrated into the buying firm's innovation process. With regard to product innovation, supplier innovation refers to sub-products, or intermediate products of the final product, which are provided by the supplier. Relative to current sub-products, they make the final product better, securer, simpler, faster, cheaper, are easier to integrate, provide a modular design or support standardisation.¹⁵² In line with the process discussed in section 2.1.3, any supplier innovation can be classified in terms of concretisation, or maturity level.¹⁵³

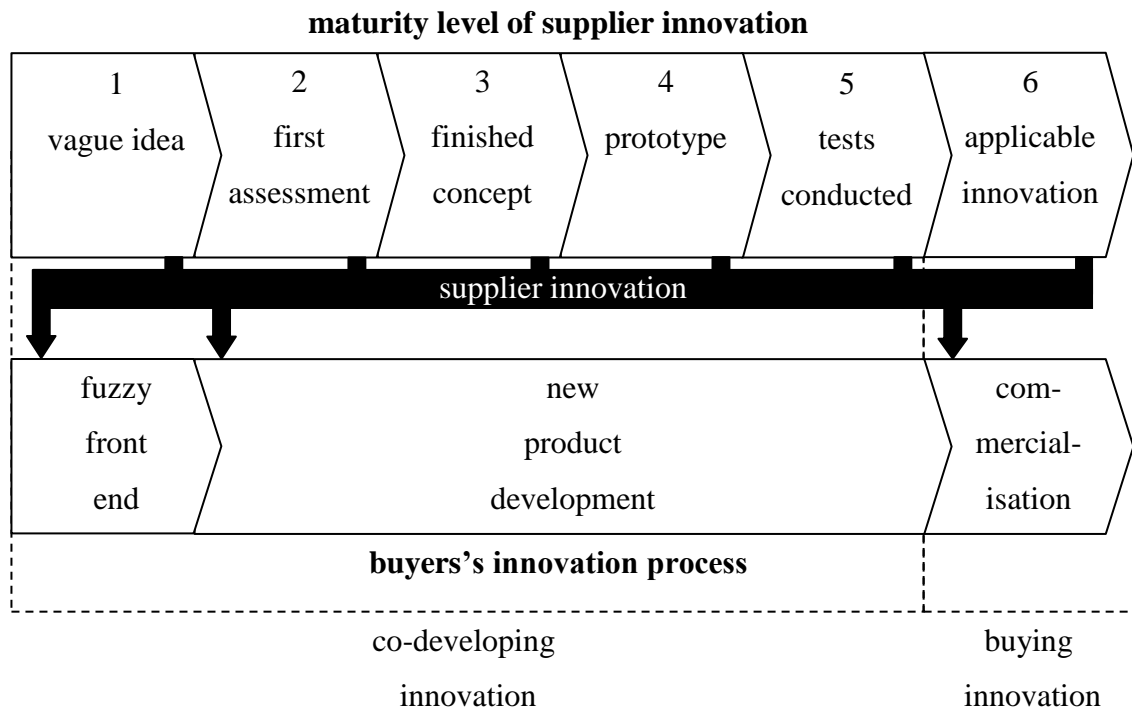


Figure 5: Buying vs. co-developing innovation
(based on Handfield et al., 1999, p. 62 and Monczka et al., 2011, p. 29)

If the buying firm is integrating a supplier innovation that is applicable and ready to be commercialised (maturity level 6), it is 'buying innovation'.¹⁵⁴ However, if the buying firm integrates a supplier innovation that is in an earlier stage (maturity level 1-5), the respective idea, concept or prototype has to be further developed, which means that the

¹⁵¹ See Groher, 2003, p. 222; Huizingh, 2011, p. 6; Monczka et al., 2011, p. 51.

¹⁵² See Winter & Lasch, 2012, pp. 238–239.

¹⁵³ See Handfield et al., 1999, p. 62; Winter & Lasch, 2012, p. 241.

¹⁵⁴ See Schiele, 2006, p. 927.

buying firm may get involved in NPD and is thus ‘co-developing innovation’ (see Figure 5). The first case, ‘buying innovation’, is a quite familiar and straightforward process. The supplier completes the new product development process and offers the ‘finished’ innovation to the buyer. It then rests with the latter to design its own products so that they include the innovative sub-product provided by the supplier.¹⁵⁵

The second case, ‘co-developing innovation’, is more sophisticated and refers to activities that are often framed with the term early supplier involvement in new product development.¹⁵⁶ Almost by definition, a supplier innovation is not immediately applicable, but needs to be adapted to the buyer’s requirements,¹⁵⁷ i.e. co-developed by buyer and supplier. This early involvement of suppliers helps to avoid the challenge of adjusting the specifications of sub-products in later phases of the innovation process.¹⁵⁸

An obvious but crucial difference between buying and co-developing innovation is that in the latter case, supplier innovation is a product that is developed specifically to the needs of the buying company, while in the former case supplier innovation is just some new product that the buyer can access.¹⁵⁹ Many small and medium-sized enterprises do not even have the financial power to develop and commercialise innovations without the support of their partners. Thus, a buying firm that is not willing to financially support its suppliers’ innovation efforts is likely to obtain only those innovations that have already been realised with other partners, i.e. the buyer’s competitors.¹⁶⁰ Furthermore, it should be mentioned that suppliers seldom present finished innovations, but rather try to show what they could do in terms of know-how and innovation if they got the support of the buyer.¹⁶¹

Supplier innovation can benefit the buying firm in three main ways.¹⁶² Firstly, the purchased item may reduce the buyer’s total cost of ownership by decreasing the related operating cost (e.g. due to a process or business model innovation with the supplier). Secondly, the purchased item may decrease the operating cost and the total cost of ownership of the buying firm’s customer. Thirdly, the purchased item may again provide superior value to the buying firm’s customer. Both of the latter two cases would allow the buying firm to charge higher prices and thus increase its sales and/or margin.

¹⁵⁵ See Winter & Lasch, 2012, p. 239.

¹⁵⁶ See Schiele, 2006, p. 927.

¹⁵⁷ See Schumacher et al., 2008, p. 245.

¹⁵⁸ See Henke & Zhang, 2010, p. 42.

¹⁵⁹ See Rogers, 2008, p. 1.

¹⁶⁰ See Groher, 2003, p. 219.

¹⁶¹ See Golfetto & Gibbert, 2006, p. 905.

¹⁶² For the following description see Wynstra & Hurkens, 2005, p. 479.

2.3.2 Organisational requirements: early and cross-functional integration of purchasing, the gatekeeper for supplier innovation

Purchasing is usually the first contact for the supplier, and can thus be considered the gatekeeper for supplier innovation.¹⁶³ Therefore, the purchasing function can significantly affect a firm's innovation capability and needs to be organised properly.¹⁶⁴ Generally, a purchasing department that is open for innovation¹⁶⁵ is cross-functionally integrated,¹⁶⁶ maintains a culture of cooperation and open communication,¹⁶⁷ and shows particular commitment to innovation.¹⁶⁸ Specifically, it has been shown that the cross-functional integration of purchasing with R&D among others indeed has a positive impact on its contribution to innovation.¹⁶⁹ On the operative level, cross-functional collaboration can be fostered by allocating team members to a single location (dedicated project rooms),¹⁷⁰ or demonstrated by the establishment of cross-functional innovation committees that decide whether an idea is further pursued or not.¹⁷¹ However, alignment is also required on the strategic level, that is between the company's innovation or general business strategy, and the single commodity strategies.¹⁷² To link the strategies, it is recommended to use technology roadmaps (which can also be used to align suppliers)¹⁷³ as well as to involve purchasing in corporate strategy-making.¹⁷⁴ Schiele argues that purchasing's cross-functional and early involvement is prerequisite for successfully involving suppliers in the innovation process.¹⁷⁵ However, when including suppliers early in NPD, purchasing needs to be aware of its 'dual role'.¹⁷⁶ On the one hand, it has a company-wide, lifecycle-spanning rationalisation and structuring function,¹⁷⁷ reflecting the traditional responsibility for ensuring reliable delivery of supplies in good quality at an acceptable price.¹⁷⁸ Thus, purchasing has to avoid single sourcing situations that may result from a lock-in with a

¹⁶³ See Matthyssens & Faes, 1985, p. 156; Schumacher et al., 2008, p. 245; Schiele, 2010a, p. 14.

¹⁶⁴ See Luzzini & Ronchi, 2011, p. 14.

¹⁶⁵ See Schumacher et al., 2008, p. 253.

¹⁶⁶ See McGinnis & Vallopra, 1999, p. 11.

¹⁶⁷ See Schumacher et al., 2008, pp. 267–268; Schiele, 2010a, p. 26.

¹⁶⁸ See Atuahene-Gima, 1995, p. 223; Goffre, Plaizier, & Schade, 2005, p. 55.

¹⁶⁹ See Castaldi, Kate, & Braber, 2011, p. 994.

¹⁷⁰ See Schuh & Hoppe, 2012, p. 267.

¹⁷¹ See Schiele & Haas, 2007, p. 31.

¹⁷² See Schumacher et al., 2008, p. 255.

¹⁷³ See Schiele, 2010b, p. 139.

¹⁷⁴ See Schumacher et al., 2008, p. 255.

¹⁷⁵ See Schiele, 2010a, pp. 15–16.

¹⁷⁶ Schiele, 2010b, p. 149.

¹⁷⁷ See Wynstra, Weggeman, & van Weele, 2003, p. 69; Schiele, 2010b, p. 149.

¹⁷⁸ See Dowlatshahi, 1998, pp. 147–148; Schiele, 2006, p. 928; Melander & Lakemond, 2012, p. 3.

certain technology that can only be procured from one supplier.¹⁷⁹ On the other hand, purchasing has a development function that aims at exploiting suppliers' technical competencies in the firms R&D and supporting the process of innovation.¹⁸⁰ These two perspectives (innovation vs. cost-orientation) are potentially conflicting, that is 'the best supplier in the development phase may not necessarily be the best for the rest of the lifecycle'.¹⁸¹ Therefore, it is considered best practice to introduce an 'advanced sourcing' function as a third pillar of purchasing – in addition to operative procurement and strategic/lifecycle sourcing.¹⁸² The task of the advanced sourcing team, consisting of highly-skilled employees with a strong technical background, is to mediate between the technically-oriented R&D department and the commercially-oriented strategic sourcing unit.¹⁸³ To get an understanding of market requirements, it is further recommended that advanced buyers closely cooperate with marketing and product management.¹⁸⁴ Moreover, to gear the purchasing organisation to innovation, companies are well-advised to rely on clearly defined processes for ESI, NPD and innovation, ensuring an appropriate execution of tasks that is independent of specific actors, and, thus, improving process quality and reducing the potential for conflicts.¹⁸⁵

Luzzini and Ronchi account for the risk of innovation, which in the case of supplier innovation is affecting costly and critical sub-components of the buyer's product.¹⁸⁶ In a multiple case study, they found that the status of the purchasing function and the optimal degree of its integration are contingent on the technological uncertainty and complexity of products.¹⁸⁷ If technological risk, product complexity and the degree of outsourcing are high (e.g. in the aerospace industry), the purchasing function is considered highly strategic and is in charge of *any* activity involving suppliers,¹⁸⁸ whereas in mature industries with low product complexity, buyers have a rather clerical role (price negotiation, contract management, etc.) and act as 'coordinator'. Also, Rosell and Lakemond agree that the best practices for innovation with suppliers may depend on the organisational context.¹⁸⁹

¹⁷⁹ See Gassmann, 2003, pp. 633–634; Wynstra et al., 2003, p. 69; Schumacher et al., 2008, p. 264.

¹⁸⁰ See Wynstra et al., 2003, p. 69; Schiele, 2010b, p. 149.

¹⁸¹ Schiele, 2010b, p. 141.

¹⁸² See Gassmann, 2003, p. 638; Schumacher et al., 2008, p. 257; Schiele, 2010b, p. 149.

¹⁸³ See Schumacher et al., 2008, p. 257; Schiele, 2010b, p. 146; Monczka et al., 2011, p. 89.

¹⁸⁴ See Monczka et al., 2011, p. 89.

¹⁸⁵ See Schumacher et al., 2008, pp. 262–263.

¹⁸⁶ See Luzzini & Ronchi, 2011, p. 15.

¹⁸⁷ See Luzzini & Ronchi, 2011, p. 18.

¹⁸⁸ For the following description see Luzzini & Ronchi, 2011, pp. 19–23.

¹⁸⁹ See Rosell & Lakemond, 2012, p. 204.

2.3.3 Open communication, mutual trust and customer attractiveness: Relational success factors to be fostered

Organising the purchasing department for innovation is only half the battle.¹⁹⁰ To make supplier innovation a success, it is also necessary that certain requirements are fulfilled that relate to inter-organisational collaboration and the buyer-supplier-relationship.

Successful supplier innovation projects usually build on a good personal relationship between buyer and supplier staff.¹⁹¹ In a study of 26 NPD projects in six industrial firms, Wagner and Hoegl found that buyer-supplier collaboration is positively related to both the efficiency and the effectiveness of NPD projects with supplier involvement.¹⁹² For them, strong buyer-supplier collaboration is characterised by effective communication within the team, an open exchange of information, participative decision making, shared attitudes, mutual support and respect, and high commitment to the project.¹⁹³ According to a survey among 252 US senior purchasing managers, new product success benefits from the sharing of confidential information.¹⁹⁴ As shown in a study among 111 manufacturing firms from the UK, knowledge sharing can be fostered by informal socialisation mechanisms (communication guidelines, social events), which in turn can be supported by formal socialisation mechanisms, such as formal project structures or cross-functional teams.¹⁹⁵

However, fruitful collaboration might be hampered by barriers that relate to innovation's inherent uncertainty. In advance, the outcome of the supplier innovation process, such as the monetary value and associated intellectual property rights, cannot be determined in detail.¹⁹⁶ Thus, even if a win-win approach to intellectual property ownership is applied,¹⁹⁷ it is difficult to agree by contract how exactly rewards will eventually be shared,¹⁹⁸ although this is recommended by Breckner.¹⁹⁹ Therefore, it is required that the parties initially have confidence that a mutually beneficial solution will be found in the end. Trust can also help to overcome concerns with regard to the disclosure of confidential information.²⁰⁰ Also, Wang and colleagues have demonstrated in their study among 262 purchasing managers that trust has a significant positive impact on creativity in buyer-

¹⁹⁰ See Schiele, 2010a, p. 28.

¹⁹¹ See Groher, 2003, p. 226.

¹⁹² See Hoegl & Wagner, 2005, p. 540.

¹⁹³ See Hoegl & Gemuenden, 2001, p. 438; Hoegl & Wagner, 2005, p. 532; Wagner, 2009, p. 9.

¹⁹⁴ See McGinnis & Vallopra, 1999, p. 10.

¹⁹⁵ See Lawson, Petersen, Cousins, & Handfield, 2009, pp. 166–167.

¹⁹⁶ See Schiele, 2006, p. 930.

¹⁹⁷ See Monczka et al., 2011, p. 35.

¹⁹⁸ See Schiele, 2006, p. 930.

¹⁹⁹ See Breckner, 2004, p. 130.

²⁰⁰ See Gassmann, 2003, pp. 642–643; Breckner, 2004, p. 130.

supplier-relationships.²⁰¹ Spekman and colleagues investigated 22 European and American companies from diverse industries, and found that trust and commitment have a positive effect on learning within the supply chain.²⁰² Hence, it seems that trust between buyer and supplier is a key enabler for supplier innovation.²⁰³ In fact, ‘goodwill trust may directly translate into a supplier's proactive behavior of presenting ideas’,²⁰⁴ i.e. the process of supplier innovation push.

To build trusting relationships, buying firms are recommended to show top management support (e.g. by physical presence in the R&D environment)²⁰⁵ and make meaningful contributions to the relationship (as a signal of its importance).²⁰⁶ Also, the temporary co-location of engineers can help to create trust.²⁰⁷ Moreover, the buyer is advised to avoid burdening its suppliers with unreasonable price-reduction pressure.²⁰⁸ To the contrary, buyers can even profit from assisting their suppliers,²⁰⁹ e.g. by investing in their capabilities through supplier development, because these joint buyer-supplier activities generate trust and foster subsequent supplier innovation.²¹⁰ In a case study of two British aerospace and defence companies, Reed and Walsh found that supplier development explicitly aiming at improving the innovativeness of suppliers was successful, in particular because it positively impacted trust and open communication, two major antecedents of successful supplier innovation.²¹¹ While there are other beneficial factors that are not directly manipulable, such as proximity (e.g. in a cluster)²¹² or the fit of corporate cultures,²¹³ several authors emphasise the importance of being a ‘preferred customer’ to technology-leading suppliers,²¹⁴ because the latter will only present their innovative ideas first to their most favoured customers.²¹⁵ While relational reliability and supplier involvement in NPD have been identified as antecedents of the preferred customer status, the latter has been found to be indeed positively related to technology access.²¹⁶

²⁰¹ See Wang, Bradford, Xu, & Weitz, 2008, p. 115.

²⁰² See Spekman, Spear, & Kamauff, 2002, p. 50.

²⁰³ See Schumacher et al., 2008, p. 271; Henke & Zhang, 2010, p. 43.

²⁰⁴ Schiele, 2006, p. 930.

²⁰⁵ See Gassmann, 2003, p. 642.

²⁰⁶ See Monczka, Carter, et al., 2010, p. 64.

²⁰⁷ See Gassmann, 2003, p. 643.

²⁰⁸ See Henke & Zhang, 2010, p. 42.

²⁰⁹ See Hoegl & Gemuenden, 2001, p. 438.

²¹⁰ See Schiele & Haas, 2007, p. 31; Henke & Zhang, 2010, p. 45.

²¹¹ See Reed & Walsh, 2002, p. 241.

²¹² See Schiele, 2006, p. 928.

²¹³ See Gassmann, 2003, p. 643; Slowinski et al., 2009, p. 29.

²¹⁴ See Breckner, 2004, p. 125; R. Baxter, 2012, pp. 1255–1256; Ellis, Henke, & Kull, 2012, pp. 1265–1266.

²¹⁵ See Schiele, 2012, p. 46.

²¹⁶ See R. Baxter, 2012, pp. 1265–1266.

2.4 Innovation management to enable and follow up supplier innovation process

2.4.1 Seizing innovations by innovation meetings, fairs, web platforms and more

To start the inbound open innovation process and make innovations find their way from the supplier into the buying firm's business, several channels and innovation management tools can be used.²¹⁷

The most basic opportunity that suppliers may use to present their innovative ideas are formal purchasing conversations that take place on a regular basis between buyer and supplier.²¹⁸ Another more formal and commercially-oriented event that the buying firm may use to seize innovations in the supply base are so-called supplier days: As opposed to periodic purchasing conversations, these high-level events do involve not only one but instead all major suppliers, who are invited for one or two days to listen to presentations and participate in workshops. As regular purchasing conversations and supplier days normally have rather broad agendas, it might well be the case that the topic 'innovation' does not receive sufficient attention. Therefore, the buying firm may invite a supplier to present its scope of technologies, and current and future developments in the context of a 'technology show'.²¹⁹ These shows can either be used to discuss highly specific topics with a small circle of experts, or to make the supplier's capabilities known to a broader audience. One of the main benefits of this kind of event is the personal contact and exchange between engineers from both sides (sales engineers, R&D), which is often the starting point for further discussion of ideas. Moreover, as technology shows usually take place at the buyer's site, they save time for the buying firm and enable the supplier to reach many stakeholders at a time. If a company invites a couple of usually non-competing suppliers to such a road show, the event might be called a supplier innovation fair.²²⁰ Another means that is e.g. described by Schiele and applied by German car manufacturer BMW are dedicated innovation meetings.²²¹ For these usually daylong workshops, the buyer invites the supplier or several suppliers as well as own employees from the relevant fields (R&D, purchasing, marketing, production, etc.) to discuss innovation and come up with ideas for development projects.²²² Often, when revealing current innovation activities, the supplier even requires the buyer's employees to sign an NDA, to ensure the protection

²¹⁷ See Winter & Lasch, 2011, p. 96.

²¹⁸ For the following description see Groher, 2003, pp. 224–225.

²¹⁹ Groher, 2003, p. 224.

²²⁰ See Groher, 2003, p. 235.

²²¹ See Schiele, 2010b, p. 148.

²²² See Schumacher et al., 2008, pp. 266–267.

of their intellectual property. The meeting can, but does not necessarily need to be focused on a specific, pre-defined problem.²²³ What distinguishes innovation workshops from technology shows is the active participation by both supplier and buyer staff, and the concrete action list as a result of the meeting.²²⁴

While the tools explained above describe events that include ‘active’ face-to-face exchange and take place at discrete points in time, the buying firm can also use continuous, ‘passive’ tools to foster supplier innovation. It is suggested that buyers offer effective incentives, such as innovation contests, challenges and awards, to stimulate supplier innovation,²²⁵ and then provide software tools that actually allow suppliers to share their ideas with the buyer.²²⁶ BMW, for example, is using a web platform called ‘virtual innovation agency’ to source innovations from both existing and potential suppliers²²⁷ – an approach similar to the virtual customer integration described by Rohrbeck, Steinhoff and Perder, who, in this regard, distinguish between uni- and bidirectional communication, the latter involving guidance and feedback provided by the buying firm.²²⁸

To overcome trust issues or a lack of experience in partnering,²²⁹ or to reduce transaction costs,²³⁰ firms may also rely on external providers of innovation management tools, i.e. specialised innovation intermediaries, of which ‘Yet2.com’ and ‘InnoCentive’ are probably the most prominent examples.²³¹ In the example described above, BMW is indeed relying on such an external service provider for a first selection of ideas. In the context of intermediaries, also public trade fairs (e.g. Hannover Messe) may be considered as certain kind of innovation matchmaker.

Last but not least, the buying firm can foster the highly valuable informal contact between technically oriented employees from both sides, e.g. by inviting them to become a member of dedicated ‘technology clubs’.²³²

In order to avoid that ideas collected by any of the above mentioned means come to nothing, it is considered best practice to charge a person or department with the follow-up of the identified supplier innovations.²³³

²²³ See Rink & Wagner, 2009, p. 22.

²²⁴ Schiele, 2010b, p. 148.

²²⁵ See Terwiesch & Xu, 2008, p. 1530; Slowinski et al., 2009, p. 29.

²²⁶ See Slowinski et al., 2009, p. 31.

²²⁷ See Groher, 2003, p. 236; Breckner, 2004, pp. 152–153.

²²⁸ See Rohrbeck, Steinhoff, & Perder, 2010, p. 121.

²²⁹ See Ford, Mortara, & Probert, 2012, p. 47.

²³⁰ See Hagi & Jullien, 2011, p. 339.

²³¹ See Markman, Gianiodis, & Phan, 2009; Gianiodis, Ellis, & Secchi, 2010.

²³² Groher, 2003, p. 223.

²³³ See Schiele, 2006, p. 148.

2.4.2 Evaluation and integration of innovative ideas as challenge for the buying firm

Seizing innovations from external sources is only the first step. In order for the buying firm to profit from supplier innovations, their proper integration into the buyer's business is required.²³⁴ However, as the number of supplier innovation ideas is potentially high and resources at the same time limited, not all ideas can be realised.²³⁵ Therefore, in order to select the most promising ideas, a detailed and systematic evaluation process is advised.²³⁶ This assessment, e.g. done by business case analysis, may not only take costs into account, but instead focus on the total return on investment,²³⁷ and the technical qualities and feasibility of the proposed concept.²³⁸ A comprehensive set of requirements for the evaluation of supplier product innovations (see Table 3) has been developed by Winter and Lasch in their multiple case study of seven medium-sized to large companies from diverse industries (electrical, engineering, automotive, mining and metal, measurement and control technology).²³⁹

Evaluation ...	Question	Answer
Object	What is evaluated?	Supplier innovation with a certain maturity level (1-6, see section 2.3.1)
Objective	Why is it evaluated?	Select the most promising innovation ideas
Time	When is it evaluated?	Ex-ante
Methods	How is it evaluated?	Qualitatively, quantitatively, or both combined
Criteria	By what is it evaluated?	Categorical criteria (yes/no), gradual criteria (degrees of performance), and integrative criteria (performance indicators)
Reference	With what is the result compared?	Alternative supplier innovations, a particular status, or an aspired objective
Person	Who evaluates?	A single person, or a group (see section 2.3.2)
Recipient	For whom is it evaluated?	General management, head of division/department, or decision team

Table 3: Characteristics of an evaluation situation (based on Winter & Lasch, 2012, pp. 240-244)

When the buying firm has assessed a supplier innovation and decided in favour of its realisation, 'the innovation must be fully integrated into the firm's R&D activities'.²⁴⁰ What makes uniform approaches, however, hardly suitable for not only the evaluation, but

²³⁴ See West & Bogers, 2013, p. 14.

²³⁵ See Völker & Berberich, 2007, p. 4.

²³⁶ See Stern & Jaberg, 2010, p. 203.

²³⁷ See Monczka et al., 2011, p. 45.

²³⁸ See Schiele, 2006, p. 926.

²³⁹ See Winter & Lasch, 2012, pp. 238, 246.

²⁴⁰ West & Bogers, 2013, p. 14.

also the integration of supplier innovations is the considerable diversity of these contributions²⁴¹ – they might appear in high or low maturity levels,²⁴² as product or process innovation,²⁴³ et cetera. Based on Henderson and Clark’s framework, Rosell and Lakemond distinguish between incremental and radical supplier innovations that are either extending existing knowledge, that is innovation on the component level, or reconfiguring existing knowledge, that is innovation on the architectural level (see Figure 6). While the latter (right column) are led by the assembler (i.e. the buyer), the former (left column) more often originate from suppliers.²⁴⁴ Gassmann describes these component innovations as modular innovations and, in this regard, emphasises the importance of clearly defined interfaces for a well-working cooperation with suppliers.²⁴⁵ He further claims that early supplier involvement in NPD is only useful if the number of proprietary, customer-specific interfaces is high, and the supplier is competent and innovative.

		Component level: <i>Extending existing knowledge</i>	Architectural level: <i>Reconfiguring existing knowledge</i>
Input by the supplier	Radical	Development of a completely new component (e.g. an advanced material that revolutionizes performance in braking parts)	Development of a completely new system (architecture) (e.g. a completely new braking system for a vehicle using a new technology)
	Incremental	Improvement of a component (e.g. a lighter component within a disc-brake that gives better performance and stability)	Improvement of a system (architecture) (e.g. new versions of a braking system for vehicles with better performance)

Figure 6: Categorisation of supplier inputs to innovation (Rosell & Lakemond, 2012, p. 207)

Moreover, Gassmann recommends separating the content-related aspects from the commercial and legal aspects.²⁴⁶ Thus, when engineers work or brainstorm together, they are supposed to focus on technical details, rather than costs, prices or quantities – topics that are discussed between purchasing and sales. Finally, a commonly discussed²⁴⁷ barrier that needs to be overcome is the not-invented-here syndrome, the ‘internal resistance from at least some of the company’s technical staff’²⁴⁸ to external sources of innovation.

²⁴¹ See Schiele, 2006, p. 926; Winter & Lasch, 2012, p. 248.

²⁴² See Winter & Lasch, 2012, p. 241.

²⁴³ See Rosell & Lakemond, 2012, p. 207.

²⁴⁴ See Lee & Veloso, 2008, p. 431.

²⁴⁵ See Gassmann, 2003, p. 635.

²⁴⁶ See Gassmann, 2003, p. 637.

²⁴⁷ See Gassmann, 2003, p. 634; Tidd et al., 2005, p. 28; West & Bogers, 2013, p. 15.

²⁴⁸ Laursen & Salter, 2006, p. 137.

2.5 Supplier innovation push – possible, but expected to be contingent on various parameters at buyer and supplier side

Taking all the theoretical perspectives discussed above into account, it seems indeed possible that buyers benefit from innovations that have been unsolicitedly developed by their suppliers. However, successful supplier innovation push is only likely if certain requirements at both buyer and supplier firm are fulfilled.

Apparently, supplier innovation originates with firms that supply systems, modules, sub-systems, components, norm parts and raw materials to OEMs, which in turn integrate these intermediate products into their final product that is to be sold to the end customer. The role the supplier plays in NPD depends, among other factors, on the sub-product's interface complexity, the rate of technological change, and the way specifications are provided by the buyer (performance vs. physical specifications). Suppliers' innovation efforts may, however, also depend on their strategy, and its relation to the buyer's strategy. On the one hand, it is the more likely that innovation is supplier-driven, the less emphasis the buyer sets on innovation. On the other hand, if the OEM is in a clearly dominant position, suppliers are more likely to follow an adaption rather than an innovation strategy.

To create value through innovation, best-in-class suppliers are market-oriented, that means they rely on a cross-functional team to analyse both expressed and latent customer (and end customer) needs. They may then develop innovations on their own or in downstream cooperation, and offer them to their (preferred) customers, usually with benevolent pricing. Suppliers' motivation to innovate, however, stems not only from financial payment for sales volume and product development services, but also from possible access to technological knowledge and the reputation of doing business with leading-edge firms. Yet, innovations resulting from market orientation are supposed to involve relatively minor changes: Suppliers might want to retain the linkages between core concept and components, and keep the technological change low for the producer. Therefore, suppliers are likely to come up with incremental, modular and application innovations, rather than innovations that are radical and discontinuous, or even disruptive.

On the other side of the dyad, reflecting the open innovation paradigm, buying firms have an increased need for input to their innovation funnel. While customers are perceived as the more important source for mere ideas, suppliers are widely considered to be most important for actual collaboration in NPD, which corresponds to the characteristics of the relationship, namely individualised service provision, and the long-term orientation of

transactions. To make suppliers approach the buying firm with innovative ideas, both a trusting relationship and an organisation that is open for innovation are required. Only if they feel valued, respected and encouraged to provide innovation, and if they are convinced that their intellectual property is treated confidentially, suppliers will share their innovations with the buyer. Therefore, buyers – in order to attain preferred customer status – are recommended to make meaningful investments in the supplier relationship. For that purpose, the buying firm may involve a supplier in supplier development activities, rely on formal socialisation mechanisms (e.g. co-location of engineers), avoid unreasonable price-reducing pressure and communicate top management commitment.

As internal alignment (e.g. between the firm's innovation strategy and the commodity strategies) and a cooperative culture are considered antecedents of successful supplier involvement in innovation, firms have to pay attention to the organisation of their purchasing department and its cross-functional integration, e.g. participation in strategy-making. To reconcile the two potentially conflicting perspectives of innovation on the one side, and cost-orientation on the other, it is advised to introduce an advanced sourcing department that employs buyers with a strong technical background who closely cooperate with marketing and/or product management. However, the precise role of an advanced buyer may depend on the specific context (e.g. low vs. high product complexity).

With regard to processes, the buying firm needs to select, define and apply innovation management tools that help to seize innovations in the supply chain. While an opportunity for suppliers to present their ideas can indeed be provided within usual purchasing appointments, such as periodic meetings or supplier days, it can also be helpful to organise events that are dedicated to innovation, such as technology shows, supplier fairs or innovation meetings. Also, buyers could rely on more passive approaches, e.g. providing a web-platform as communication channel or relying on external innovation intermediaries.

Finally, when acquiring innovation from the supplier, two concerns stand out: the uncertainty concerning the value of the innovation, and the associated risk. While risk is clearly perceived as negative and recognised by the supplier, value is a more ambiguous concept. Buyer and supplier may not be in agreement about expected benefits and/or cost-reductions, leading to two different ex ante assessments of value. Therefore, the buying firm is recommended to professionalise the evaluation of supplier innovation, in order to recognise its value and apply it to commercial ends, that is to integrate the innovation into the own R&D activities. The best practices for both the evaluation and integration of supplier innovations may be contingent on whether a supplier innovation is bought as a

finished product or co-developed with the supplier, and on whether the innovation concerns the component or the architectural level.

The general solution concept described above already provides first answers to the main question of this research, stated in the first chapter: How can the principal of this thesis harness innovations that are unsolicitedly pushed from suppliers? Unlike the sub-questions of this research, the theory explained above does not distinguish between barriers on the one hand, and means to overcome these barriers on the other. Therefore, the answer to the first sub-question is twofold. Firstly, there are barriers that directly emerge from the literature (A-E, see Table 4).

	Direct Barriers	Main references	... that may be overcome by (see Table 5)
A	Concerns with regard to intellectual property	Gassmann, 2003 Breckner, 2004	I, P
B	Too strong market orientation of suppliers (customer-led)	Atuahene-Gima, 1996 Slater & Narver, 1998	J, L
C	Innovation's inherent risk	Backhaus & Voeth, 2011 Luzzini & Ronchi, 2011	H, I, J, P
D	Supplier salespeople's reluctance to sell radical innovations	Kauppila et al., 2010	J, L, M, N
E	Uncertainty concerning the real value of an innovation	Schiele, 2006	G, H, I, J, P, Q

Table 4: Preliminary findings - direct barriers to supplier innovation push (own elaboration)

Secondly, there are barriers that are derived from the literature only by implication: If certain antecedents are not given, these shortcomings can also be conceived as barriers (G-Q, see Table 5). However, adhering to the recommendations provided by the literature may in turn already help to answer the second sub-question of this research (referring to suitable processes, tools and organisational structures).

	Indirect Barriers → Lack of ...	Main references
G	Absorptive capacity	Rosell & Lakemond, 2012 Salge et al., 2012, 2013 Clausen, 2013
H	Appropriate evaluation of supplier innovation	Schiele, 2006 Stern & Jaberg, 2010 Winter & Lasch, 2012
I	Appropriate tools for seizing innovation	Groher, 2003 Schumacher et al., 2008 Slowinski et al., 2009

	Indirect Barriers → Lack of ...	Main references
J	Commitment to innovation by buyer	Atuahene-Gima, 1995 Goffre et al., 2005 Wynstra et al., 2010
K	Cross-functional integration of purchasing	McGinnis & Vallopra, 1999 Schiele, 2010a Castaldi et al., 2011
L	Incentive for supplier innovation	Terwiesch & Xu, 2008 Slowinski et al., 2009 Smals & Smits, 2012
M	Mutual support and respect	Hoegl & Gemuenden, 2001 Hoegl & Wagner, 2005
N	Participative decision making and shared attitudes	Hoegl & Wagner, 2005 Wagner, 2009
O	Preferred customer status	Henke & Zhang, 2010 Schiele, 2012 R. Baxter, 2012
P	Trust	Schiele, 2006 Schumacher et al., 2008 Henke & Zhang, 2010
Q	Well-defined processes for ESI, NPD and innovation	Gassmann, 2003 Schumacher et al., 2008 Cooper & Edgett, 2012

Table 5: Preliminary findings - indirect barriers to supplier innovation push (own elaboration)

While the list of barriers is already quite extensive, there might be more factors that hamper successful supplier innovation push. The case study presented in the following chapters aims at both verifying the barriers identified in the literature, and complementing the list with some first-hand empirical insights. The literature review is thus not an end by itself, but a means to an end: It guides the researcher in data collection and allows posing the right questions in the course of the case study.²⁴⁹ Moreover, the empirical analysis serves to explore solution directions, i.e. further processes, tools and organisational structures that can be applied in a company to enable supplier innovation push.

²⁴⁹ See Ghauri & Grønhaug, 2005, p. 213.

3 Bombardier Transportation – technology leader with broad rail portfolio

3.1 Multinational corporation – grown quickly, and mainly through acquisition

As one of the two subsidiaries of Bombardier Inc., Bombardier Transportation (BT) employs 36,000 people, who have generated revenues of \$8.1 billion in 2012. Bombardier Transportation is a world leading provider of rail equipment and systems, while its similarly sized sister company Bombardier Aerospace is a leading player in the business, commercial, specialised and amphibious aircraft markets.²⁵⁰

Bombardier Transportation is a multinational corporation that is organised in six divisions (excluding the headquarters), operating 64 production and engineering sites all over the world (as of 2013).²⁵¹ To understand the structure and organisation of Bombardier, it is required to have a brief retrospect on the history of the originally Canadian corporation.

In 1941, when Joseph-Armand Bombardier founded the company as ‘L’Auto-Neige Bombardier’ in Valcourt (Quebec), it was providing snowmobiles for the Canadian market.²⁵² The demand for snowmobiles soared and Bombardier was performing great for several decades²⁵³ – but in the 1970’s, when the market environment sharply worsened, its strong focus on snowmobiles got the company into serious trouble. However, Bombardier learned from its failure to spread risk and, since then, has been strongly emphasising the value of diversification (‘diversify or die’).²⁵⁴ After acquiring licenses and know-how from French manufacturer CIMT-Lorraine (today part of the Alstom group), Bombardier won its first railway contract in 1974, supplying 400 cars for the Montreal subway.²⁵⁵ In 1982, Bombardier won the ‘deal of the century’, a \$1 billion contract over 825 subway cars for New York City. Yet, it was not before 1989 that Bombardier’s credentials were established in the European market. The company won parts of a contract for supplying to the Channel Tunnel (Eurotunnel) project and, in the same year, acquired Crespin-based ANF-Industrie, France’s second-largest provider of rail equipment.²⁵⁶ In the following years further acquisitions followed (see p. A3), including the takeover of Adtranz in 2001, which added electrical and propulsion skills to Bombardier’s expertise and finally turned the company into a fully integrated producer of rail equipment.²⁵⁷

²⁵⁰ See BT-Doc, 2013a.

²⁵¹ See BT-Doc, 2013a.

²⁵² See MacDonald, 2013, pp. 16, 27.

²⁵³ See MacDonald, 2013, pp. 44–45, 58.

²⁵⁴ See MacDonald, 2013, p. 59.

²⁵⁵ See MacDonald, 2013, pp. 64–66.

²⁵⁶ See MacDonald, 2013, p. 130,133.

²⁵⁷ MacDonald, 2013, pp. 137–141.

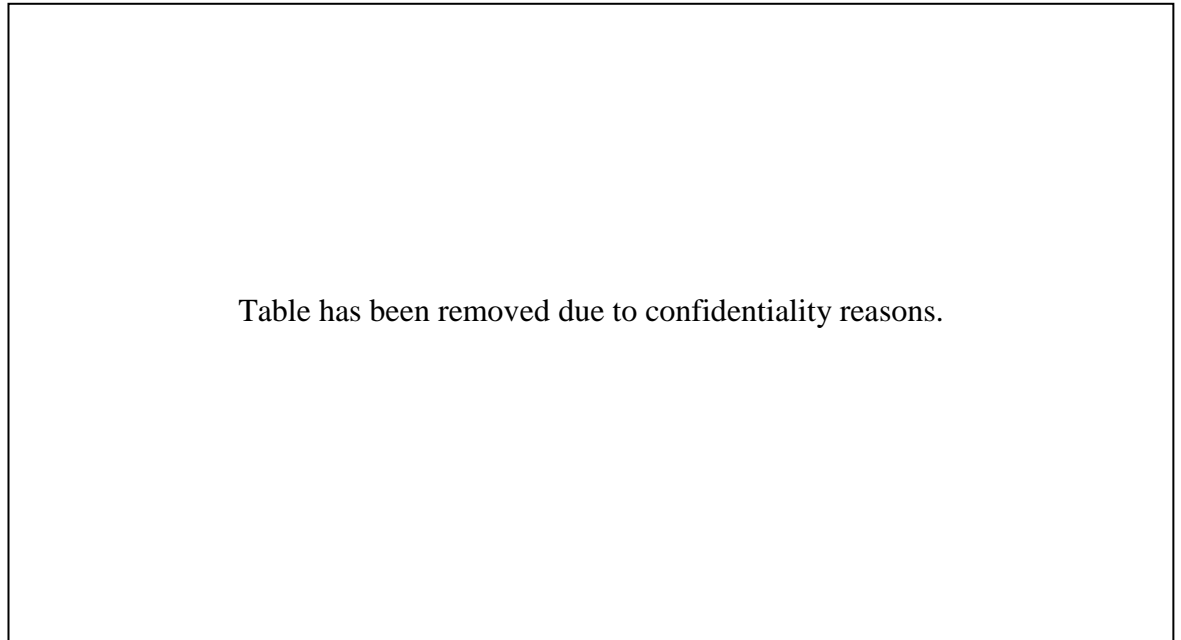


Table 6: Divisions of Bombardier Transportation (as of 2013, own elaboration)

To align the divisions, their different historically grown structures and cultures, there are central departments for each function (innovation management, engineering, sales ...) in the Berlin-based headquarters of the company, which support, coordinate and govern the company-wide guidelines across the divisions.

As fully integrated provider of rail equipment,²⁵⁸ Bombardier Transportation does not only produce rolling stock (all vehicles that move on a railway), but also wayside equipment (rail control and signalling systems) as well as essential train components like bogies, propulsion converters, traction drives and the related electronics. Moreover, Bombardier offers services such as fleet management, operations and maintenance, asset life management, material solutions, and component re-engineering and overhaul. Yet, the largest part of sales is generated by the design and manufacturing of rolling stock. One of the divisions that produce rolling stock is [REDACTED]

[REDACTED] the analysis is focused on the division [REDACTED] and the rolling stock business accordingly.

²⁵⁸ For the following description see BT-Doc, 2013a.

3.2 Environment: Europe vs. China – changing balance of power?

3.2.1 Providing rolling stock: timely delivery, reliability and safety as crucial factors

Rolling stock can be perceived as complex products and systems,²⁵⁹ i.e. high-technology, high-value capital goods that are software- and engineering-intensive. They are designed and produced on a project basis, according to the requirements of large professional government and institutional customers.²⁶⁰ Thus, unlike consumers of mass-produced products, the customer is intimately involved in the design process throughout the lifecycle of the project.²⁶¹ Within this framework, Bombardier is the vehicle manufacturer that acts as systems integrator, and is often the prime contractor as well. Hence, one of the company's core competencies is the integration of systems and the management of unique, large-scale projects involving a myriad of component and sub-system suppliers, as well as the customer.²⁶² For each bid, the system integrator designs a vehicle or adapts an existing vehicle design to the usually quite detailed customer requirements specification.²⁶³ These design tasks include adaptations to the respective national and regional systems, e.g. concerning the track gauge or the voltage of rail overhead lines. Furthermore, customers explicitly require individualised rather than standardised products – tramways and metros are an often cited example here. Widely considered a landmark (Berlin, New York), their physical appearance is different from city to city.

In general, the industry is known to be rather sceptical towards new technologies and innovation.²⁶⁴ The daily news reports explain this conservative attitude best. Train operators are always under fire due to trains that are out of service or not on time. Accordingly, vehicle manufacturers are regularly sued for belated delivery or lacking reliability of their products. Therefore, it is mainly two attributes that are perceived to create value for the customer: in-time delivery of rolling stock, and its reliability and durability over the whole lifecycle, which is approximately 30 years.

Finally, safety is a mandatory requirement for every train that is put on the rail, and ensured by two standard processes: homologation and authorisation. While delays with regard to both inspections need to be avoided by any means,²⁶⁵ it is especially authorisation that creates immense cost for vehicle builders. This legal requirement needs to be fulfilled

²⁵⁹ See Davies & Hobday, 2005, p. 8.

²⁶⁰ See Davies & Hobday, 2005, pp. 6–7.

²⁶¹ See Davies & Hobday, 2005, p. 9.

²⁶² See Davies & Hobday, 2005, p. 12.

²⁶³ See BT-Doc, 2013c.

²⁶⁴ For the following description see BT-Letourneux, 2013c.

²⁶⁵ See BT-Doc, 2013d.

by the vehicle manufacture before rail equipment can be placed into service, independent of any given rail operator. This challenging approval process considerably slows down the introduction of new products.²⁶⁶ Or, as the former chief executive officer of Siemens Rail Systems put it, ‘the Eisenbahn-Bundesamt [remark by the author: the German national safety authority] is costing us between two and four million Euro a week’.²⁶⁷

3.2.2 Berlin as the heart of a greater European railway cluster?

Although the railway industry in general is rather conservative, this does not mean that there is no innovation at all. However, there may be players that are more innovative than others – an attribute that is said to depend among other factors on firms’ geographic location, that means whether they are located within a cluster, or not.²⁶⁸ And while Bombardier Transportation clearly is a multinational corporation with sites all over the world, its European-based divisions indeed appear to be part of a cluster-like environment. This will be demonstrated by the following analysis of BT in terms of Schiele’s amplified version²⁶⁹ of Porter’s diamond of national competitive advantage (see Figure 7).²⁷⁰

Taking Bombardier Transportation as point of departure, the mere existence of eight German production sites employing 8,000 people already points out the importance of the European market for the company. Indeed, Europe is not only the largest but also one of the most competitive and challenging rail markets.²⁷¹ This is also reflected by the large number of highly capable competitors. Besides relatively small companies like AnsaldoBreda (Italy), CAF (Spain), Stadler (Switzerland), Thales (France) or Talgo (Spain), also Alstom (France) and Siemens (Germany) – which together with Bombardier Transportation constitute the ‘Big Three’ – are based in Europe.²⁷² Moreover, these players are in active exchange. Several BT employees stated that they very well know their counterparts at Alstom Transport and Siemens Rail Systems.

However, challenge and pressure to innovate does not only come from competitors. While not compromising on reliability, safety and performance standards, customers like the major railway companies of Germany (Deutsche Bahn) and Switzerland (SBB) demand comparably innovative, high-tech products and may, thus, anticipate global trends. It is

²⁶⁶ See BT-Doc, 2013b.

²⁶⁷ BT-Doc, 2013b.

²⁶⁸ See Schiele, 2008, p. 30.

²⁶⁹ For the following description see Schiele, 2008, p. 30.

²⁷⁰ See Porter, 1990, p. 77.

²⁷¹ See BT-Doc, 2013a.

²⁷² See BT-Doc, 2013b.

hence no coincidence that the head offices of both Bombardier Transportation and Siemens Rail Systems are located in Berlin, where also Deutsche Bahn (DB) is headquartered.

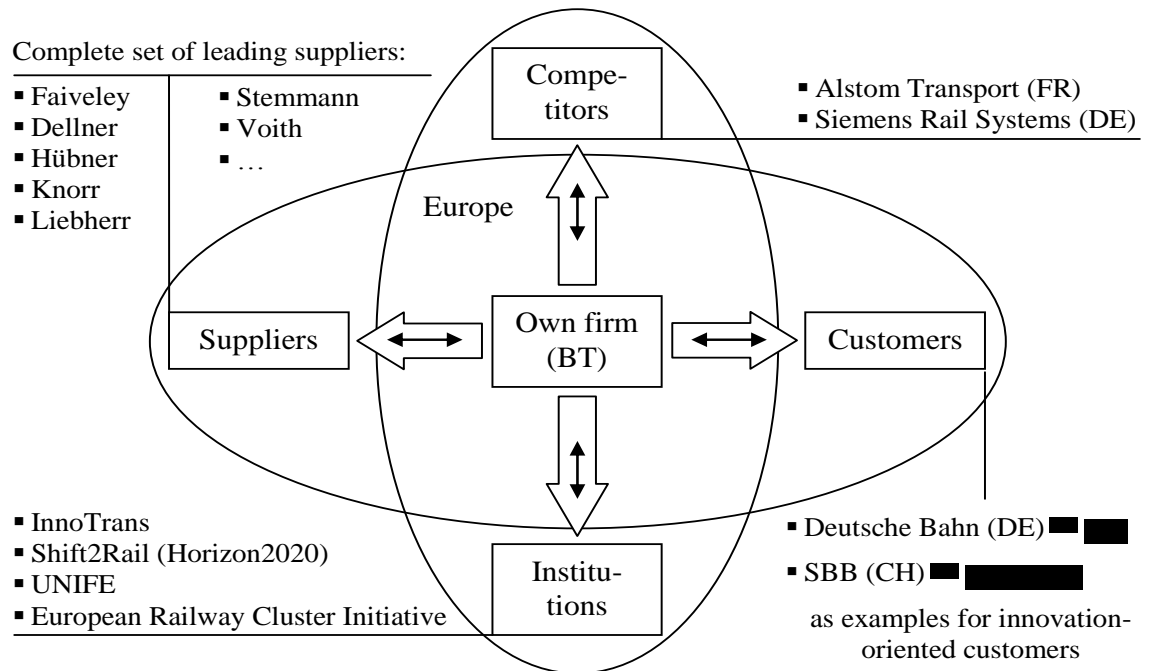


Figure 7: BT analysed in terms of the amplified Porterian diamond (based on Schiele, 2008, pp. 29-30)

To meet the challenging customer demands, rail equipment providers need to rely on a complete set of leading suppliers, present in close vicinity. However, probably due to their diversity, not all sub-systems and components can be sourced from only one region. The specialised railway suppliers are scattered over at least parts of Europe. Yet, there are some cluster initiatives that focus on single regions such as BTS railway industry in Eastern Germany and i-Trans in Northern France.²⁷³ Eight of these clusters moreover joined forces within the European Railway Clusters Initiative, in order to accelerate innovation and maintain the technological supremacy of European players. Another related initiative is Shift2Rail, a research programme that is supported by the European Commission and coordinated by UNIFE, the association of the European rail industry. This large-scale joint technology initiative aims at increasing the competitiveness of the European rail industry, in order to respond to the increasingly fierce competition with Asian companies.²⁷⁴ For that purpose, 15 major rail stakeholders (including both OEMs and suppliers) have teamed up and committed themselves to a long-term investment in European rail research.²⁷⁵ Thus,

²⁷³ See ERCI, 2013.

²⁷⁴ See UNIFE, 2013, p. 16.

²⁷⁵ UNIFE, 2013, p. 20.

these companies are trying to foster collaboration and develop an ‘innovative milieu’,²⁷⁶ while at the same time maintaining competition. Last but not least, it is worth mentioning that the industry’s leading trade fair (InnoTrans) is held in Berlin, too.

In conclusion, it seems that only some of Bombardier’s European sites are located in a regional cluster, but that all of them are at least embedded within the European railway region, with Berlin as its centre – being home to two leading rail equipment providers, the major customer Deutsche Bahn and the trade fair InnoTrans.

3.2.3 Trend: breaking oligopoly in an increasingly liberalised market

Already above the ‘Big Three’ rolling stock providers were mentioned: Alstom, Bombardier and Siemens. Traditionally, it has been this trio that dominated the rail equipment industry, accounting for approximately half of the global market.²⁷⁷ In line with the ‘merger endgame model’,²⁷⁸ the three companies all grew by mergers and acquisitions (see p. A3 for Bombardier’s growth path). However, there are certain industry particularities that may impede further consolidation:²⁷⁹ As the lifecycle of rolling stock is 20 to 30 years, customers have no immediate need to take the investment decision. Therefore, they could even put pressure on a monopolist, because the latter is still in need of operating at full capacity. Moreover, as already discussed in section 3.2.1, customers often require individualised solutions rather than standardised products. Therefore, ‘even small market players (...) [may] leverage individual projects in order to grow and pose a serious competitive threat to the major vendors’.²⁸⁰ Specialities can also be observed with regard to the competition in the industry: On the one hand, there are national providers in all key markets that may grow into substantial global competitors (e.g. Rotem in South Korea). On the other hand, responding to captive markets, customers already start to integrate backward by taking over the modernisation of their rolling stock. In fact, their maintenance units may even have the skills to build new rail vehicles on their own. Last but not least, the oligopoly of the ‘Big Three’ is also threatened by political influence.²⁸¹ The increasing liberalisation of the European market allows Asian companies to expand into Europe, whereas for instance the Chinese and Japanese markets are not liberalised yet.²⁸²

²⁷⁶ Schiele, 2008, p. 30.

²⁷⁷ See Roland Berger Strategy Consultants, 2006, p. 20.

²⁷⁸ Roland Berger Strategy Consultants, 2006, p. 20.

²⁷⁹ For the following description see Roland Berger Strategy Consultants, 2006, p. 22.

²⁸⁰ Roland Berger Strategy Consultants, 2006, p. 22.

²⁸¹ See BT-Doc, 2011a.

²⁸² See Roland Berger Strategy Consultants, 2012, p. 61; Adachi, 2013, p. 10; UNIFE, 2013, p. 39.

A new balance of power is already reflected in the 2011 sales numbers (see Figure 8): Although the state-owned Chinese enterprises CNR and CSR mainly grew due to an expanding domestic market that was protected from foreign competition by the government,²⁸³ they are nowadays often included when referring to the major rolling stock providers, enlarging the ‘Big Three’ to make it a group of the ‘Big Five’.

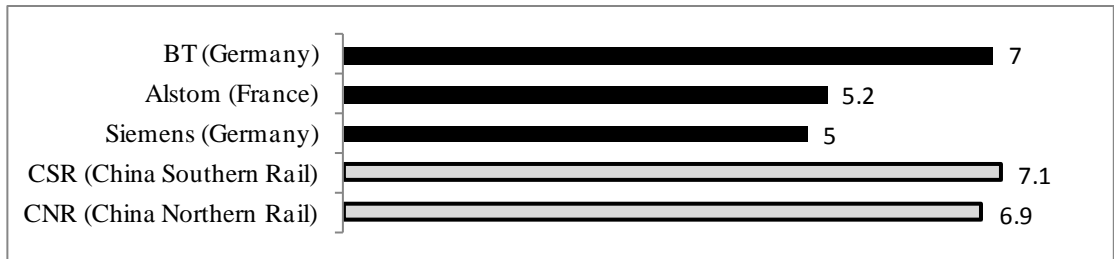


Figure 8: Rail-related revenues of the ‘Big Five’ [in billion EUR] in 2011 (based on BT-Doc, 2013b)

As the Chinese market is slowing down, CNR and CSR are starting to export, challenging the market with aggressive delivery times.²⁸⁴ Only recently, CSR was awarded a contract for the metro in Ankara (Turkey), while CNR won four patents in the United States, indicating that Chinese companies are even catching up in terms of technology.²⁸⁵

3.3 Lead Buyers and Lead Engineers as main contact for project-spanning issues

[REDACTED]

²⁸³ See Adachi, 2013, p. 10.

²⁸⁴ See BT-Doc 2013b.

²⁸⁵ For the following description see BT-Doc, 2013h.

[REDACTED]

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3.4 Innovation as one pillar of the business strategy

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4 Combining theory-based problem solving and case study research

4.1 Theory-based business problem solving as general approach

The principal of this thesis ‘seems to struggle to actually implement structures and processes that enable supplier innovation push in a multinational organisation’. This problem, which is stated in the introduction, directly emerges from practice and relates to the business context of Bombardier Transportation. While relevance is hence ensured by the very nature of the project (its affiliation with BT), this thesis also needs to satisfy academic requirements in terms of scientific rigour. The business problem solving methodology developed by van Aken and his colleagues from the Eindhoven University of Technology fulfils this double requirement of relevance and rigour, as it is both result-oriented and theory-based.³⁰⁴ Unlike in practice, this methodology relies on a strong theoretical foundation, ‘using state-of-the-art literature’.³⁰⁵ The authors moreover claim that their approach best suits business problems that have a significant technical-economic component,³⁰⁶ which makes the approach perfectly suitable for a project that is closely related to technological innovation.

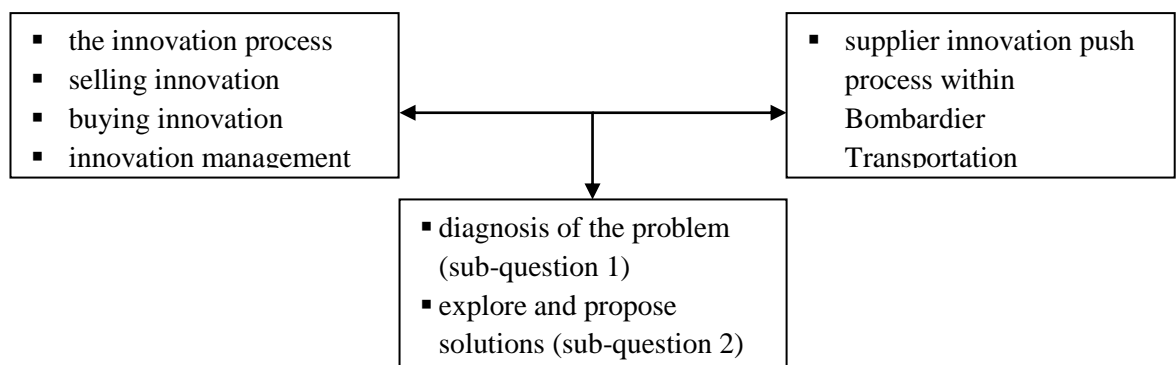


Figure 9: Conceptual project design (based on van Aken et al., 2006, p. 51-53)

To visualise the research project, van Aken and colleagues suggest a conceptual project design that consists of three boxes (see Figure 9). Firstly, the box on the right side represents the phenomenon being studied, i.e. supplier innovation push (and the related business processes). Secondly, the box on the left contains the ‘set of theoretical perspectives that are required to study the problem’.³⁰⁷ Usually, practical problems are too complex to fit them into the ideas of a single theory.³⁰⁸ Therefore, the comprehensive

³⁰⁴ See van Aken et al., 2007, p. i.

³⁰⁵ van Aken et al., 2007, p. 4.

³⁰⁶ See van Aken et al., 2007, p. 21.

³⁰⁷ van Aken et al., 2007, p. 52.

³⁰⁸ See van Aken et al., 2007, p. 52.

review of the existing literature in the previous chapter covers the issues of innovation and the innovation process in general, selling and buying innovation, as well as innovation management tools. Section 2.5 attempts to integrate all these perspectives into one homogenous theoretical framework, even though this is, according to van Aken and his colleagues, hardly feasible. The last box of the conceptual model depicts the deliverables of the project, which reflect the answers to the research sub-questions mentioned in the introduction: the diagnosis of the problem, i.e. the identification of barriers to supplier innovation push, and the exploration and proposal of solutions, i.e. recommendations on appropriate processes, tools and organisational structures.

4.2 Research design: exploration through a multiple case study within rolling stock commodities, complemented by insights from the whole corporation

While the theory-based business problem solving approach is applied to solve the actual business problem and come up with a thorough solution for the company, it is also to be considered what research design promises the most valuable empirical insights for solving the problem and answering the research questions.

As stated in the introduction, supplier innovation push is a relatively new subject of study,³⁰⁹ and the stated problem is unstructured and not well understood by the company.³¹⁰ Thus, an exploratory, theory-building research design seems to be appropriate – although some theoretical propositions have already been developed above.

Starting from the research question, Yin recommends case study research if ‘why’ and ‘how’ questions are concerned³¹¹ – which indeed applies to the central research question. Furthermore, the process of supplier innovation push involves diverse professionals from both buyer and supplier side. It is thus difficult to study the phenomenon in depth if it is isolated from its real-life context (the buyer-supplier-relation).³¹² Therefore, and as supplier innovation push is a contemporary process or event that can hardly be controlled by the investigator, case study rather than experiment or history research appears to be useful.³¹³ When discussing the specific design of the case study, special attention needs to be paid to what the case actually is:³¹⁴ What is the unit of analysis, and what is the context that it is based in? The answer to the first part of the question is quite obvious. This re-

³⁰⁹ See Eisenhardt, 1989, p. 548; Babbie, 2010, p. 92.

³¹⁰ See Ghauri & Grønhaug, 2005, p. 58; Blumberg et al., 2011, p. 256.

³¹¹ See Yin, 2009, p. 10.

³¹² See Ghauri & Grønhaug, 2005, p. 114; Eisenhardt & Graebner, 2007, p. 25.

³¹³ See Yin, 2009, p. 13.

³¹⁴ See Yin, 2009, pp. 29–30.

search is interested in what may hamper the process of supplier innovation push and aims at identifying means to enable it. Thus, this very process is the unit of analysis. The choice of context is, however, more ambiguous. For example, the process of supplier innovation push could have been considered from a global point of view, i.e. in the context of BT as a whole. This would then have led to a single case study with the entire corporation as context for the analysis. However, as described above, Bombardier is a highly complex company. Moreover, the literature review indicates that the supplier innovation process may also be contingent on commodity and relationship characteristics. Therefore, this research is designed as a multiple case study, with the particular buyer-supplier-relation as varying context for the analysis – an approach that similarly has been applied by other researchers in the field.³¹⁵ Thus, rather than considering BT as one typical case, several cases with slightly different contexts are investigated, in order to reveal critical differences between cases.³¹⁶ While this approach increases robustness and reliability of the findings for Bombardier Transportation, it does not improve the comparably low external validity of the study, i.e. the findings' transferability to other company contexts.³¹⁷

Concerning the selection of cases, theoretical sampling or, as Yin calls it, theoretical replication is recommended.³¹⁸ This means that 'cases are selected because they are particularly suitable for illuminating and extending relationships and logic among constructs'.³¹⁹ This requirement was satisfied to a large extent, as suitable cases (e.g. given by awareness of past innovation activities) were identified in preliminary talks with professionals from procurement, engineering and innovation management. However, as supplier relationships are highly sensitive, Lead Buyers were not keen to involve every supplier in the study. This restricted selection may have introduced a certain sampling bias.³²⁰ It can be expected that all suppliers that were contacted have maintained a good relationship to Bombardier. In the end, nine suppliers were asked to participate in the research, eight of which accepted to be part of the analysis. By default, one supplier was analysed as one case. Two suppliers, however, were subsumed under one case (CountingCo), because they both supply passenger counting devices and thus have the same contacts at BT side. Therefore, the final sample consisted of seven rather than eight cases for analysis.

³¹⁵ See van Echtelt et al., 2008, p. 185.

³¹⁶ See P. Baxter & Jack, 2008, p. 550.

³¹⁷ See Yin, 2009, p. 43.

³¹⁸ See Eisenhardt & Graebner, 2007, p. 27; Yin, 2009, pp. 54–55.

³¹⁹ Eisenhardt & Graebner, 2007, p. 27.

³²⁰ See Quinlan, 2011, p. 298.

The presentation of the case study is divided into two parts: the within-case analysis, and the cross-case analysis. While the goal of the former is to ‘become intimately familiar with each case as a stand-alone entity’,³²¹ the latter serves to generalise patterns across cases.³²² Thus, in a first step, every case is briefly described individually in order to create an understanding for the case characteristics and to synthesise different perspectives into one comprehensive narrative. The within-case analysis also reveals that some cases yield much more insights than others. Subsequently, all seven cases are analysed and compared according to dimensions that derive from both the theoretical constructs identified in the literature review and the topics that emerged during data collection. Finally, to close the research cycle, the insights from the case study are again related to the preliminary findings proposed in section 2.5.

4.3 Analysis of qualitative data collected mainly via semi-structured interviews

Although case study research may as well rely on quantitative data,³²³ it is more common to use qualitative data collection methods.³²⁴ For explorative research in particular the latter are highly useful, as they allow respondents to answer according to their own thinking – they are not restricted by being provided with only a few predefined answers.³²⁵ Moreover, the interviewer can ask for further elaboration of issues that appear to be interesting. Thus, data collection did not rely on a quantitative survey or structured interviews, but on semi-structured, qualitative interviews.³²⁶

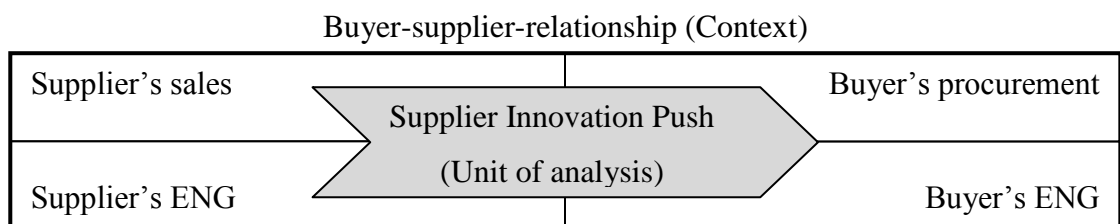


Figure 10: Buyer-supplier-relationship as context of supplier innovation push (own elaboration)

Above it was described that the supplier innovation push process (unit of analysis) takes place within the context of a buyer-supplier-relationship (see Figure 10). This relationship usually involves salespeople and engineers from the supplier, and procurement and engineering staff from the buying firm. As these people cover both the commercial and the

³²¹ Eisenhardt, 1989, p. 540.

³²² For the following description see Eisenhardt, 1989, pp. 540–541.

³²³ See Eisenhardt, 1989, p. 534; Yin, 2009, pp. 132–133.

³²⁴ See Eisenhardt & Graebner, 2007, p. 28.

³²⁵ See Ghauri & Grønhaug, 2005, p. 133.

³²⁶ See Blumberg et al., 2011, p. 265.

technical aspects of supplier innovation, it was expected that triangulating their different perspectives would lead to a holistic picture of the phenomenon.

For all cases at least the Bombardier Lead Buyer and Lead Engineer were interviewed. In some cases, however, Lead Engineers pointed to other engineers that were more deeply involved in the respective topic, who were then also asked to participate in the study. Suppliers were contacted either via e-mail or via phone. They were introduced to the topic of the research project and asked whether staff from both sales and engineering or R&D would be available for an interview. However, some suppliers responded that both perspectives could be covered by one and the same person, usually the key account manager. The interviews were done face-to-face or via phone, and lasted up to two hours. To increase validity in data collection³²⁷, interviews were recorded if permitted. However, to save time, the interviews were not transcribed completely.³²⁸ The interviewees that did not agree on recording were provided with an interview summary, which they were asked to approve.³²⁹ General background information about the involved suppliers was retrieved from their company websites (see p. A5). Follow-up calls and e-mails were used to clarify doubts and complete missing information, which is a common approach in case study research.³³⁰

Although Babbie states that ‘a qualitative interview is essentially a conversation in which the interviewer establishes a general direction for the conversation and pursues specific topics raised by the respondent’,³³¹ interview guidelines were used to ensure that certain issues were covered in all interviews (see p. A45). Yet, the interview design was flexible and iterative, that means questions not only built on the literature review (‘departure from theory’,³³²), but also on insights gained from previous interviews.

All interviews started with a general introduction, including the clarification of definitions to establish a shared understanding and ensure content validity.³³³ The interviewees were then asked about their prior experience with regard to (supplier) innovation and requested to explain how they had witnessed the process. If interviewees did not bring up the topic that was expected on grounds of theory and previous interviews, the interviewer would point interviewees towards the specific issue. Finally, the interviewees were asked what

³²⁷ See Quinlan, 2011, p. 305.

³²⁸ See Blumberg et al., 2011, p. 268.

³²⁹ See Ghauri & Grønhaug, 2005, p. 140.

³³⁰ See Luzzini & Ronchi, 2011, p. 17; Yam, Lo, Tang, & Lau, 2011, p. 396.

³³¹ Babbie, 2010, p. 320.

³³² Ghauri & Grønhaug, 2005, p. 213.

³³³ See Babbie, 2010, p. 155.

they thought would be a good solution, and whether they would be willing to share some of their experience they had made with other customers (applies to suppliers only).

Case studies both allow and require the use of multiple sources of evidence.³³⁴ Therefore, the primary means of data collection (semi-structured interviews) was augmented by company documents. [REDACTED]

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[REDACTED] This combination of data sources allowed for data triangulation,³³⁵ which in turn helped to increase construct validity.³³⁶

The qualitative data collected from interviews, observations and company documents was analysed following the ‘simple, yet valid and useful approach’ suggested by Quinlan.³³⁷

While going through the empirical evidence (listening and reading), the researcher created a list of all the themes that occurred in the data. This list was then continuously extended and condensed until no new themes emerged. The themes derived from this analysis are reflected in the four sections that the cross-case analysis is divided into. To allow the reader to roughly reconstruct the researcher’s interpretation of the data, illustrative quotes (or key insights, respectively) from the interviews are included in the annexure (see p. A8), where also the interview guidelines (see p. A45) as well as photographs of the flipcharts from the workshop (see p. A52) are available. This provision of at least parts of the case study database eventually increases the reliability of the present research.³³⁸

While for the within-case analysis it is obvious where the used information comes from, namely the respondents and documents related to the case, references to the respective case are provided in footnotes for the cross-case analysis; moreover, the relevant interviews are indicated in brackets.

³³⁴ See Eisenhardt & Graebner, 2007, p. 28; Yin, 2009, p. 114; Blumberg et al., 2011, p. 258.

³³⁵ See Jick, 1979, p. 602; Eisenhardt, 1989, p. 538; Yin, 2009, p. 116.

³³⁶ See Yin, 2009, p. 41.

³³⁷ For the following description see Quinlan, 2011, p. 363.

³³⁸ See Yin, 2009, p. 45.

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5.2 Cross-case analysis: understanding innovation in the buyer-supplier-dyad

5.2.1 Suppliers' innovation activities: contingent on strategy, industry affinity and impact on the buyer's product

All suppliers that were part of the analysis employed a dedicated R&D department. Yet, the actual missions of these units seem to differ significantly. [REDACTED], on the one hand, described their R&D engineers as 'crazy innovators' and mentioned a spin-off that was set up to enter a new market,³³⁹ indicating a strategy of future value production. On the other hand, [REDACTED] as one example stated that they improve the product base,³⁴⁰ which rather refers to a core or value-added strategy of value production. These differences between suppliers, however, may not only depend on their different strategies, but also on the extent to what they are affiliated with only one industry, i.e. whether they are a dedicated railway supplier or not. While ElconCo develops new products according to general market requirements and tries to sell them to diverse industries, DoorCo, TrainconCo, or BrakesCo offer systems specifically developed for the railway industry. WeldingCo, Alpha and Beta, in contrast, strongly rely on cross-industry innovations, i.e. adapting solutions from other industries (often automotive) to their use in railway applications.³⁴¹ Yet, except for [REDACTED] architectural [REDACTED] concept, most innovations pushed from suppliers appear to be incremental and modular, i.e. to be limited

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

5.2.4 Innovation driven by project and end customer requirements

If a supplier innovation found its way to the right people within Bombardier, it still needs to be sold to the end customer. In this regard, all interviewees stated that operators usually want to avoid new technologies, and rather require proven design and reliable solutions,³⁷⁴ as illustrated in the case of ElconCo.³⁷⁵ Therefore, in the railway industry, innovation is ‘only possible in small doses’.³⁷⁶ Moreover, innovation often leads to an overfulfilment of the customer requirements specifications.³⁷⁷ Thus, while creating higher cost and risk for both Bombardier and the supplier, the unsolicited application of innovative solutions in a project is not necessarily valued by the end customer. There is hence no immediate motivation for project managers to decide in favour of innovation. In contrast, if the end customer is ready and willing to opt for innovative solutions, ‘a lot is possible’.³⁷⁸ For instance, [REDACTED] has developed a new [REDACTED] specifically to the requirements of a project for [REDACTED]. The important role of the end customer is best explained from an engineering point of view. It is almost impossible to simulate all conditions that may appear during operation, i.e. it is very difficult to make sure in the laboratory that certain parts and systems of a train will withstand 30 years in service.³⁷⁹ Therefore, vehicle builders and suppliers are dependent on the end customer’s willingness to collaboratively test the innovation in the field and provide feedback from operation.³⁸⁰ However, innovation is by definition not a proven solution. To break this vicious cycle, operators may either be inherently committed to innovation or need to be rewarded to take the innovation risk.³⁸¹

[REDACTED]

5.3 Contrasting theory and empirical insights: varying accordance

To ground the empirical insights in theory, the findings from the case study are linked to the direct and indirect barriers identified in chapter 2.5 (see Table 7).

Table has been removed due to confidentiality reasons.

Table 7: Contrasting preliminary theoretical findings and empirical insights (own elaboration)

6 Using theoretical concepts to solve the real-life problem: not all issues covered by prior research

6.1 Main barriers: rooted in innovation uncertainty, strong project-focus and end customer dependence?

The goal of the case study was to validate the theoretical findings, i.e. to check whether the barriers that have been identified based on prior literature are actually relevant in practice. In order to better understand what precisely hampers supplier innovation push at Bombardier Transportation, the analysis goes one step further and looks at the barriers' underlying causes. Moreover, to show what their business consequences are, it is explained how these barriers manifest themselves. The findings are summarised in Figure 11.

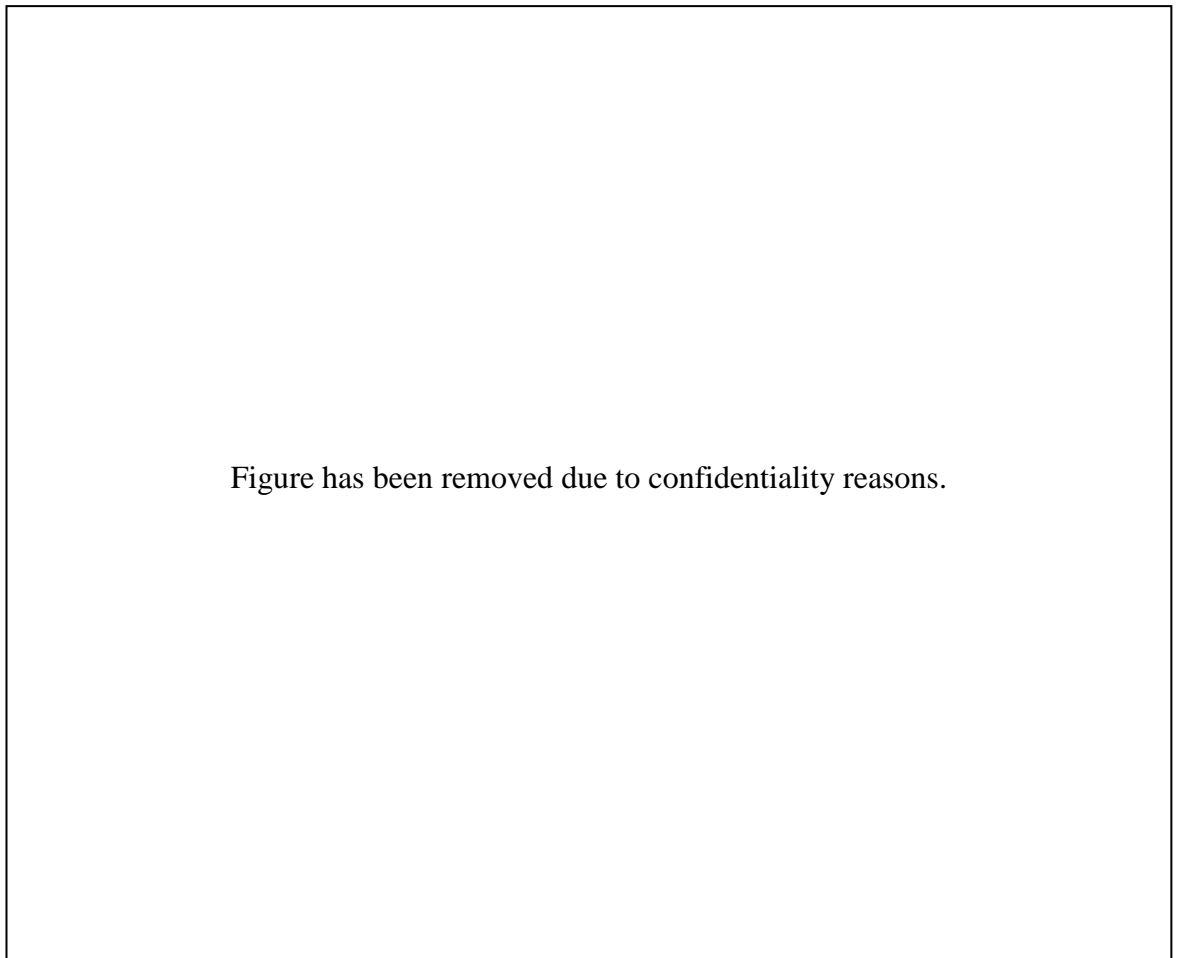
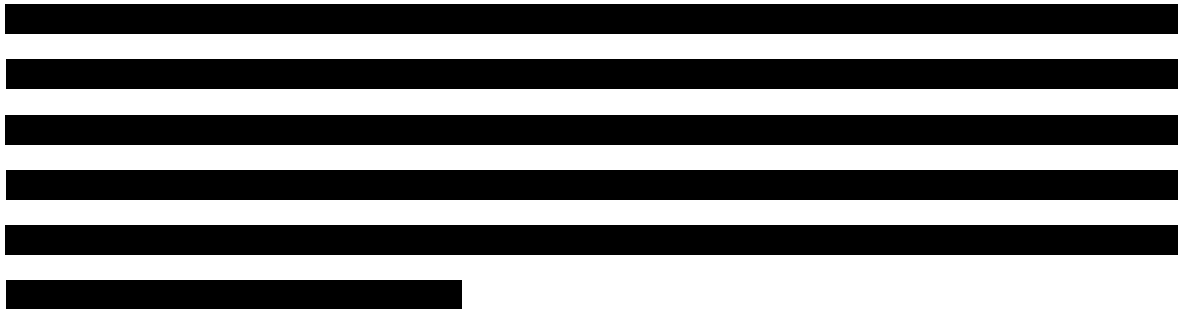


Figure 11: Barriers to supplier innovation push at Bombardier Transportation (own elaboration)





6.2 Developing an intermediate model for Bombardier: introduce advanced sourcing, actively use fairs to seize innovation and establish a test train

Based on literature and case study insights, the supplier innovation push process (see Figure 12) can be broken down into four generic steps that are to be taken by the buying firm: motivating and guiding, seizing, evaluating, and integrating supplier innovation. It seems that, at least in a project-driven business context, these four core tasks need to be supported by a constant follow-up of the process. As innovation is highly dependent on the willingness of end customers, it may also be helpful to canvass them already in parallel. As an outcome of the process, the supplier innovation is ready to be offered in a bid, and can thus find its way into the buyer’s business.

To enable supplier innovation push, the six process steps need to be designed in a way that they help to mitigate the barriers identified in the previous chapter.

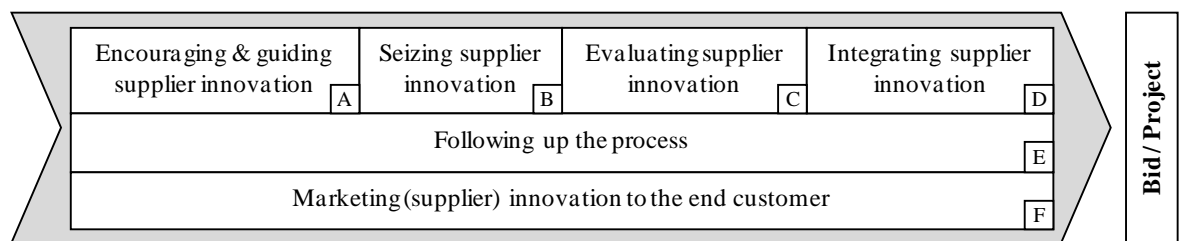
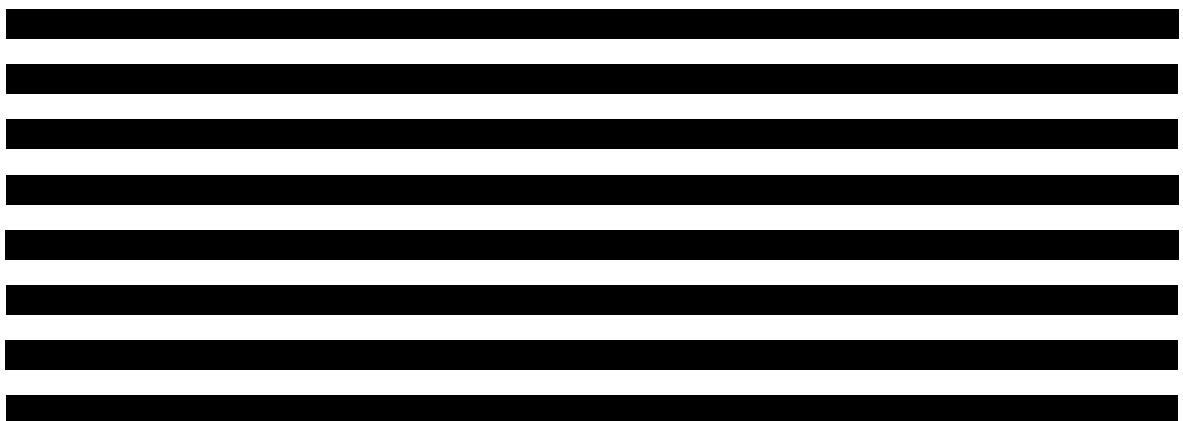


Figure 12: The supplier innovation push process (own elaboration)



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6.3 Final model: taking restrictions and feedback from practice into account

The model proposed in the previous chapter takes a ‘think big’ approach and sketches an ideal situation without accounting for the required efforts and investments. That is why this intermediate solution has been presented to professionals from both procurement and innovation management. By critically assessing the applicability of the model in cooperation with the involved professionals, the researcher was able to come up with suggestions that are as relevant for practice as possible.

[REDACTED]

7 Discussion: exploring a complex topic in an innovation-averse environment

7.1 Conclusion: industry and firm specialities impede application of best practices

This thesis began with the question of how Bombardier Transportation can harness innovations pushed from their supply base. After conducting an in-depth case study in this very company, it is arguable whether that is the right question to pose. Rather, the main issue seems to be why suppliers to a project-driven business in a conservative industry should innovate without being explicitly asked to do so. The respective lack of incentive can be traced back directly to the end customer: Most operators require highly reliable, proven solutions, which is, by definition, not the case for innovation. Thus, all BT departments involved in executing customer projects (including procurement and engineering) have hardly any motivation and no mandate to integrate unsolicited supplier innovations. If these circumstances are taken into account, the insights from the eight suppliers involved in the study appear less surprising. Rather than being an ‘innovation powerhouse’, the typical rail equipment provider seems to be an ‘innovation railhead’. Thus, suppliers are mostly working on incremental improvements of existing products, while setting a strong focus on cost and reliability. This finding challenges common assumptions: Rather than an open innovation paradigm, in-house innovation may be the key to success in a slowly developing, conservative industry that provides complex products and systems. Yet, exceptions like [REDACTED] architectural innovation not only prove the rule, but demonstrate that the innovation potential in the railway supply chain cannot be entirely neglected. For supplier innovations to be harnessed by Bombardier, the company in general and procurement in particular need to be open to innovation. Best practices for firms to develop this kind of ‘absorptive capacity’ can be derived from prior literature. Cross-functional integration and collaboration, as well as in-house R&D capability are considered particularly crucial to make (upstream) open innovation a success. In the setting of Bombardier, however, it is not only the strong project focus that makes it difficult to follow this advice; it is also the company’s divisional organisation. With buyers and engineers spread over more than 60 sites it is a challenge to have all innovations pushed from suppliers find their way to the right point within Bombardier. Thus, not seizing innovations *from* suppliers, but seizing and integrating supplier innovation *within* the company is the real trick. While the more structured use of fairs and innovation meetings may still be useful to make seizing innovation more efficient, it seems to be much more important to define clear responsibilities for the follow-up of the process.

Moreover, two strategic alignments are necessary to make supplier innovation push work in the railway context: First, with regard to external effectiveness, sales needs to be involved early in the process, to make sure that innovation meets market requirements and that conservative stakeholders in the railway industry are prepared for ‘the new’. Secondly, relating to internal efficiency, Bombardier’s rolling stock business is advised to strengthen its platform and product management. This would enable suppliers to better calibrate their innovation efforts and, due to standardisation, make innovation pay out eventually.

Finally, besides preventing Bombardier from capitalising on potential preferred customer statuses, a lack of organisation for supplier innovation may even harm the supplier relationship: Starting with high expectations, the supplier may become demotivated if the latter are not fulfilled. In the worst case, the supplier would then turn away in anger and present its innovations first to other customers.

7.2 Lesson for others: integrate cross-functionally, but understand context first

Although this work is focused on Bombardier Transportation and the railway industry accordingly, lessons can also be derived for managers in other companies. Already the literature review in the second chapter pointed to the importance of clearly defined processes and the cross-functional integration of procurement in particular. As shown in the study of Bombardier, companies may indeed struggle to harness innovations pushed from suppliers if these organisational requirements are not put into place. Especially for managers in large and dispersed multinationals, it is difficult to ensure that all proposals reach the right place within the firm, because suppliers may use any and every channel to present their innovations. This requires communication within the buying firm, which could be facilitated by the active use of collaboration tools, like intranet-based software solutions.

The empirical analysis has shown that before actually implementing processes and structures geared to harnessing supplier innovation, managers need to understand the respective business context. Is innovation an explicit goal of the competitive strategy? And is its unsolicited application valued by the end customer? How is the firm’s own R&D function endowed? How is it organised? And who has the ultimate mandate to drive innovation? Only when managers have the answer to these questions, can they appropriately design the supplier innovation process. For that purpose, the conceptual model presented in chapter 6.2 may serve as guidance: While, at the outset of this work, supplier innovation has been described as a rather fuzzy concept, the model developed in this thesis reveals the steps

that need to be taken by the buying firm. Supplier innovation push can only be successful if clear responsibilities and processes are defined for each of the six described tasks.

By confirming the barriers identified in the literature review and taking a closer look on their underlying causes, this thesis makes managers aware of the potential sticking points they might face when implementing supplier innovation ('forewarned is forearmed'). If, for instance, the end customer is highly involved in the design of the product, their early involvement can help to overcome reservations against innovation.

Moreover, the case study has shown that it may be useful to distinguish structures for supplier innovation according to their degree of innovativeness: incremental and modular innovations on the one hand, and architectural and more radical innovations on the other. While the former can usually be easily integrated into the buying firm's offering, the latter may often go beyond the component level and require significant co-development efforts.

Finally, for managers to understand the innovation potential of a certain commodity group, it is useful to analyse their own industry's share in the sales of the supplying industry. If their own company is only a minor demander, innovation is usually driven by other customer industries. In these cases, managers cannot expect suppliers to develop innovations that are ready-to-use for their industry. Instead, the buying firm may profit from inviting suppliers to present ideas and technologies that they think would be suitable for being transferred to the respective industry in collaborative efforts.

7.3 Limitations and theoretical implications: more research needed for supplier innovation in other project-driven settings

The major shortcoming of the present study has been mentioned before – as the analysis is focused on only one company, external validity, that is the extent to which findings can be generalised, is restricted. Moreover, several potential sources of bias need to be acknowledged. Besides the sampling bias discussed in section 4.3, a certain respondent bias among suppliers may result from their concerns about the customer relationship. Bias may also be introduced by the researcher's inexperience with regard to the case study method. However, as the research is exploratory in nature, these methodological flaws seem to be less weighty. The goal of this thesis was to uncover barriers that hamper supplier innovation push, and to explore solution directions in the context of Bombardier. Beyond providing practice-oriented advice, the case study indeed sheds light on issues that have not received extensive attention in prior literature, and points to subjects for further research.

First and foremost, it is to be questioned whether pertinent theory on supplier innovation applies to project-driven companies providing complex products and systems. Most literature refers to companies that offer mass-produced products, including cars, electronics, food, machine tools, medical equipment, printers and toys.³⁸² It could thus be useful to revisit the conceptual work on early supplier involvement from the perspective of firms that think from project to project and have less marked NPD capacities. The Bombardier example indicates that, in these settings, platform strategies and/or parallel customer involvement could contribute to fostering supplier innovation. Further research could examine whether this notion also applies in non-railway contexts.

Secondly, moderating effects can be expected with regard to the individual contributions of different suppliers. Prior literature suggests that breakthrough innovations often arise from cross-industry cooperation with non-suppliers.³⁸³ As shown in the case of Bombardier, this finding can indeed be transferred to existing suppliers: More radical innovations may originate with suppliers that are not solely focused on railway, but supply other industries as well. These insights contradict the proposition of Schiele, who claims that specialised suppliers are more innovative than firms supplying several industries.³⁸⁴ Further research may resolve this conflict, probably by developing a contingency model that again takes the characteristics of the buying firm's business into account – a moderator that has also been suggested by other researchers in the field.³⁸⁵

Thirdly, this thesis may lend support to the concept of suppliers' end-user orientation that has only recently been introduced by Kibbeling and colleagues.³⁸⁶ While in the railway setting the influence of the end customer may be above average, the congruence of research findings demonstrates that the topic deserves further attention.

Finally, researchers could test whether the suggestions derived in this thesis really are recipes for success. While the proposed model is theoretically grounded and takes first-hand empirical insights into account, a link between its implementation and the success of supplier innovation push has not been established yet. Future research could, for instance, compare the performance of supplier innovation in firms that employ an advanced sourcing function with firms that do not. If longitudinal in nature, such a study could demonstrate that proper organisation is indeed an antecedent of successful supplier innovation.

³⁸² See van Echtelt et al., 2008, p. 184; Wagner, 2009, p. 8, 2012, p. 41; Lau et al., 2010, p. 766.

³⁸³ See Gassmann, Zeschky, et al., 2010, p. 649.

³⁸⁴ See Schiele, 2006, p. 929.

³⁸⁵ See Kibbeling et al., 2013, p. 512.

³⁸⁶ See Kibbeling et al., 2013, p. 501.

References

1. **Adachi, M. (2013).** Case Study: China South Locomotive and Rolling Stock Corporation (CSR). *China's Competitiveness: Myth, Reality, and Lessons for the United States and Japan*. Retrieved September 26, 2013, from http://csis.org/files/publication/130129_competitiveness_CSRcasestudy_Web_0.pdf
2. **Adams, R., Bessant, J., & Phelps, R. (2006).** Innovation management measurement: A review. *International Journal of Management Reviews*, 8(1), 21–47.
3. **Van Aken, J. E., Berends, H., & van der Bij, H. (2007).** *Problem Solving in Organizations*. Cambridge: Cambridge University Press.
4. **Anderson, J., & Narus, J. (2004).** *Business Market Management: Understanding, Creating, and Delivering Value*. Englewood Cliffs, NJ: Pearson Prentice Hall.
5. **Arnold, T. J., Fang, E., & Palmatier, R. W. (2010).** The effects of customer acquisition and retention orientations on a firm's radical and incremental innovation performance. *Journal of the Academy of Marketing Science*, 39(2), 234–251.
6. **Atuahene-Gima, K. (1995).** Involving organizational buyers in new product development. *Industrial Marketing Management*, 24(3), 215–226.
7. **Atuahene-Gima, K. (1996).** Market Orientation and Innovation. *Journal of Business Research*, 35(2), 93–103.
8. **Babbie, E. (2010).** *The Practice of Social Research*. Wadsworth: Cengage Learning.
9. **Backhaus, K., & Voeth, M. (2011).** *Industriegütermarketing [Marketing for industrial goods]*. München: Vahlen.
10. **Bahemia, H., & Squire, B. (2010).** A Contingent Perspective of Open Innovation in New Product Development Projects. *International Journal of Innovation Management*, 14(4), 603–627.
11. **Baxter, P., & Jack, S. (2008).** Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers. *The Qualitative Report*, 13(4), 544–559.
12. **Baxter, R. (2012).** How can business buyers attract sellers' resources? *Industrial Marketing Management*, 41(8), 1249–1258.
13. **Bigwood, M. P. (2004).** Managing the new technology exploitation process. *Research-Technology Management*, 47(6), 38–42.
14. **Blumberg, B., Cooper, D. R., & Schindler, P. S. (2011).** *Business Research Methods*. London: McGraw-Hill Education.

15. **Boehme, J. (1986).** *Innovationsförderung durch Kooperation: Zwischenbetriebliche Zusammenarbeit als Instrument des Innovationsmanagements in kleinen und mittleren Unternehmen bei Einführung der Mikroelektronik in Produkte und Verfahren [Fostering innovation by cooperation: inter-company collaboration as means of innovation management in small and medium-sized enterprises when introducing microelectronics in products and processes]*. Berlin: Erich Schmidt Verlag.
16. **Bohlmann, J. D., Spanjol, J., Qualls, W. J., & Rosa, J. A. (2013).** The Interplay of Customer and Product Innovation Dynamics: An Exploratory Study. *Journal of Product Innovation Management*, 30(2), 228–244.
17. **Breckner, C. (2004).** *E-Innovationsmanagement in der Automobilindustrie [E-innovation management in the automotive industry]*. Köln: EUL Verlag.
18. **Brem, A., & Schuster, G. (2012).** Open Innovation and the Integration of Suppliers - Literature Review and Discussion on Supplier Innovation. In A. Brem & J. Tidd (Eds.), *Perspectives on Supplier Innovation: Theories, Concepts and Empirical Insights on Open Innovation and the Integration of Suppliers* (pp. 67–94). London: Imperial College Press.
19. **Castaldi, C., Kate, C. ten, & Braber, R. Den. (2011).** Strategic purchasing and innovation: A relational view. *Technology Analysis & Strategic Management*, 23(9), 983–1000.
20. **Chandy, R. K., & Tellis, G. J. (1998).** Organizing for Radical Product Innovation: The Overlooked Role of Willingness to Cannibalize. *Journal of Marketing Research*, 35(4), 474–487.
21. **Chesbrough, H. (2003).** *Open Innovation - The New Imperative for Creating and Profiting from Technology*. Boston: Harvard Business School Press.
22. **Chesbrough, H. (2006).** Open Innovation: A New Paradigm for Understanding Industrial Innovation. In H. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), *Open Innovation - Research a New Paradigm* (pp. 1–34). New York: Oxford University Press.
23. **Christensen, C. M. (1997).** *The Innovator's Dilemma*. New York: Harvard Business School Press.
24. **Clausen, T. H. (2013).** Innovation cooperation and the role of absorptive capacity: empirical evidence from Norway and Sweden. *Technology Analysis & Strategic Management*, 25(1), 57–70.
25. **Cohen, W. M., & Levinthal, D. A. (1990).** Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128–152.
26. **Cooper, R. G. (1990).** Stage-Gate Systems: A New Tool for Managing New Products. *Business Horizons*, 33(3), 44–54.

27. **Cooper, R. G. (1994).** Third-Generation New Product Processes. *Journal of Product Innovation Management*, 11(1), 3–14.
28. **Cooper, R. G. (2009).** How companies are reinventing their idea-to-launch methodologies. *Research-Technology Management*, 52(2), 47–57.
29. **Cooper, R. G., & Edgett, S. J. (2007).** *Generating Breakthrough New Product Ideas: Feeding the Innovation Funnel*. Canada: Product Development Institute.
30. **Cooper, R. G., & Edgett, S. J. (2008).** Maximizing productivity in product innovation. *Research-Technology Management*, 51(2), 47–58.
31. **Cooper, R. G., & Edgett, S. J. (2012).** Best Practices in the Idea-to-Launch Process and Its Governance. *Research-Technology Management*, 55(2), 43–54.
32. **Corsten, D., & Felde, J. (2005).** Exploring the performance effects of key-supplier collaboration: An empirical investigation into Swiss buyer-supplier relationships. *International Journal of Physical Distribution & Logistics Management*, 35(6), 445–461.
33. **Le Dain, M.-A., Calvi, R., & Cheriti, S. (2011).** Measuring supplier performance in collaborative design: proposition of a framework. *R&D Management*, 41(1), 61–79.
34. **Darr, A. (2002).** The Technicization of Sales Work: an Ethnographic Study in the US Electronics Industry. *Work, Employment & Society*, 16(1), 47–65.
35. **Davies, A., & Hobday, M. (2005).** *The Business of Projects: Managing Innovation in Complex Products and Systems*. Cambridge: Cambridge University Press.
36. **Deshpandé, R., & Farley, J. U. (1998).** Measuring Market Orientation: Generalization and Synthesis. *Journal of Market Focused Management*, 2(3), 213–232.
37. **Dowlatshahi, S. (1997).** The role of product design in designer-buyer-supplier interface. *Production Planning & Control*, 8(6), 522–532.
38. **Dowlatshahi, S. (1998).** Implementing early supplier involvement: a conceptual framework. *International Journal of Operations & Production Management*, 18(2), 143–167.
39. **Van Echtelt, F. E., Wynstra, F., van Weele, A. J., & Duysters, G. (2008).** Managing Supplier Involvement in New Product Development: A Multiple-Case Study. *Journal of Product Innovation Management*, 25(2), 180–201.
40. **Eckles, R. W. (1990).** *Business Marketing Management, Marketing of Business Products and Services*. Englewood Cliffs, NJ: Prentice-Hall.
41. **Eisenhardt, K. (1989).** Building Theories from Case Study Research. *The Academy of Management Review*, 14(4), 532–550.

42. Eisenhardt, K., & Graebner, M. E. (2007). Theory Building From Cases: Opportunities and Challenges. *Academy of Management Journal*, 50(1), 25–32.
43. Ellis, S. C., Henke, J. W., & Kull, T. J. (2012). The effect of buyer behaviors on preferred customer status and access to supplier technological innovation: An empirical study of supplier perceptions. *Industrial Marketing Management*, 41(8), 1259–1269.
44. Engelhardt, W. H., & Günter, B. (1981). *Investitionsgütermarketing [Marketing for investment goods]*. Stuttgart: Kohlhammer.
45. ERCI (2013). Join forces for a stronger European railway. Retrieved August 8, 2013, from www.eurailclusters.com
46. Ettl, J. E., Bridges, W. P., & Keefe, R. D. O. (1984). Organization strategy and structural differences for radical versus incremental innovation. *Management Science*, 30(6), 682–695.
47. European Commission (2008). *Science, technology and innovation in Europe: 2008 edition*. Luxembourg: Office for Official Publications of the European Communities,.
48. Fliess, S., & Becker, U. (2006). Supplier integration—Controlling of co-development processes. *Industrial Marketing Management*, 35(1), 28–44.
49. Ford, S. J., Mortara, L., & Probert, D. R. (2012). Disentangling the Complexity of Early-Stage Technology Acquisitions. *Research-Technology Management*, 55(3), 40–48.
50. Gassmann, O. (2003). Lieferanten als Innovationsquelle in F&E [Suppliers as source of innovation in R&D]. In R. Boutellier, S. M. Wagner, & H. P. Wehrli (Eds.), *Handbuch Beschaffung* (pp. 631–646). München: Hanser.
51. Gassmann, O., Enkel, E., & Chesbrough, H. (2010). The future of open innovation. *R&D Management*, 40(3), 213–221.
52. Gassmann, O., Zeschky, M., Wolff, T., & Stahl, M. (2010). Crossing the Industry-Line: Breakthrough Innovation through Cross-Industry Alliances with “Non-Suppliers.” *Long Range Planning*, 43(5-6), 639–654.
53. Ghauri, P., & Grønhaug, K. (2005). *Research Methods in Business Studies: A Practical Guide*. Harlow: FT Prentice Hall.
54. Gianiodis, P. T., Ellis, S. C., & Secchi, E. (2010). Advancing a Typology of Open Innovation. *International Journal of Innovation Management*, 14(4), 531–572.
55. Gobeli, D. H., & Brown, D. J. (1987). Analyzing Product Innovations. *Research Management*, 30(4), 25–31.

56. **Goffre, J., Plaizier, W., & Schade, J. (2005).** Scaling new heights. What separates the leaders from the followers in procurement today? A major benchmarking study offers some answers. *CPO Agenda*, 1(1), 54–58.
57. **Golfetto, F. (2003).** Communicating competence. An experimental communication approach for business markets. *Web proceedings of the 19th annual IMP Conference*. Lugano.
58. **Golfetto, F., & Gibbert, M. (2006).** Marketing competencies and the sources of customer value in business markets. *Industrial Marketing Management*, 35(8), 904–912.
59. **Groher, E. (2003).** *Gestaltung der Integration von Lieferanten in den Produktentstehungsprozess [Design of the integration of suppliers in the product engineering process]*. München: TCW Transfer-Centrum GmbH & Co. KG.
60. **Grönlund, J., Sjödin, D. R., & Frishammar, J. (2010).** Open Innovation and the Stage-Gate Process: A Revisited Model for New Product Development. *California Management Review*, 52(3), 106–132.
61. **Guenzi, P., & Troilo, G. (2006).** Developing marketing capabilities for customer value creation through Marketing – Sales integration. *Industrial Marketing Management*, 35(8), 974–988.
62. **Guesalaga, R., & Johnston, W. (2010).** What’s next in key account management research? Building the bridge between the academic literature and the practitioners' priorities. *Industrial Marketing Management*, 39(7), 1063–1068.
63. **Hagi, A., & Jullien, B. (2011).** Why do intermediaries divert search? *The RAND Journal of Economics*, 42(2), 337–362.
64. **Hakansson, H., & Eriksson, A. K. (1993).** Getting Innovations Out of the Supplier Networks. *Journal of Business-to-Business Marketing*, 1(3), 3–34.
65. **Handfield, R. B., Ragatz, G., Petersen, K. J., & Monczka, R. M. (1999).** Involving suppliers in new product development. *California Management Review*, 42(1), 59–82.
66. **Henderson, R., & Clark, K. (1990).** Architectural innovation: the reconfiguration of existing product technologies and the failure of established firms. *Administrative Science Quarterly*, 35(1), 9–30.
67. **Henke, J. W., & Zhang, C. (2010).** Increasing Supplier-Driven Innovation. *MIT Sloan Management Review*, 51(2), 41–46.
68. **Hoegl, M., & Gemuenden, H. (2001).** Teamwork quality and the success of innovative projects: A theoretical concept and empirical evidence. *Organization Science*, 12(4), 435–449.
69. **Hoegl, M., & Wagner, S. M. (2005).** Buyer-Supplier Collaboration in Product Development Projects. *Journal of Management*, 31(4), 530–548.

- 70. Huizingh, E. K. R. E. (2011).** Open innovation: State of the art and future perspectives. *Technovation*, 31(1), 2–9.
- 71. Hutt, M. D., Johnston, W. J., & Ronchetto, J. R. (1985).** Selling centers and buying centers: formulating strategic exchange patterns. *Journal of Personal Selling & Sales Management*, 5(1), 32–40.
- 72. Jick, T. D. (1979).** Mixing Qualitative and Quantitative Methods: Triangulation in Action. *Administrative Science Quarterly*, 24(4), 602–611.
- 73. Kauppila, O.-P., Rajala, R., & Jyrämä, A. (2010).** Antecedents of salespeople's reluctance to sell radically new products. *Industrial Marketing Management*, 39(2), 308–316.
- 74. Kibbeling, M., van der Bij, H., & van Weele, A. (2013).** Market Orientation and Innovativeness in Supply Chains: Supplier's Impact on Customer Satisfaction. *Journal of Product Innovation Management*, 30(3), 500–515.
- 75. Kirca, A. H., Jayachandran, S., & Bearden, W. O. (2005).** Market Orientation: A Meta-Analytic Review and Assessment of Its Antecedents and Impact on Performance. *Journal of Marketing*, 69(2), 24–41.
- 76. Knudsen, M. P., & Mortensen, T. B. (2011).** Some immediate – but negative – effects of openness on product development performance. *Technovation*, 31(1), 54–64.
- 77. Koen, P., Ajamian, G., Burkart, R., Clamen, A., Davidson, J., D'Amore, R., Elkins, C., et al. (2001).** Providing clarity and a common language to the “fuzzy front end.” *Research-Technology Management*, 44(2), 46–55.
- 78. Kopecka, J. A., Santema, S. C., & Hultink, E. J. (2012).** Supplier's Sales Engineer as a Knowledge Worker. *21st Annual IPSERA Conference. Purchasing & Supply Management in a Changing World*. Naples.
- 79. Koufteros, X. a., Vonderembse, M. a., & Doll, W. J. (2002).** Integrated product development practices and competitive capabilities: the effects of uncertainty, equivocality, and platform strategy. *Journal of Operations Management*, 20(4), 331–355.
- 80. Laseter, T. M., & Ramdas, K. (2002).** Product types and supplier roles in product development: an exploratory analysis. *IEEE Transactions on Engineering Management*, 49(2), 107–118.
- 81. Lau, A. K. W., Tang, E., & Yam, R. C. M. (2010).** Effects of Supplier and Customer Integration on Product Innovation and Performance: Empirical Evidence in Hong Kong Manufacturers. *Journal of Product Innovation Management*, 27(5), 761–777.
- 82. Laursen, K., & Salter, A. (2006).** Open for innovation: the role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal*, 27(2), 131–150.

- 83. Lawson, B., Petersen, K. J., Cousins, P. D., & Handfield, R. B. (2009).** Knowledge Sharing in Interorganizational Product Development Teams: The Effect of Formal and Informal Socialization Mechanisms. *Journal of Product Innovation Management*, 26(2), 156–172.
- 84. Lee, J., & Veloso, F. M. (2008).** Interfirm Innovation under Uncertainty: Empirical Evidence for Strategic Knowledge Partitioning. *Journal of Product Innovation Management*, 25(5), 418–435.
- 85. Leiponen, A., & Helfat, C. E. (2010).** Innovation objectives, knowledge sources, and the benefits of breadth. *Strategic Management Journal*, 31(2), 224–236.
- 86. Lindgreen, A., Hingley, M. K., Grant, D. B., & Morgan, R. E. (2012).** Value in business and industrial marketing: Past, present, and future. *Industrial Marketing Management*, 41(1), 207–214.
- 87. Linton, J. D. (2002).** Forecasting the market diffusion of disruptive and discontinuous innovation. *IEEE Transactions on Engineering Management*, 49(4), 365–374.
- 88. Luzzini, D., & Ronchi, S. (2011).** Organizing the purchasing department for innovation. *Operations Management Research*, 4(1-2), 14–27.
- 89. MacDonald, L. (2013).** *The Bombardier story: from snowmobiles to global transportation powerhouse*. Mississauga: Wiley.
- 90. Markman, G. D., Gianiodis, P. T., & Phan, P. H. (2009).** Supply-Side Innovation and Technology Commercialization. *Journal of Management Studies*, 46(4), 625–649.
- 91. Matthyssens, P., & Faes, W. (1985).** OEM buying process for new components: purchasing and marketing implications. *Industrial Marketing Management*, 14(3), 145–157.
- 92. McGinnis, M. A., & Vallopra, R. M. (1999).** Purchasing and Supplier Involvement: Issues and Insights Regarding New Product Success. *Journal of Supply Chain Management*, 35(3), 4–15.
- 93. McIvor, R., Humphreys, P., & Cadden, T. (2006).** Supplier involvement in product development in the electronics industry: A case study. *Journal of Engineering and Technology Management*, 23(4), 374–397.
- 94. Melander, L., & Lakemond, N. (2012).** Sourcing technology from suppliers in new product development – Purchasing’s role as a trouble shooter. *21st Annual IPSERA Conference. Purchasing & Supply Management in a Changing World*. Naples.
- 95. Meyer, M. H., Marion, T. J., & Crane, F. G. (2010).** Selling innovation to the c-suite. *Research-Technology Management*, 53(4), 15–20.
- 96. Moenaert, R. K., De Meyer, a., Souder, W. E., & Deschoolmeester, D. (1995).** R&D/marketing communication during the fuzzy front-end. *IEEE Transactions on Engineering Management*, 42(3), 243–258.

97. Möller, K. (2006). Role of competences in creating customer value: A value-creation logic approach. *Industrial Marketing Management*, 35(8), 913–924.
98. Monczka, R. M., Carter, P. L., Scannell, T. V., & Carter, J. R. (2010). *Implementing Supplier Innovation: Case Study Findings*. Tempe: CAPS Research.
99. Monczka, R. M., Carter, P. L., Scannell, T. V., & Carter, J. R. (2011). *Innovation Sourcing: Contributing to Company Competitiveness*. Tempe: CAPS Research.
100. Monczka, R. M., Handfield, R. B., Giunipero, L., Patterson, J., & Waters, D. (2010). *Purchasing and Supply Chain Management*. Andover (Hampshire): Cengage Learning EMEA.
101. Moon, M. A., & Gupta, S. F. (1997). Examining the Formation of Selling Centers: A Conceptual Framework. *Journal of Personal Selling & Sales Management*, 17(2), 31–41.
102. Mowery, D., & Rosenberg, N. (1979). The influence of market demand upon innovation: a critical review of some recent empirical studies. *Research Policy*, 8(2), 102–153.
103. O’Cass, A., & Ngo, L. V. (2012). Creating superior customer value for B2B firms through supplier firm capabilities. *Industrial Marketing Management*, 41(1), 125–135.
104. O’Connor, P. (1994). Implementing a Stage-Gate Process: A Multi-Company Perspective. *Journal of Product Innovation Management*, 11(3), 183–200.
105. OECD, & Eurostat (2005). *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*. Paris: OECD Publications.
106. Osterwalder, A., & Pigneur, Y. (2010). *Business Model Generation*. Hoboken: Wiley.
107. Palmberg, C. (2004). The sources of innovations – looking beyond technological opportunities. *Economics of Innovation and New Technology*, 13(2), 37–41.
108. Petersen, K. J., Handfield, R. B., & Ragatz, G. L. (2003). A Model of Supplier Integration into New Product Development. *Journal of Product Innovation Management*, 20(4), 284–299.
109. Porter, M. E. (1990). The Competitive Advantage of Nations. *Harvard Business Review*, March-April, 73–91.
110. Quinlan, C. (2011). *Business Research Methods*. Andover (Hampshire): Cengage Learning EMEA.
111. Ragatz, G. G. L., Handfield, R. B., & Scannell, T. V. (1997). Success factors for integrating suppliers into new product development. *Journal of Product Innovation Management*, 14(3), 190–202.

- 112. Reed, F. M., & Walsh, K. (2002).** Enhancing Technological Capability Through Supplier Development: A Study of the U.K. Aerospace Industry. *IEEE Transactions on Engineering Management*, 49(3), 231–242.
- 113. Rink, C., & Wagner, S. M. (2009).** Frischer Wind: So fördert der Einkauf Innovationen [Wind of change: How purchasing fosters innovation]. *Beschaffung Aktuell*, 56(8), 20–22.
- 114. Rogers, S. C. (2008).** Value Focused Relationships: The Key to Accessing Supplier Innovation. *93rd Annual International Supply Management Conference*. Louis.
- 115. Rohrbeck, R., Steinhoff, F., & Perder, F. (2010).** Sourcing innovation from your customer: how multinational enterprises use Web platforms for virtual customer integration. *Technology Analysis & Strategic Management*, 22(2), 117–131.
- 116. Roland Berger Strategy Consultants (2006).** Executive Review. *Engineered Products & High Tech 1/2006*. Retrieved September 26, 2013, from http://www.rolandberger.com/media/pdf/rb_press/RB_Executive_Review_EN_20060130.pdf
- 117. Roland Berger Strategy Consultants (2012).** *UNIFE World Rail Market Study 2012*. Brussels: UNIFE.
- 118. Rosell, D. T., & Lakemond, N. (2012).** Collaborative innovation with suppliers - a conceptual model for characterising supplier contributions to NPD. *International Journal of Technology Intelligence and Planning*, 8(2), 197–214.
- 119. Rothwell, R. (1994).** Towards the Fifth-generation Innovation Process. *International Marketing Review*, 11(1), 7–31.
- 120. Salge, T. O., Bohné, T. M., Farchi, T., & Piening, E. P. (2012).** Harnessing the Value of Open Innovation: the Moderating Role of Innovation Management. *International Journal of Innovation Management*, 16(3), 1240005.
- 121. Salge, T. O., Farchi, T., Barrett, M. I., & Dopson, S. (2013).** When Does Search Openness Really Matter? A Contingency Study of Health-Care Innovation Projects. *Journal of Product Innovation Management*, 30(4), 1–18.
- 122. Schiele, H. (2006).** How to distinguish innovative suppliers? Identifying innovative suppliers as new task for purchasing. *Industrial Marketing Management*, 35(8), 925–935.
- 123. Schiele, H. (2008).** Location, location: the geography of industry clusters. *Journal of Business Strategy*, 29(3), 29–36.
- 124. Schiele, H. (2010a).** *Innovationen von und mit Lieferanten - Ergebnisse einer quantitativen Studie [Innovations from and with suppliers - results of a quantitative study]*. Enschede: BME-Report.

- 125. Schiele, H. (2010b).** Early supplier integration: the dual role of purchasing in new product development. *R&D Management*, 40(2), 138–153.
- 126. Schiele, H. (2012).** Accessing Supplier Innovation By Being Their Preferred Customer. *Research-Technology Management*, 55(1), 44–50.
- 127. Schiele, H., Calvi, R., & Gibbert, M. (2012).** Customer attractiveness, supplier satisfaction and preferred customer status: Introduction, definitions and an overarching framework. *Industrial Marketing Management*, 41(8), 1178–1185.
- 128. Schiele, H., & Haas, C. (2007).** Innovationsquelle Lieferant [The supplier as source of innovation]. *Beschaffung Aktuell*, 38(4), 30–31.
- 129. Schiele, H., Veldman, J., & Hüttinger, L. (2011).** Supplier innovativeness and supplier pricing: the role of preferred customer status. *International Journal of Innovation Management*, 15(1), 1–27.
- 130. Schoenherr, T., Modi, S., Benton, W., Carter, C. R., Choi, T. Y., Larson, P. D., Leenders, M. R., et al. (2012).** Research opportunities in purchasing and supply management. *International Journal of Production Research*, 50(16), 4556–4579.
- 131. Schuh, G., & Hoppe, M. (2012).** The Role of Purchasing in New Product Development - Results of a Consortium Benchmarking Study. In W. Kersten, T. Blecker, & C. Ringle (Eds.), *Managing the Future Supply Chain – Current Concepts and Solutions for Reliability and Robustness* (pp. 257–275). Lohmar: EUL Verlag.
- 132. Schumacher, S. C., Schiele, H., Contzen, M., & Zachau, T. (2008).** *Die 3 Faktoren des Einkaufs: Einkauf und Lieferanten strategisch positionieren [The 3 factors of purchasing: Strategic positioning of purchasing and suppliers]*. Weinheim: Wiley.
- 133. Schumpeter, J. A. (1942).** *Capitalism, Socialism and Democracy*. New York: HarperCollins.
- 134. Schumpeter, J. A. (1971).** The fundamental phenomenon of economic development. In P. Kilby (Ed.), *Entrepreneurship and Economic Development* (pp. 43–70). New York: Free Press.
- 135. Slater, S. F., & Narver, J. C. (1998).** Customer-led and market-oriented: let's not confuse the two. *Strategic Management Journal*, 19(10), 1001–1006.
- 136. Slowinski, G., Hummel, E., Gupta, A., & Gilmont, E. R. (2009).** Effective practices for sourcing innovation. *Research-Technology Management*, 52(1), 27–34.
- 137. Smals, R. G. M., & Smits, A. a. J. (2012).** Value for value—The dynamics of supplier value in collaborative new product development. *Industrial Marketing Management*, 41(1), 156–165.
- 138. Somaya, D., Kim, Y., & Vonortas, N. (2010).** Exclusivity in licensing alliances: using hostages to support technology commercialization. *Strategic Management Journal*, 32(2), 159–186.

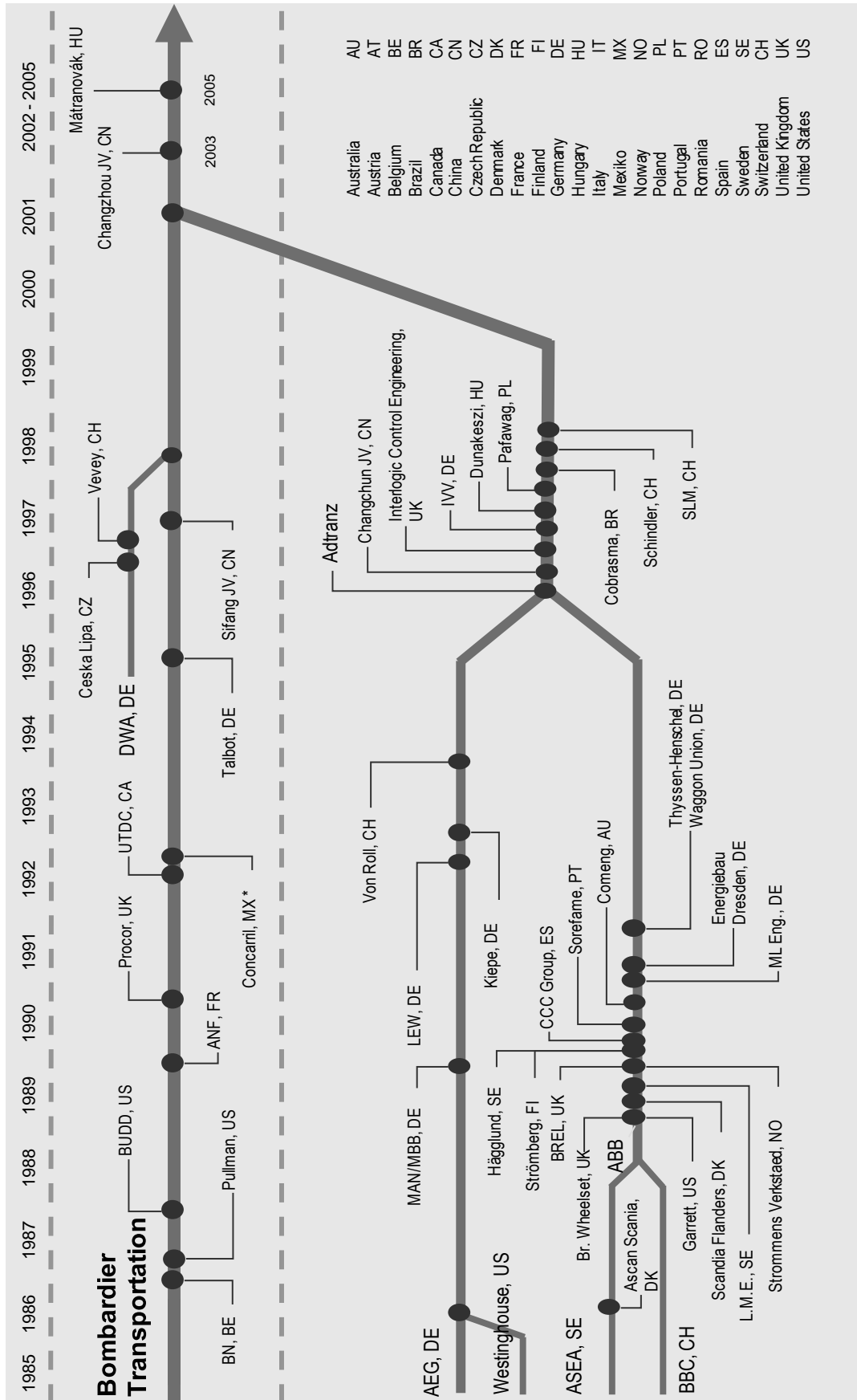
- 139. Spekman, R. E., Spear, J., & Kamauff, J. (2002).** Supply chain competency: learning as a key component. *Supply Chain Management: An International Journal*, 7(1), 41–55.
- 140. Stern, T., & Jaberg, H. (2010).** *Erfolgreiches Innovationsmanagement [Successful innovation management]*. Wiesbaden: Gabler.
- 141. Stones, R. (2001).** UK Innovation Survey 2001. Retrieved May 7, 2013, from <http://www.dti.gov.uk/iese/ecotrends.pdf>
- 142. Terwiesch, C., & Xu, Y. (2008).** Innovation Contests, Open Innovation, and Multiagent Problem Solving. *Management Science*, 54(9), 1529–1543.
- 143. Tidd, J., Bessant, J., & Pavitt, K. (2005).** *Managing Innovation: Integrating Technological, Market and Organizational Change*. Hoboken: John Wiley & Sons.
- 144. UNIFE (2013).** *Annual Report 2012*. Brussels.
- 145. Vázquez, R., Santos, M. L., & Álvarez, L. I. (2001).** Market orientation, innovation and competitive strategies in industrial firms. *Journal of Strategic Marketing*, 9(1), 69–90.
- 146. Völker, R., & Berberich, J. (2007).** Kategorisierung von F&E-Projekten und deren Bewertung [Categorisation of R&D projects and their evaluation]. *Kompetenzzentrum Innovation und Marktorientierte Unternehmensführung*, 20, 1–16.
- 147. Wagner, S. M. (2009).** Getting innovation from suppliers. *Research-Technology Management*, 52(1), 8–9.
- 148. Wagner, S. M. (2012).** Tapping Supplier Innovation. *Journal of Supply Chain Management*, 48(2), 37–52.
- 149. Wang, Q., Bradford, K., Xu, J., & Weitz, B. (2008).** Creativity in buyer-seller relationships: The role of governance. *International Journal of Research in Marketing*, 25(2), 109–118.
- 150. West, J., & Bogers, M. (2013).** Leveraging External Sources of Innovation: A Review of Research on Open Innovation. *Journal of Product Innovation Management*, 30(forthcoming), 1–52.
- 151. Wiktionary (2012).** innovatio. Retrieved April 11, 2013, from <http://en.wiktionary.org/wiki/innovatio#Latin>
- 152. Winter, S., & Lasch, R. (2011).** Management of Supplier Innovation: A Framework for Accessing and Realizing Innovation from Suppliers. In E. Sucky, B. Asdecker, A. Dobhan, S. Haas, & J. Wiese (Eds.), *Logistikmanagement - Herausforderungen, Chancen & Lösungen* (pp. 85–104). Bamberg: University of Bamberg Press.

153. **Winter, S., & Lasch, R. (2012).** Supplier Innovation Evaluation: Derivation of Requirements for an Assessment. In Wolfgang Kersten, T. Blecker, & C. M. Ringle (Eds.), *Managing the Future Supply Chain* (pp. 235–256). Lohmar: EUL Verlag.
154. **Wynstra, F., von Corswant, F., & Wetzels, M. (2010).** In Chains? An Empirical Study of Antecedents of Supplier Product Development Activity in the Automotive Industry. *Journal of Product Innovation Management*, 27(5), 625–639.
155. **Wynstra, F., & Hurkens, K. (2005).** Total Cost and Total Value of Ownership. In M. Eßig (Ed.), *Perspektiven des Supply Management* (pp. 463–482). Berlin: Springer.
156. **Wynstra, F., Weggeman, M., & van Weele, A. (2003).** Exploring purchasing integration in product development. *Industrial Marketing Management*, 32(1), 69–83.
157. **Yam, R. C. M., Lo, W., Tang, E. P. Y., & Lau, A. K. W. (2011).** Analysis of sources of innovation, technological innovation capabilities, and performance: An empirical study of Hong Kong manufacturing industries. *Research Policy*, 40(3), 391–402.
158. **Yin, R. K. (2009).** *Case study research: design and methods* (4th ed.). Thousand Oaks: SAGE Publications, Inc.
159. **Zbaracki, M., Ritson, M., Levy, D., Dutta, S., & Bergen, M. (2004).** Managerial and customer costs of price adjustment: Direct evidence from industrial markets. *Review of Economics and Statistics*, 86(2), 514–533.

Annexure 1: List of referenced informal conversations

	<u>Date</u>	<u>Contact</u>	<u>Function</u>
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]		[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]		
[REDACTED]			
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[REDACTED]		[REDACTED]	[REDACTED]
			[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]		[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]		[REDACTED]
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[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
			[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
			[REDACTED]

Annexure 3: Acquisition history of Bombardier Transportation



Annexure 5: Comparative case study - overview of cases

Case 1: AuxiCo

Company website: [REDACTED]
Employees: [REDACTED]
Relevant commodity: Auxiliary converters
Short description: [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Case 2: ElconCo

Company website: [REDACTED]
Employees: [REDACTED]
Relevant commodity: Electrical connectors
Short description: [REDACTED]
[REDACTED]
[REDACTED]

Case 3a: CountingCo-Alpha

Company website [REDACTED]
Employees: [REDACTED]
Relevant commodity: Passenger counting devices
Short description: [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Case 3b: CountingCo-Beta

Company website: [REDACTED]

Employees: [REDACTED]

Relevant commodity: Passenger counting devices

Short description: [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Case 4: DoorCo

Company website: [REDACTED]

Employees: [REDACTED]

Relevant commodity: Entrance systems

Short description [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Case 5: TrainconCo

Company website: [REDACTED]

Employees: [REDACTED]

Relevant commodity: Couplers, gangways

Short description: [REDACTED]
[REDACTED]
[REDACTED]

Case 6: BrakesCo

Company website:

[REDACTED]

Employees:

[REDACTED]

Relevant commodity:

Braking systems

Short description:

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Case 7: WeldingCo

Company website:

[REDACTED]

Employees:

[REDACTED]

Relevant commodity:

Welded subassemblies for car bodies

Short description:

[REDACTED]
[REDACTED]
[REDACTED]

Case 1 (AuxiCo) – Interview 5

Date: 10.07.2013
Communication: face-to-face
Language: English
Means to increase validity: use of dictaphone
Company: BT
Position/function of interviewee: Lead Buyer Auxiliary Converters

Illustrative quotes:

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

Case 2 (ElconCo) – Interview 3

Date: 19.07.2013
Communication: phone & e-mail
Language: English
Means to increase validity: use of dictaphone
Company: BT
Position/function of interviewee: Lead Buyer Electrical Cabinets, Driver Desks & Low Voltage Components

Illustrative quotes:

- [REDACTED]
- [REDACTED]
[REDACTED]
[REDACTED]
- [REDACTED]
[REDACTED]
- [REDACTED]
[REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
[REDACTED]

Case 4 (DoorCo) – Interview 1

Date: 11.06.2013
Communication: phone (conference call)
Language: English
Means to increase validity: use of dictaphone
Company: DoorCo
Position/function of interviewee: - Key Account Manager
- Marketing Director Doors & Accessibility
- Lead Buyer Entrance Systems (BT)

Illustrative quotes (from supplier staff, unless otherwise specified):

- [REDACTED]
- [REDACTED]
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[REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED]
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Case 4 (DoorCo) – Interview 3

Date: 01.08.2013
Communication: phone
Language: German
Means to increase validity: use of dictaphone
Company: BT
Position/function of interviewee: Lead Buyer Entrance Systems

Illustrative quotes:

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

- [REDACTED]

- [REDACTED]

- [REDACTED]

- [REDACTED]

- [REDACTED]

Case 5 (TrainconCo) – Interview 1

Date: 04.06.2013 & 25.06.2013
Communication: face-to-face
Language: German
Means to increase validity: approval of interview summary
Company: BT
Position/function of interviewee: Lead Engineer Couplers, Gangways & Windows

Main statements:

- [REDACTED]
- [REDACTED]
- [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
- [REDACTED]
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Case 6 (BrakesCo) – Interview 4

Date: 19.07.2013
Communication: face-to-face
Language: German
Means to increase validity: use of dictaphone
Company: BT
Position/function of interviewee: Lead Engineer Braking Systems

Illustrative quotes:

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

- [REDACTED]

- [REDACTED]

- [REDACTED]

- [REDACTED]

- [REDACTED]

Case 7 (WeldingCo) – Interview 1

Date: 24.07.2013
Communication: face-to-face
Language: German
Means to increase validity: use of dictaphone
Company: WeldingCo
Position/function of interviewee: Key Account Manager

Illustrative quotes:

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

Case 7 (WeldingCo) – Interview 3

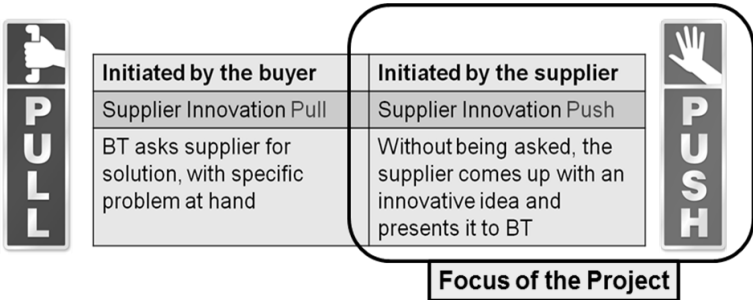






Date: 31.07.2013
Communication: face-to-face
Language: English
Means to increase validity: approval of interview summary
Company: BT
Position/function of interviewee: Lead Buyer Carbodies and Welded Subassemblies

Main statements:

- [REDACTED]
- [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]

Annexure 7: General interview guideline

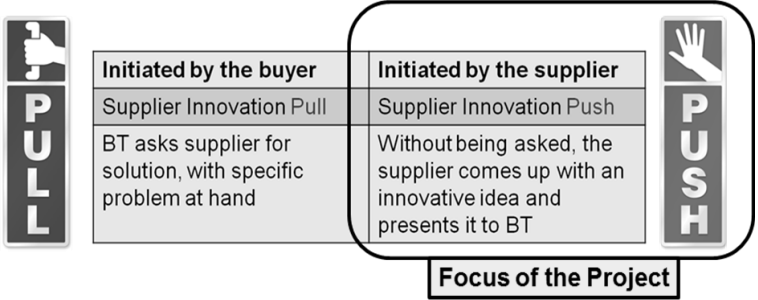






Supplier	
Purpose	Details (structure, questions, ...)
Introduction	<ul style="list-style-type: none"> - Introduction by the interviewer (background, purpose, people involved, ...) - Reassurance of anonymity - Question whether recording of interview is allowed - Introductory questions about interviewee (function, tenure, contact/relationship to BT staff, cooperation between sales and engineering, ...) - Introductory questions about the company and the products it supplies
Explain approach of the research	To explain why exactly they have been selected Figure 10 was presented to the interviewee.
Check interviewee's definition of (supplier) innovation	'What do you understand under the term innovation?'
Provide interviewee with definition of supplier innovation as applied in this research (to increase content validity)	<p>Supplier innovation is any new (to the firm) development that originates from existing suppliers, creates an obvious benefit for the buyer's customer and promises economic success for the buying firm.</p> <p>With regard to product innovations, supplier innovation refers to sub-products, or intermediate products of the final product, which are provided by the supplier. Relative to current sub-products, they make the final product better, securer, simpler, faster, cheaper, or are easier to integrate, provide a modular design or support standardisation.</p>
Check what specifically supplier is working on in terms of innovation	<ul style="list-style-type: none"> - Do you innovate 'just like that' (without project in mind, unattached to customer orders)? - What can you provide, in terms of innovation? <ul style="list-style-type: none"> ○ Do you work on product innovations? ○ Do you work on process innovations?

	<ul style="list-style-type: none"> ○ Do you think beyond your current projects? ○ Do you think beyond your current products? ○ Do you think beyond your current market? ○ Do you think beyond your current business? ○ Do you think about new business models? <p>- Is it possible for you to innovate without financial support, or guaranteed customer order?</p> <p>- Concerning product innovations, at what stage in the development phase would you approach your customers?</p> <p>- Why exactly in this phase, and not earlier/later?</p> <p>- Do you purposefully target your customer's engineers to present/sell innovation?</p> <p>- Do you purposefully target the end customer to present/sell innovation?</p> <p>- How do you seize the right time/opportunity for presenting/selling innovation?</p>									
<p>Explain what possibilities there are for suppliers to contribute with innovative ideas</p>	<p>Figure 5 was presented to the interviewee.</p>									
<p>Check what has happened in the past with regard to supplier innovation (both push and pull)</p>	<ul style="list-style-type: none"> - Do you have any past experience with BT in terms of innovation? - Do you have any past experience with other customers in terms of innovation? 									
<p>Explain the distinction between push and pull</p>	<p>The following figure was presented to the interviewee:</p>  <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">  PULL </td> <td> <table border="1"> <tr> <th>Initiated by the buyer</th> <th>Initiated by the supplier</th> </tr> <tr> <td>Supplier Innovation Pull</td> <td>Supplier Innovation Push</td> </tr> <tr> <td>BT asks supplier for solution, with specific problem at hand</td> <td>Without being asked, the supplier comes up with an innovative idea and presents it to BT</td> </tr> </table> </td> <td style="text-align: center;">  PUSH </td> </tr> </table> <p style="text-align: center;">Focus of the Project</p>	 PULL	<table border="1"> <tr> <th>Initiated by the buyer</th> <th>Initiated by the supplier</th> </tr> <tr> <td>Supplier Innovation Pull</td> <td>Supplier Innovation Push</td> </tr> <tr> <td>BT asks supplier for solution, with specific problem at hand</td> <td>Without being asked, the supplier comes up with an innovative idea and presents it to BT</td> </tr> </table>	Initiated by the buyer	Initiated by the supplier	Supplier Innovation Pull	Supplier Innovation Push	BT asks supplier for solution, with specific problem at hand	Without being asked, the supplier comes up with an innovative idea and presents it to BT	 PUSH
 PULL	<table border="1"> <tr> <th>Initiated by the buyer</th> <th>Initiated by the supplier</th> </tr> <tr> <td>Supplier Innovation Pull</td> <td>Supplier Innovation Push</td> </tr> <tr> <td>BT asks supplier for solution, with specific problem at hand</td> <td>Without being asked, the supplier comes up with an innovative idea and presents it to BT</td> </tr> </table>	Initiated by the buyer	Initiated by the supplier	Supplier Innovation Pull	Supplier Innovation Push	BT asks supplier for solution, with specific problem at hand	Without being asked, the supplier comes up with an innovative idea and presents it to BT	 PUSH		
Initiated by the buyer	Initiated by the supplier									
Supplier Innovation Pull	Supplier Innovation Push									
BT asks supplier for solution, with specific problem at hand	Without being asked, the supplier comes up with an innovative idea and presents it to BT									

<p>Check what has happened in the past with regard to supplier innovation push</p>	<ul style="list-style-type: none"> - Have you tried to unsolicitedly present innovative solutions and ideas to BT? <ul style="list-style-type: none"> ○ Who (from your company) approached whom (at BT)? ○ What was the innovation about? ○ What did you experience? ○ Was it a success? ○ What difficulties did you face? ○ How did you overcome them? ○ What do you think can be further improved? ○ Do you still think that, in general, supplier innovation push can work? - What do you think is required (at your side and at BT side) to have your innovations find their way into BT's business? - Is there anything that prevents you from presenting innovative ideas to BT? <ul style="list-style-type: none"> ○ Do intellectual property issues play a role? ○ What measures do you suggest to protect your intellectual property? ○ Would you consider an NDA an appropriate measure for protecting your IP? ○ How should that NDA look like? ○ Would you agree to sign an NDA that includes the whole BT group (worldwide)? - What did you experience with other customers?
<p>Check how supplier would like to design the information exchange with regard to innovation</p>	<ul style="list-style-type: none"> - What tools and channels would you suggest to enable supplier innovation push? <ul style="list-style-type: none"> ○ What do you think about supplier innovation workshops? ○ What do you think about supplier innovation fairs? ○ What do you think about an innovation competition for suppliers?

	<ul style="list-style-type: none"> ○ What do you think about an internet platform? ○ What do you think about the periodic supplier meetings as an opportunity to present/push innovations? ○ What do you think about the supplier days as an opportunity to present/push innovations? ○ To what extent do you use informal conversations with BT staff to present/push innovations? - How should these tools and channels be shaped? <ul style="list-style-type: none"> ○ What do you think, how much guidance is required? ○ Do you need a problem definition from BT side? ○ What do you need to know with regard to BT's future plans (in terms of technology)? - What tools and channels do our competitors provide you?
Closing	<ul style="list-style-type: none"> - Asking the interviewee whether they think that an important issue was not covered in the interview - Expression of thanks - Expression of commitment to keep the interviewee posted about the findings of the study

Buyer	
Purpose	Details (structure, questions, ...)
Introduction	<ul style="list-style-type: none"> - Introduction by the interviewer (background, purpose, people involved, ...) - Reassurance of anonymity - Question whether recording of interview is allowed - Introductory questions about interviewee (function, tenure, contact/relationship to supplier staff, cooperation between procurement and engineering, ...) - Introductory questions about the commodity (how are specifications provided, ...)
Explain approach of the research	To explain why exactly they have been selected Figure 10 was presented to the interviewee.
Check interviewee's definition of (supplier) innovation	'What do you understand under the term innovation?'
Provide interviewee with definition of supplier innovation as applied in this research (to increase content validity)	<p>Supplier innovation is any new (to the firm) development that originates from existing suppliers, creates an obvious benefit for the buyer's customer and promises economic success for the buying firm.</p> <p>With regard to product innovations, supplier innovation refers to sub-products, or intermediate products of the final product, which are provided by the supplier. Relative to current sub-products, they make the final product better, securer, simpler, faster, cheaper, or are easier to integrate, provide a modular design or support standardisation.</p>
Check how BT-people cooperate with each other and what they know about BT's innovation management and R&D organisation	<ul style="list-style-type: none"> - With which other functions within BT do you cooperate? - How is this cooperation defined/organised? - How is the commodity strategy linked to BT's overall business strategy? - How is the commodity strategy linked to BT's innovation strategy?

	<ul style="list-style-type: none"> - What do you associate with innovation with regard to BT? - What do you know about BT's innovation management? - What do you know about the BT innovation strategy? - What do you know about the BT Innovation Express? - Do you use the BT Innovation Express on a regular basis? - What do you know about BT P-Dev and R&D cases? 									
<p>Explain what possibilities there are for suppliers to contribute with innovative ideas</p>	<p>Figure 5 was presented to the interviewee.</p>									
<p>Check what has happened in the past with regard to supplier innovation (both push and pull)</p>	<ul style="list-style-type: none"> - Do you have any past experience with supplier XY in terms of innovation? 									
<p>Explain the distinction between push and pull</p>	<p>The following figure was presented to the interviewee:</p>  <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;"> PULL</td> <td style="text-align: center;"> <table border="1"> <tr> <th>Initiated by the buyer</th> <th>Initiated by the supplier</th> </tr> <tr> <td>Supplier Innovation Pull</td> <td>Supplier Innovation Push</td> </tr> <tr> <td>BT asks supplier for solution, with specific problem at hand</td> <td>Without being asked, the supplier comes up with an innovative idea and presents it to BT</td> </tr> </table> </td> <td style="text-align: center;"> PUSH</td> </tr> </table> <p style="text-align: center;">Focus of the Project</p>	 PULL	<table border="1"> <tr> <th>Initiated by the buyer</th> <th>Initiated by the supplier</th> </tr> <tr> <td>Supplier Innovation Pull</td> <td>Supplier Innovation Push</td> </tr> <tr> <td>BT asks supplier for solution, with specific problem at hand</td> <td>Without being asked, the supplier comes up with an innovative idea and presents it to BT</td> </tr> </table>	Initiated by the buyer	Initiated by the supplier	Supplier Innovation Pull	Supplier Innovation Push	BT asks supplier for solution, with specific problem at hand	Without being asked, the supplier comes up with an innovative idea and presents it to BT	 PUSH
 PULL	<table border="1"> <tr> <th>Initiated by the buyer</th> <th>Initiated by the supplier</th> </tr> <tr> <td>Supplier Innovation Pull</td> <td>Supplier Innovation Push</td> </tr> <tr> <td>BT asks supplier for solution, with specific problem at hand</td> <td>Without being asked, the supplier comes up with an innovative idea and presents it to BT</td> </tr> </table>	Initiated by the buyer	Initiated by the supplier	Supplier Innovation Pull	Supplier Innovation Push	BT asks supplier for solution, with specific problem at hand	Without being asked, the supplier comes up with an innovative idea and presents it to BT	 PUSH		
Initiated by the buyer	Initiated by the supplier									
Supplier Innovation Pull	Supplier Innovation Push									
BT asks supplier for solution, with specific problem at hand	Without being asked, the supplier comes up with an innovative idea and presents it to BT									
<p>Check what has happened in the past with regard to supplier innovation push</p>	<ul style="list-style-type: none"> - Has supplier XY unsolicitedly presented innovative solutions and ideas to BT? <ul style="list-style-type: none"> ○ Who (from the supplier) approached whom (at BT)? ○ What was the innovation about? ○ What did you experience? ○ Was it a success? ○ What difficulties did you face? ○ How did you overcome them? ○ What do you think can be further improved? 									

	<ul style="list-style-type: none"> ○ Do you still think that, in general, supplier innovation push can work? - What do you think is required (at supplier side and at BT side) to have supplier innovations find their way into BT's business? - What hampers supplier innovation in general and supplier innovation push in particular?
<p>Check how BT people would like to design the information exchange with regard to innovation</p>	<ul style="list-style-type: none"> - What tools and channels would you suggest to enable supplier innovation push? <ul style="list-style-type: none"> ○ What do you think about supplier innovation workshops? ○ What do you think about supplier innovation fairs? ○ What do you think about an innovation competition for suppliers? ○ What do you think about an internet platform (e.g. Innovation Express)? ○ What do you think about the periodic supplier meetings as an opportunity for the supplier to present/push innovations? ○ What do you think about the supplier days as an opportunity for the supplier to present/push innovations? ○ To what extent do suppliers use informal conversations with BT staff to present/push innovations?
<p>Closing</p>	<ul style="list-style-type: none"> - Asking the interviewee whether they think that an important issue was not covered in the interview - Expression of thanks - Expression of commitment to keep the interviewee posted about the findings of the study

Annexure 8: Photographs of the flipcharts from the workshop

Photographs have been removed due to confidentiality reasons.

Annexure 9: Management summary

Management summary has been removed due to confidentiality reasons.